report

Identify and Evaluate the Key Indicators of Construction Disputes in the Real Estate

By

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Major Project

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Submitted in partial fulfillment of the requirements for the degree of

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in

Construction Technology and Management

Submitted By

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Under the guidance of

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Statement of Originality

I, **PATEL MEHUL RAJESHBHAI**, Roll No. **22MCLT10**, give undertaking that the Major Project entitled **"Identify and Evaluate the Key Indicators of Construction Disputes in the Real Estate"** submitted by me, towards the partial fulfillment of the requirements for the degree of Master of Technology in **Construction Technology and Management** from Civil Engineering Department of Institute of Technology, Nirma University, Ahmedabad, contains no material that has been awarded for any degree or diploma in any university or school in any territory to the best of my knowledge. It is the original work carried out by me and I give assurance that no attempt of plagiarism has been made. It contains no material that is previously published or written, except where references have been made. I understand that in the event of similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action

Patel Mehul R.
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Date:
Place:

Endorsed by
Prof. Purvesh Raval
(Signature of Guide)

Certificate

This is to certify that the report of Major Project entitled **"Identify and Evaluate the Key Indicators of Construction Disputes in the Real Estate"** submitted by **"Patel Mehul R."**, towards the partial fulfillment of the requirements for the degree of Masters of Technology in Construction Technology and Management of Nirma University, Ahmedabad, is the record of work carried out by him/her under my supervision and guidance. In my opinion, the submitted work has reached the level required to be accepted for examination. The results embodied in this report, to the best of my knowledge, haven't been submitted to any other university or institution.

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Abstract

This research investigates construction disputes in construction projects in Ahmedabad and further examines the effective methods of dispute resolution. Identification of causes of disputes in the construction sector is derived from the review of the literature. Dispute-resolution methods were selected from the literature review. A structured questionnaire is designed and developed for the data collection from the expert. It consists of 5 parts, and a Likert scale is used which is of 5 points. A total of 21 Causes were identified based on the literature survey in which 20 literature papers were considered after removing irrelevant and conference papers. Firstly, there were 42 causes which were compacted into 21 causes. The research objectives are to identify the key indicators of the disputes in construction and then evaluate the key indicators with the help of the analysis tools and methods. Based on that a dispute model will be prepared. For analysis, Exploratory Factor Analysis (EFA) was conducted with 21 attributes which were further reduced by the principal component analysis (PCA) method using Varimax rotation. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy as well as Bartlett's Test of sphericity were conducted. The 21 causes were clubbed into 4 groups which are named phases of the project, initial phase to the closeout phase. Based on analysis and literature survey of disputes in construction DRM was prepared which was validated using a questionnaire survey of 5-point Likert scale. Dispute resolution methods are also explained in this study. The first step should be the prevention of the project from dispute and the last step should be litigation. The result of this study contributes knowledge and provides valuable insights into the causes of disputes in real estate and resolution methods if disputes arise in any phase of the project. The disputes affect project success and productivity. Construction engineers need to focus and handle it carefully as disputes consume resources. Disputes vary from person to person as well as from project to project, so it an essential to research it to minimize it as it cannot be avoided. Disputes are a barrier to the successful completion of construction projects.

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Abbreviations and Acronyms

CS ..... Construction Sector
DRM ..... Dispute Resolution Model
KMO ..... kaiser-Meyer-Olkin
EFA ..... Exploratory Factor Analysis
PCA ..... Principal Component Analysis
DRB ..... Dispute Resolution Board
SPSS ..... Statistical Package for Social Sciences
ADR ..... Alternate Dispute Resolution
GDP ..... Gross Domestic Product
ADR ..... Alternate Dispute Resolution
RERA ..... Real Estate Regulatory Authority
CI ..... Construction Industry
DR ..... Dispute Resolution

Chapter 1

Introduction

1.1 Background

The Indian construction industry plays a vital role in contributing to the nation's development. The construction sector is also an employment provider, it is the largest employment provider after the agriculture sector, as we are aware that the construction sector is growing rapidly, and structures are getting more complex day by day. It is in the top 3 for the highest contribution to GDP. Construction assiduity is a pivotal profitable sector that encompasses the entire lifecycle of structure and structure systems, from conceptualization and planning to prosecution and conservation. Its impact is profound, impacting civic development, profitable substance, and societal well-being. This assiduity can be astronomically divided into domestic, marketable, artificial, and structure construction, each serving specific places in shaping the erected terrain. Many major factors impact the Projects. Which are Disputes, cost overruns, delays, and more. Disputes affect the project in terms of the budget of the project assigned, the schedule prepared, and the quantity estimated, it affects project performance on a large scale. Francis et al. 2017. In this major project research out of many Construction Disputes in the Construction sector will be researched, and analysis will be done to avoid construction disputes in the project for successful completion of the project. In the past many months, disputes in construction become an important issue to the stakeholders and projects in the construction industry, Construction, as projects are getting complex in nature, The stakeholders who have their thinking and viewpoints may lead to conflicts between various stakeholders. Every party involved, covering an array of professions, has

specific goals and professionals to optimize their gains. But as more individuals from various societies join the construction value chain, then inevitably will be greater financial dealings and disagreements. Cakmak and Cakmak, 2014.

1.2 Disputes

Dispute – especially within the construction industry describes dispute as a situation where a claim or assertion(strongly believed) made by one of the stakeholders is not approved by the other stakeholders and that rejection is not accepted back by the stakeholder who claimed. Naji et al., 2020. Disputes have become an essential and crucial component of the project manager's responsibility. Illankoon et al.,2019. The dispute is one of the main causes of unsuccessful completion of projects. Cakmak and Cakmak, 2014. Disputes are generally time and cost-consuming, not relaxing, and expensive for any project as it consumes time as well as cost if is raised in the project. Construction disputes are conflicts or disagreements that arise during any stage of the project like planning, design, bidding, or execution phases of construction projects or phases like pre-construction, construction, and post-construction. These disputes can involve various parties, including owners, contractors, subcontractors, architects, engineers, and suppliers. Conflict can originate from a clash of interests or a significant disagreement on something essential. It has become essential to manage the conflict between stakeholders. Disputes arise during the construction process due to the problem of contractual terms in the contract signed such as payment, variation, extension of time, and the unavailability of information. Researchers have identified construction contracts and unpredictable events as sources of disputes. Moreover, disputes are associated with justiciable issues and require resolution such as mediation, negotiation, and arbitration, among others. Cakmak and Cakmak, 2014. Every stakeholder in this complicated environment, representing a variety of professions, has a particular set of objectives and expertise to help them optimize benefits. Nonetheless, there will be more commercial interactions and disputes as the number of actors in the construction value chain with diverse cultural backgrounds rises. Cakmak and Cakmak, 2014. Construction disputes can be minimized but cannot be avoided because there are many reasons like the unpredictable nature of the construction sector. Alrasheed et al.,2023. If disagreements are not settled quickly, they can worsen and require the involvement of conflict resolution procedures. These

processes take a lot of money and time. For example, the 2018 edition of the Worldwide Construction Sector Disputes Report Arcadis 2019 claims the average duration needed for the resolution of a construction dispute is 17 months.

1.3 Need of the Study

According to Arcadis 2022 Global Construction Disputes Report-

1. The global average value of conflicts in the construction was United States dollar 52.6 million.

2. As per the Arcadis global report the average length of disputes is increased to 15.4 months.

According to a report by Arcadis in 2016, the worldwide construction industry faced an average dispute value of USD 46 million and a dispute duration of 15.5 months in 2015. The subsequent year, 2016, saw a rise in total construction dispute value to USD 67 million, with an extended average dispute length of 19.5 months. Remarkably, the Asian region surpassed global averages in both dispute costs and duration, holding the record for the lengthiest dispute resolution time and the second-highest total dispute resolution cost globally. Given these findings, it is imperative to examine and assess appropriate dispute resolution mechanisms specifically tailored to the unique problems faced by the construction sector in the Asian region.

Particularly in India, contractors have to face both government and local resistance. It is widely known that government-caused payment delays, which cite concerns relating to poor outcomes and delays in handover, significantly lower contractor morale. Not only is the contractor's record being tainted, but sustainability raises questions about when the project will be completed. Kalyan et al. 2022.

The Figure 1.1 gives details about the Global values for Dispute resolution from 2015 to 2021 given by Arcadis Report. For Asian, it is more than average global values (2016),

1. Total cost = 67 million Dollar,

2. Average time for dispute resolution = 19.5 months.

According to the World Bank's State of Running a Business Index, dealing with a dispute in India can take as long as four years (1,445 days), with costs that may account for up to 31 percentage of the claim amount.

So, It gives the motivation to study dispute causes and their resolution for the construc-

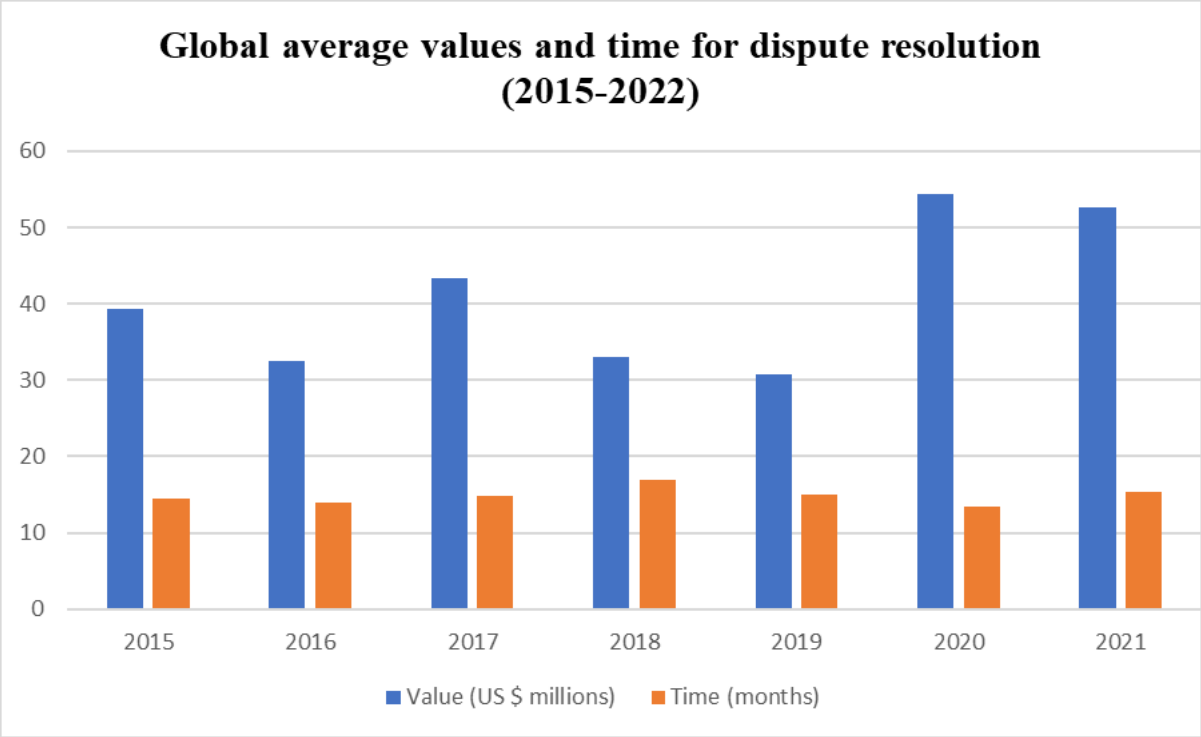

Figure 1.1: Graph of Arcadis Report 2015-2022

tion industry as it is a hurdle for successful completion of any project in scheduled time and cost. Also, dispute sources differ from place to place and project to project.

Disputes in Construction can be a major obstacle for industries like construction, real estate, and infrastructure that view many disputes. Construction sectors contribute the largest proportion of disputes as compared to the other sectors in the country.

1.4 RERA

Real Estate Regulatory Authority (RERA), was established in May 2017. RERA All Act 2016 and also the sections come into execution in the year 2017. The RERA is the authority that regulates and promotes the construction sector, especially real estate in Gujarat.

The objectives of the RERA are to provide a secure, trustful real estate culture and to protect the rights of the real estate consumer as well as to work on the complaints of the consumer in the real estate.

Table 1.1: RERA Complaints in Different Cities of Gujarat

City	**Complaints**
Ahmedabad	1901
Vadodara	1628
Surat	726
Rajkot	330
Gandhinagar	545
Bhavnagar	78
Valsad	91
Others	725
Total	**6024**

As shown in Table 1.1 Complaints in RERA are registered and shown on its website. Ahmedabad has a total of 1901 complaints, Vadodara has 1628 complaints registered, Surat has 726 complaints registered, Rajkot has 330 complaints registered and the total complaints registered from the year 2017 to 2024 are 6024. These numbers are large in number and as this dispute cases will take time to resolve. Dispute prevention and resolution is an important task as it is time-consuming and resource-consuming, resource consuming and it can damage the relationships between the various stakeholders. Although in the total of 6024 cases different types of claims, conflicts, and Dispute complaints are received by RERA. These complaint numbers give purpose to research on the causes of the construction sector disputes in real estate also provide a model to resolve the disputes or the claims raised by any parties. As shown in Table 1.1, Ahmedabad has the highest number of complaints from the year 2017 starting of the RERA to the year 2024. As we are witnessing the real estate of Ahmedabad has rapidly changed as compared to the past decades. Buildings are converted into high-rise structures so as structures are getting complex in nature and the scope of work is also increasing which leads to an increase in the number of stakeholders, due to various causes, there are high chances of rising claims which may be turned out as conflicts and causing the situation to be turned as Disputes. Table 1.1 data is collected from the official site of the RERA also it has the judgements of the complaints registered. Few complaints are negotiated outside of the court while other complaints are litigated in courts which increases the time and cost of the people who are involved in it. So, 6024 total numbers of complaints are large

numbers that need to be resolved, as well as the construction industry expert should tend to predict the construction sector disputes at the first stage of the construction project, and if disputes are bound to happen then a framework or model should be designed to be used for the dispute resolution process.

1.5 Research Aim

This research for major projects intends to Identify and Evaluate the sources causing disputes in real estate and to find the major effects of disputes on the projects as well as effective dispute resolution methods by taking responses through questionnaire survey professionals of the construction sector, intending to improve project delivery.

1.6 Objectives of study

The objectives of this research are -

1. To identify key indicators causing disputes in Real Estate.
2. To evaluate key indicators and prepare a Dispute Resolution Model.

1.7 Scope of work

Following is the work needed for the research-

1. Literature survey is needed specifically selecting appropriate journal papers for identifying research questions, Motivation for study, Literature review, Objectives, and Methodology.

2. Identifying Key causes for disputes in the construction sector based on the literature review.

3. Designing a comprehensive questionnaire consists of the attributes causing disputes and their effects on the project as well as the effective method for dispute resolution in Real Estate and modifying it as per suggestions.

4. Surveying the selected professionals and stakeholders in real estate.

5. Selecting appropriate tools and methods for the analysis of the data collected.

6. Analyzing the collected data to determine the significant factors and their impact and forming a Dispute Resolution Model (DRM).

Chapter 2

Literature Review

2.1 Overview

This chapter provides an overview of pertinent literature related to construction industry disputes. Construction disputes, recognized as significant factors that mainly lead to project delays, disruptions in construction schedules, and escalated project costs, are examined in depth. Furthermore, disputes emerge as primary obstacles hindering the successful completion of construction projects in the construction sector. The sources of disputes within construction sector projects are explored, alongside an examination of the effects that construction disputes exert on project outcomes. The construction industry holds a pivotal role in the economic development of numerous countries, constituting a significant sector that contributes substantially to their overall growth. In many nations, the construction industry is a major economic player, representing a substantial business sector with widespread impact and influence. It is affected by many factors which decrease its productivity. Disputes in construction are one of the major factors causing the increase in the chaos of the sector projects. These persistent issues in the sector have led to an upsurge in claims and disputes during the previous few decades. Wang et al. 2023. Disputes pose a significant obstacle to the seamless execution of construction projects, hindering their successful completion. This chapter delves into an exploration of the origins of disputes within construction projects, examining the various sources that contribute to their emergence. Furthermore, it scrutinizes the far-reaching effects that construction disputes can have on the overall progress of a project. Within the last few years, there has been an increase in disputes and lawsuits due to these continual issues in the

construction sector. Wang et al. 2023.

Using innovative techniques and technologies, the construction sector is performing superiorly on a worldwide basis when it comes to finishing projects that are getting faster and more complicated. On the other hand, several initiatives have failed because of the frequency of disputes and disagreements. Francis et al. 2017.

2.2 Construction Disputes

In the construction sector, disputes have been called a worldwide problem because they frequently result in project failure, financial and time loss, and strained relationships between project participants. Claims involving the assertion of rights by one party against the other give rise to construction disputes. The conflict starts when the opposing party rejects or talks down the claim. Conflicts are costly, uncomfortable, and highly resource-intensive. Viswanathan et al. 2020.

Submission of a complaint does not always (though it may) lead to a contradiction; refusal of a claim will most likely do so, but not always, since the Contractor may choose to accept completely or partially the Engineer's conclusions. No disagreement may occur if the argument is not denied but rather is addressed with a request for more details or even a hesitant response. Illankoon et al.,2019.

Disputes have become an ongoing occurrence in the construction sector, It causes progress to stop. From an up-close view, payment cause for disputes may be the most common reason for a dispute. Kalyan et al. 2022.

Furthermore, several researchers commented that disputes can result in unsuccessful construction sector projects, waste of time as resolution takes time, cost overruns, and negatively harm the relationships between project stakeholders in the construction sector if it is not resolved promptly. There are various problems faced by construction sector experts, for example, such as unexpected additional work, delays, inadequate workmanship, excessive expenses, and mishaps. Conflicts are also undesirable in the construction sector. Muhammuddin et al. 2022.

Construction sector disputes are considered a key attribute stopping the success of construction projects. The industry is quite concerned about disputes as they are also costly and take time. Thus, to finish construction projects on a timeline, within budgetary con-

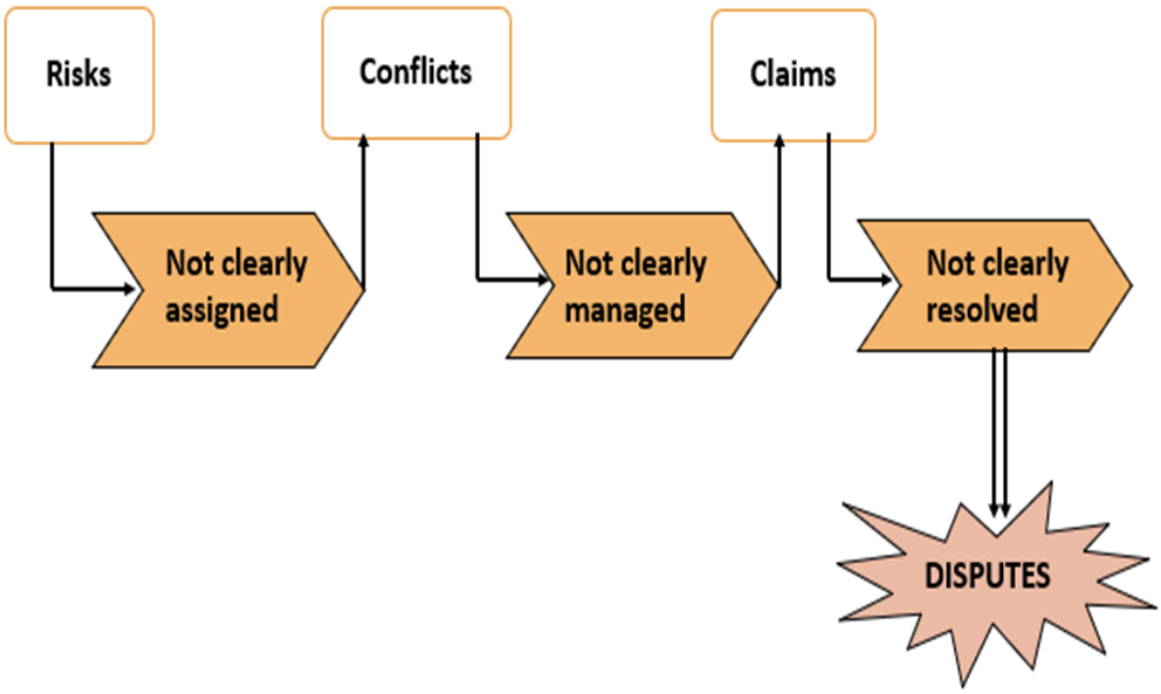

Figure 2.1: Risk, conflict, claim, and dispute Continuum Model

straints, and with a desired standard of quality, it is crucial to have an in-depth knowledge of the root reasons and to manage disputes effectively. According to the continuum model of risk, conflict, claim, and dispute in Figure 2.1 it is observed that in the construction projects at the first stage, risks arise, and if the risks are not assigned then they will be converted into conflicts. Trangkanont et al. 2018.

One of the primary causes of disagreements in the construction industry is construction claims. When an argument or assertion made by one side is rejected by the other and that denial is not recognized, it can be claimed that a dispute has arisen. Conversely, a construction disagreement arises when there is a lack of coordination between various stakeholders regarding objectives, needs, and profits, which may push them to pursue their objectives. When parties refuse to fulfill their responsibilities under the terms of the contract, a bigger dispute arises. (Mohamed et al. 2014).

The claims that arise in the project are generally of three types based on the claimant compensation which are as follows-

The claims that arise in the project are generally of three types based on the claimant compensation which are as follows-

1. Time claims
2. Cost claims
3. Delays

Any point during the project's life cycle could cause a dispute. Sometimes stakeholders resolve it directly, and other times a lawyer acts as a mediator.

Understanding the root causes of conflicts in construction sector projects improves the effectiveness of a company and enhances the success rate of projects. (VO et al. 2020). Large sums of money, protracted project durations, and the involvement of numerous stakeholders make up the construction business, which makes it an uncertain sector. It is always preferable to avoid and reduce the likelihood of disputes than to deal with and settle them. Sometimes stakeholders resolve it directly, and other times a lawyer acts as an intermediary. As a result, signing contracts is a necessary step in the process. A signed contract eliminates needless disagreements during a project's implementation by outlining each party's rights and obligations. However, it should be assumed that disagreements will arise during building projects. The building stage is characterized by the involvement of numerous resources (money, labor, machinery, etc.). VO et al. 2020.

Disputes are referred to as long-term unresolved claims and uncontrolled disruptive conflict. Although conflict is well-known for its unpleasant implications and consequences, other positive and functional aspects of conflict must not be ignored. Long-term unsettled claims and uncontrolled disruptive conflict are referred to as disputes. Even though conflict is commonly associated with negative implications and outcomes, there are also beneficial components of conflict that should not be overlooked. Multiple troublesome concerns can lead to conflicts in building projects, which can harm the project's procedure and increase the likelihood of disputes and expensive litigation. There is a suggestion that the level of disagreement increases with larger and more complex projects. Furthermore, several researchers have stated that the construction sector has been a leader in conflicts for several years. Charehzehi et al. 2017.

If conflicts arise and are not managed by the shareholders of the projects, then they will be converted into claims. If those claims are not resolved by the construction sector stakeholders or rejected by one of the parties, then that will originate disputes.

2.3 Sources of Construction Disputes

Based on the literature survey, attributes were identified that originate disputes in real estate. Below is the detail about the paper like the title of the paper, year of publication, and the attributes and source:

1. TITLE - Dispute Classification in Construction Projects Based on Litigation Cases. It was published in 2023, by Khaled et al. 2023. The source for identifying attributes in this paper was 177 litigation cases. The attributes mentioned in this paper are the following-

1) Still unfinished work

2) Order alteration

3) Design timing delay

4) Key contractor time delay

5) The owner's timeline delay

6) Work halt

7) A subcontractor's lateness

8) Legal agreements (incomplete information)

9) parties' conflicting interests disobedience, ignorance)

Inadequate works, Payment computation errors, Inadequate site management, Situation on the site, variable price increases, project cancellation, Consecutive payments, and Late payments

2. TITLE - Anatomy of Construction Disputes, 2013, by Cheung et al. 2013,

The source for the above paper was a literature survey. This paper it has given 6-factor groups which are Collaborative conflict, Contract incompleteness, Ambiguity, Deficiency, People factor, Opportunistic behavior, and Affective conflict.

3. TITLE - Causal Modeling of Disputes in Construction Projects, by Viswanathan et al. 2020, In this paper source was 15 research papers for identifying causes for disputes. A total of 14 causes were identified that cause disputes in the construction sector. The causes were identified as differences in the scope, unclear contract documents, poor communication between the stakeholders, unreasonable client demands, change of the or-

der in construction projects, delay in terms of the payment, cost overrun in the project, insufficient resources in the project, lack of technical knowledge of the various parties involved in the projects, an opportunistic mindset of the parties involved in the construction sector, not giving response on the time causing delays, poor productivity in the project.

4. TITLE - attributes of disputes, causes affecting dispute resolution, and effective alternative dispute resolution for Sri Lankan construction industry, by Illankoon et al. 2019. Based on the literature survey the author identified 14 causes of disputes-

The causes are inaccurate or missing information in the contract document, either party's failure to properly understand as well as follow its contractual duties, inadequate design data or employer demand, inadequately run construction process that results in a lack of resources and poor quality, Professionals' lack of communication abilities, Different interpretations of the provisions of the contract, Project participants' unethical behavior, lack of experience of the project parties, Differing project stakeholders' aims and objectives, Project members' unwillingness to adapt to change, Insufficient risk analysis and management, External modifications, like adjustments to the market and rules governing the environment, Unpredictable external variables like the state of the weather or laws governing the environment.

Similarly, the other literature papers list is mentioned in table 2.1 in which the title and year of publication is mentioned as well as the sources from which the causes are identified as well as the total number of causes identified in each paper.

Based on Table 2.1 causes of construction disputes in the construction sector were identified. A total of 42 attributes were recognized and after merging and compacting a total of 21 attributes were selected for causing disputes in the construction sector.

Table 2.1: Summary of Sources of Disputes

Sr.no	**Reference**	**Source for identifying causes of disputes**	**Total Causes**
01	Kalyan et al. 2022	65 cases (writ petition, response and final judgment)	8 causes and 22 attributes
02	Trangkanont et al. 2018	Literature review	3 main causes and 18 attributes
03	Mahamid et al. 2014	Literature review	Total direct causes = 29, Total indirect causes = 31
04	Mohamed et al. 2014	Literature review	3 categories and 31 factors
05	VO et al. 2020	Literature review	6 categories and 26 factors
06	Charehzehi et al. 2017	Literature review	3 categories, 11 Factors and 17 attributes
07	Chan et al. 2005	Literature papers and 41 experts	20 sources of disputes
08	Ng et al. 2007	Literature review	38 attributes
09	Jelodar et al. 2022	Literature review	Categorization 3 and causes of conflicts 13
10	Faraji et al. 2021	Literature review	210 causes of disputes
11	Yates et al. 2006	Case study & Vorster (1993, p. 8)	3 categories and attributes

In Table 2.2 the 42 causes were identified based on the literature survey of the 17 research papers out of which repetition of the factors in the papers was identified, based on the 42 causes after modification compaction and merging the similar attributes total of 21 causes were selected for the questionnaire survey.

2.4 Causes of Construction Disputes

The causes of the disputes were derived from the case studies of the project as well as the litigation cases that were studied from the literature survey. 21 Causes were formed compacting 42 causes from Table 2.2

1. Land Acquisition
2. Payment problems
3. Cost overrun
4. Poor Quality
5. Rejection for rework (poor-quality work)
6. Delay (in terms of Time, Work, Response, and Delivery)
7. Conflicting goals and objectives of stakeholders in the construction sector
8. Lack of communication
9. Contractual problems - Ambiguities in Documents
10. Design errors
11. Errors in Bid
12. Lack of experience as a contractor
13. Poor Project management - Ineffective planning and scheduling
16. Lack of knowledge of the client
17. Lack of cooperation from the client
18. Unrealistic Client Expectations (Time Targets)
19. Lack of trust (Behavioral Factors)
20. Inclement Weather/ Natural Calamities
21. Changes in Government Policy

Based on the literature survey 21 attributes were identified for the questionnaire survey.

2.5 Dispute Resolution Methods

1. Prevention: The goal of prevention techniques is to reduce the possible sources of disputes within a project. The risk distribution, the trust bid documents, the significance of construction ability analysis and paperwork, cost/schedule safeguards, and execution of agreements are a few preventive strategies. Ng et al.,2007.

2. Negotiation: To swiftly settle their issues, parties engage in open discussions and meet-

ings during the negotiation process. The goal of negotiation is to reach an agreement and a commitment to a course of action through participant communication. By taking this step, the parties get ready to handle disputes and minimize their impact whenever they happen. Ng et al.,2007.

Since negotiations help resolve disputes and maintain positive relationships amongst project participants, negotiation is preferred by those involved. Project managers believe that the most time- and energy-consuming strategy for managing disputes is negotiation. Mohamed et al.,2014.

Unless the parties enter into a settlement agreement to give legally enforceable effects to their negotiated result, negotiation is nonbinding and cannot be enforced by the courts. It can maintain the parties' working relationship and is typically seen as the least expensive mechanism in the construction sector. Chan and Suen, 2015.

3. Mediation: Through the voluntary, non-confrontational unofficial, strictly private, and non-binding process of mediation, the involved parties attempt to resolve their conflicts with the assistance of an impartial and independent third party known as a mediator. Mediation can be viewed as a compromise between conciliation and arbitration because a mediator attempts to resolve disputes and concentrate on the settlement by applying extra-legal principles rather than strict legal rules while considering trade customs, prior business relationships, and current circumstances. This makes a mediator more involved in judgment decisions than a conciliator. Illankoon et al.,2019.

A mediator helps parties voluntarily come to a mutually acceptable agreement in mediation, which is a non-adversarial and unenforceable process (unless parties enter into a settlement agreement). Chan and Suen, 2015.

4. Conciliation: can be used in place of mediation. primarily used for issues with payments. The compromiser calls each side individually based on the compromiser, the compromiser's active participation, and the compromiser's prospective solution proposals. unbiased determination made by an independent arbiter using the parties' testimony. ways of conflict resolution that are more surface-level than mediation and involve ideas from a third party. To settle their disagreements, the parties meet separately with a conciliator. Faraji et al.,2021.

5. Dispute Resolution Board: Before work begins, the owner and contractor jointly choose and approve a three-person panel that makes up the DRB. DRBs focus primarily

on "as soon as possible" dispute resolution. The panelists, owner, and contractor sign a third-party agreement when the panel is selected. Mohamed et al.,2014.

When a project first starts, a Dispute Review Board is formed. It is made up of a group of impartial technical experts that the disputing parties mutually choose and hire. At site briefings, the Board panel meets regularly to discuss potential problems before they become disputes. When parties cannot agree on a solution at the site level, the matter is brought before the Board panel, which has a deadline for presenting a recommendation. Although the proposal is not legally binding, it may be used in later court cases. Chan and Suen, 2015.

6. Adjudication: The Dispute Adjudication Board is a new form of primary dispute adjudication created by the construction industry. The dispute is also sent to an impartial third party in adjudication, known as the "adjudicator," who often has a particular number of days to decide. Illankoon et al.,2019.

7. Arbitration: In the arbitration procedure, disputing parties submit their disagreement to one or more third parties for a legally binding decision. Unlike mediation, arbitration is governed by stricter standards and is enforceable in court. Arbitrators use the material found in these documents to assess the merits of each case that is presented and decide which party, if any, should receive an award. Illankoon et al.,2019.

Although arbitration is thought to be a quicker process than traditional litigation, it is more expensive. In arbitration, a decision is made by third-party neutral(s) based on data that the disputing parties provide to them. Mohamed et al.,2014.

8. Litigation: "Battle in a court of law to enforce a right or obtain a solution" is the definition of litigation. Due to the large cost of protracted litigation, harm to commercial relationships, and delay with company resources, contractors attempt to avoid litigation as much as possible. Mohamed et al.,2014. Litigation is the final and last step for the resolution of the construction sector disputes. Illankoon et al.,2019. In most cases, the last level on the conflict resolution ladder is litigation. Even if a dispute goes to trial, there are ways to make things better, like having a strong discovery procedure and a strong presentation. At this stage, awards are based on monetary compensation, and one side wins and the other loses. Ng et al.,2007.

Table 2.2: Summary of Causes of Disputes

Sr. no	**Causes of disputes**	**Repeated / Total 17 papers**
01	Change order	15
02	Design error	13
03	Payment problem - Bankruptcy	16
04	Site problem	09
05	Delay - Time, work, response, delivery	16
06	Contractual Problem	17
07	Lack of communication (Poor)	12
08	Errors in bid	09
09	Opportunistic behavior	09
10	Price escalation	07
11	Project withdrawal	01
12	Work stoppage	02
13	Poor site management	11
14	Defective work (Poor quality)	12
15	Inclement weather	08
16	Change in Government policy	07
17	Strike	01
18	Labor shortage	05
19	Material shortage, resources shortage	10
20	Subcontractor delay in work	05
21	Item missing in bills	01
22	Psychological distress, Emotions	08
23	Unrealistic client expectations (Time targets)	07
24	Cost overrun	05
25	Technical incompetency of the stakeholder	10
26	Poor productivity and control	10
27	Ambiguities in documents	12
28	Time extension-related issues	07
29	Not agreeing to correct the defects	02
30	Lack of knowledge of client	02
31	Lack of experience	10
32	Lack of corporation	10
33	Conflicting goals and objectives of project parties	10
34	Inadequate risk identification/allocation	05
35	Land acquisition	01
36	Ineffective method (neighbor building problem)	06
37	After agreement not agreeing to contract clauses	03
38	Poor project management	08
39	Sub-contractors handling several projects at the same time	01
40	Unforeseen problems	01
41	Changes in material's cost and labor cost	02
42	Not proper and effective planning and scheduling of project by contractor in construction sector	08

Chapter 3

Methodology

3.1 Research Methodology

Methodology is the organized and theoretical examination of the techniques utilized in a specific field of study. It encompasses the principles, procedures, and regulations that direct and Mold research or investigation within a given discipline. Methodology establishes a structure for the preparation, implementation, and assessment of research, guaranteeing a systematic and logical approach to the process. Mashwama, 2016.

In Figure 3.1 the description is as follows- 1. Conceptualization: Conceptualization helps in understanding the importance and basics of the work. The Objectives of the research are set. The literature review is investigated thoroughly.

2. Literature review: The main aim is to gather information and understand the topic - disputes in the sector. By preferring the literature survey attributes were identified which eventually provided 21causes of construction disputes, also it proved dispute resolution methods as well as the effects of the disputes on the projects.

3. Identifying causes: 20 Literature papers were taken to identify causes of disputes in the construction sector.

4. Questionnaire preparation: Based on the 21 causes, effects, and dispute resolution methods questionnaire was prepared using a 5-point Likert scale where 1 indicates very low to 5 which indicates very high. Similarly, the most effective method for dispute resolution was also given Likert scale as well and the most severe effect of the dispute on the project was given a 5-point Likert scale.

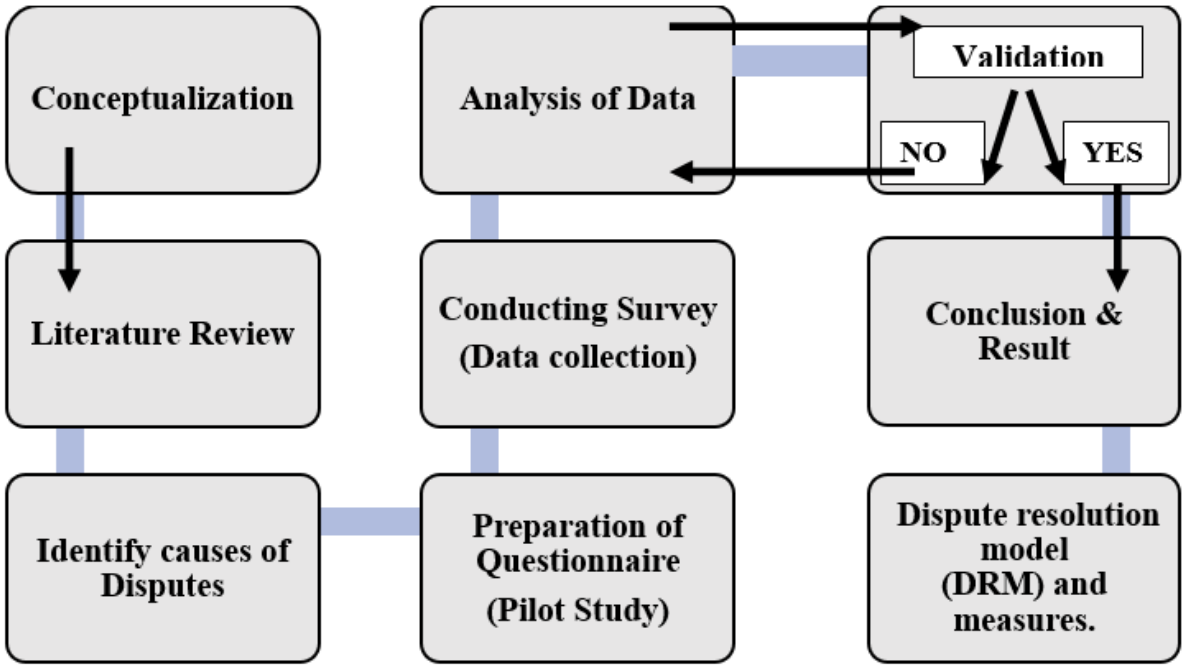

Figure 3.1: Methodology Framework

5. Data collection- Experts were identified in the construction sector and their responses were collected based on their knowledge of the respondent and experience in the construction sector. The respondent's information was also collected including their experience in the construction sector, their designation, and the organization type in which they are involved. A total of 104 responses were collected which is considered as good enough for analysis. Based on the experts who have a considerable amount of knowledge and experience in the field of construction management as well as dispute management, the questionnaire was shared. After the data collection was completed, analysis was done to provide a strong conclusion as well as fruitful output for major projects. Both a literature survey, as well a questionnaire survey, is conducted is conducted among the experts in construction and dispute management.

6. Analysis of the Data: Statistical Package of Social Sciences (SPSS) software and Microsoft Excel was used for analysis work. The EFA analysis was conducted with 21 causes which were further reduced by the PCA method using Varimax rotation. KMO Measure of Sampling Adequacy as well as Bartlett's Test of sphericity were conducted.

7. Dispute Resolution Model: Based on the literature review and the analysis of the study a framework is prepared for the dispute resolution.

3.2 Research Approach

The research employed a quantitative approach, opting for a descriptive survey as it provides a precise depiction of characteristics such as actions, viewpoints, capacities, convictions, and expertise within a particular person, circumstance, or group. This method was selected to address the study's objectives, which include analyzing the primary causes of disputes in Real Estate, assessing the effects of disputes and conflicts on construction sector projects, exploring strategies for minimizing disputes in the construction sector, and identifying ADR methods applicable to the construction sector. To achieve these goals, a meticulously designed questionnaire was developed and distributed to the participants. Mashwama, 2016. Analysis tools as well as sample size will be selected for the data collection and analysis.

3.2.1 Targeted Population

A population, in the context of research, constitutes the entirety of individuals possessing specific characteristics that align with the sample criteria defined by the researcher. The target population, on the other hand, to whom the survey is applicable—those capable of responding to the survey questions and whose responses are relevant to the study's outcomes. In this investigation, the target population comprised construction managers, project managers, engineers, and similar professionals registered with various bodies specializing in dispute and project management within the construction industry. Structured questionnaires were distributed to these respondents, recognized experts in the field of construction. This method was deemed crucial to ensure a deep and broad understanding of the causes, effects, and ideas and planning for minimizing disputes in construction sector projects. Fellows and Liu, 2008.

Chapter 4

Questionnaire and Description

4.1 Questionnaire Definition

In this approach, a set of question forms is dispatched to individuals relevant to the study, accompanied by a message to complete the questions. The questionnaire is composed of a series of questions arranged in a specific order on a form or set of forms. Respondents receive the questionnaire by mail, where They must read the questions carefully, understand them, and answer them in the places provided on the questionnaire. Respondents are responsible for answering the questions independently. The merits associated with this method include:

1. Cost-effectiveness, particularly when dealing with a large and widely dispersed population.
2. Elimination of interviewer bias, as respondents articulate their answers in their own words.
3. Adequate time for respondents to consider and provide accurate responses.
4. Accessibility to respondents who are not approached through other means.
5. The ability to utilize large sample sizes enhances the dependability and reliability of the results. Gray,2010.

4.2 Questionnaire Design

The chosen data collection instrument for this research was a questionnaire, selected for its effectiveness in gathering information through self-reported written responses. A ques-

tionnaire, in this context, is a printed form designed to elicit information directly from the subjects. Participants are expected to provide written responses to the set questions, making it a valuable tool for systematically collecting data in a structured and standardized manner. The questionnaires were crafted in the English language, considering that all respondents were expert professionals in the construction field, ensuring their ability to comprehend and respond to the questions. The questionnaires consisted of five sections: – A, B, C, D, and E.

Section A was designed to acquire respondent information, including details such as experience, organization, name, types of the project, and the positions held within the company, to aid the researcher in result interpretation. Meanwhile, Section B focused on exploring the reasons behind construction sector disputes in construction projects, and Section C aimed to evaluate the most suitable method for dispute resolution. Section D focused on the major effects of the construction disputes on the construction projects as well and part E focused on the feedback or opinions.

4.3 Statistical modes of measurement

A Likert scale consisting of five points was employed to assess the causes, effects, and strategies for minimizing disputes in the construction sector, aligning with the factors identified in the literature review. The chosen scale was as follows: 1=Very Low, 2=Low, 3=Moderate, 4=High, 5=Very High, Similarly, this scale was used to identify the most effective method for dispute resolution in the construction sector. As well as in the Likert scale was also used for the major impact of the effects of the disputes on the construction projects.

4.4 Description of Causes of Disputes

1. Payment problems: The contractor's greatest risk is that their legal right to payment will not be maintained. In this instance, a financial issue could cause a major disagreement in real estate projects.

2. Cost overrun: Insufficient expertise among contractors can result in project failure, significant cost overruns, and delays that harm the contractor-owner relationship. Mahamid, 2016. 9 of 10 construction projects incur cost overruns due to changes

in price, non-availability of raw materials and resources, delayed land acquisition, etc. Viswanathan et al. 2020.

3. Poor Quality: Low quality of work including unfit materials as well. Without the site authority's approval of certain materials, the contractor executed the work at the site, which turned into disputes. The low quality of executed tasks was directly affected by the contractor's behavior involved in the construction work. The conclusion is that the low quality of the task created an indirect connection with the cost incurred in the task. Francis et al. 2022.

4. Rejection for rework: Out of 16 projects, a couple had problems because of substandard work; the contractor refused to fix the problems even after the consultant informed them of the problems by the terms of the contract. The contractor deserved the primary blame for the substandard quality of the work. Francis et al. 2022.

5. Delay (in terms of Time, Work, Response, and Delivery): Work- Project tasks not started on schedule, affect all project parties, and prevent success. Viswanathan et al. 2020.Project delays can be caused by several things, including late permission and approval requests, working progress delays, client payment delays, material and equipment supply delays, and client decision-making delays. Many studies have found that delays are a major source of conflict discovered that in 106 claim cases involving road and bridge projects, delays were the most often mentioned reasons for disagreements. According to a recent worldwide survey on construction disputes, the main reasons for disputes in large-scale construction projects under China's One Belt One Road Initiatives were delays, which were followed by change orders and unforeseen dangers. Construction projects may be delayed by a variety of party-related issues, such as insufficient design information, frequent contract modifications, customers' delayed decision-making, and suppliers' delayed delivery and transportation. Delays can therefore lead to mistrust, time and expense overruns, lost production and income, project interruption, and legal action. Wang et al. 2022.

6. Conflicting goals and objectives of various stakeholders: Diversity of working style among parties, Contract administrators that prefer to bounce disputes to a higher

level or lawyers instead of taking charge of the issues at the source. VO et al.,2020

7. Lack of communication: Throughout a construction project, all stakeholders must maintain effective and transparent communication. However, numerous research has found that communication-related issues are the primary causes of conflicts. Observation indicates that ambiguity in contract documents, misinterpretations of terms or clauses, and errors in interpretation occur frequently in projects. Francis and associates, Poor communication leads to misunderstandings, which hamper one another and cause participants to go in opposite directions, among other issues that cause delays and decreased production. Viswanathan et al.,2020.

8. Contractual problems- unclear requirements and work scope, Orders of change, variations, disagreement with the terms and conditions of the deal as agreed, Lack of Clarity in Documents: Contractual issues include unclear language in the agreement's written terms and conditions, miscommunication between the parties, and ineffective contract administration. Diverse interpretations of the same issue resulting from a poorly worded contract could intensify tensions and disputes. Wang et al. 2022. Numerous factors, such as inadequate working drawing details, scope modifications, design errors, inexperienced owners, erroneous bill of numbers, and irrational contract durations, might result in a changing order. Mahamid, 2016. Changes in scope resulted from the client's request and the consultant's design modifications. Nearly a hundred scope modifications have been experienced by one of the individuals under consideration in the study. Francis et al. 2022.

9. Design errors: This review classified a range of terms found in the literature as design flaws, including inconsistent design documents, poorly stated design requirements and design defects. These terms were cited in 20 studies as the main sources of disagreement. Inexperienced designers, flawed drawings, and a lack of acquaintance with the site's characteristics are some of the causes of design faults. The polled contractors and consultants believed that "inconsistencies in the drawings and specifications" and "design errors and omissions" were the main sources of disagreements. Wang et al. 2022. Design flaws can cause serious delays and extra expenses, which can escalate into arguments between consultants and contractors. Such design flaws were mostly the fault of consultants. In the chosen projects, design

flaws took several forms, including missing design information, unclear drawings, and unfinished designs. Design flaws are common on highly complicated projects and have a significant impact on construction disputes. Francis et al. 2022.

10. Errors in Bid: Numerous studies also found that "disproportionate bidding" and "not adequate time for bid preparation" were significant factors that led to construction disagreements. Wang et al. 2022.

11. Lack of experience as a contractor: Inadequate contractor or subcontractor skill or experience in the field, unsuitability for project work; in addition, mismanagement by stakeholders, inadequate leadership, poor planning resulting in disagreements over cost/time overruns, technical design modifications, etc., making it difficult for stakeholders to handle the complexity of the project. Viswanathan et al. 2020.

12. Poor Project management- Unexpected issues, inadequate site management, lack of resources (people, materials, and money): inadequate project planning and scheduling by a contractor may result in inadequate site management, poor control, cost overruns, delays, and disagreements amongst project participants. VO et al.,2020.

13. Inadequate risk identification/allocation: One major factor contributing to the overall cost of construction is the improper risk allocation provided by contract disclaimer clauses. The authors also stated that unfair risk allocation in construction contracts is a major contributor to disputes because of the exculpatory clauses in contract documents regarding the uncertainty of work conditions, delaying events, indemnity, liquidated damages, and sufficiency. Kumaraswamy (1997), Francis et al. 2022.

14. Unrealistic Client Expectations (Time Targets): Due to the practical impossibility of meeting customer expectations under contract conditions, there are divergent views on project goals between the client and the contractor, which can lead to conflicts. Viswanathan et al. 2020.

15. Lack of trust (Behavioral Factors): Lack of trust, A conflicting mentality among some or all project participants. Chan and Suen, 2005.

16. Inclement Weather/ Natural Calamities: Environmental issues and weather conditions, Weather issues, Unfavorable weather conditions.

17. Lack of knowledge can lead to unrealistic client expectations causing conflicts, land acquisition can cause delay which will lead to conflicts, Ineffective methods causing conflicts between stakeholders as it will affect quality as well as to the neighboring structures as well as for an example excavation not done appropriately will cause an effect on surrounding structures.

Chapter 5

Information of Respondent

5.1 Background

In this chapter respondent experience, designation, and type of organization information is provided. Various construction industry experts were recognized for giving responses to the questionnaire designed to learn about construction disputes. A total of 104 responses were collected for the purpose of the survey. Respondents who contributed to the questionnaire survey on construction disputes in real estate included junior engineers, senior engineers, project managers, government employees belonging to AMC (Ahmedabad Municipal Corporation), and project management consultant's engineers who are the designated respondents, also experience in the sector, as well as organization type in which they were involved, is considered.

The respondent's involvement was important in gaining a thorough understanding and knowledge of the different aspects of construction disputes in the construction sector. The variety of perspectives based on the experience of professionals across different roles and organizations enhances the depth of the study. This diversity is key to identifying effective dispute-resolution strategies, based on which the Dispute Resolution model (DRM) is prepared.

5.2 Experience of Respondent

In Figure 5.1 the experience of the respondents in years of the construction sector in real estate is shown. A total of 10 out of 104 respondents, which is 10 percent, had over 25 years of experience, a group which is small but significant as it highlights the

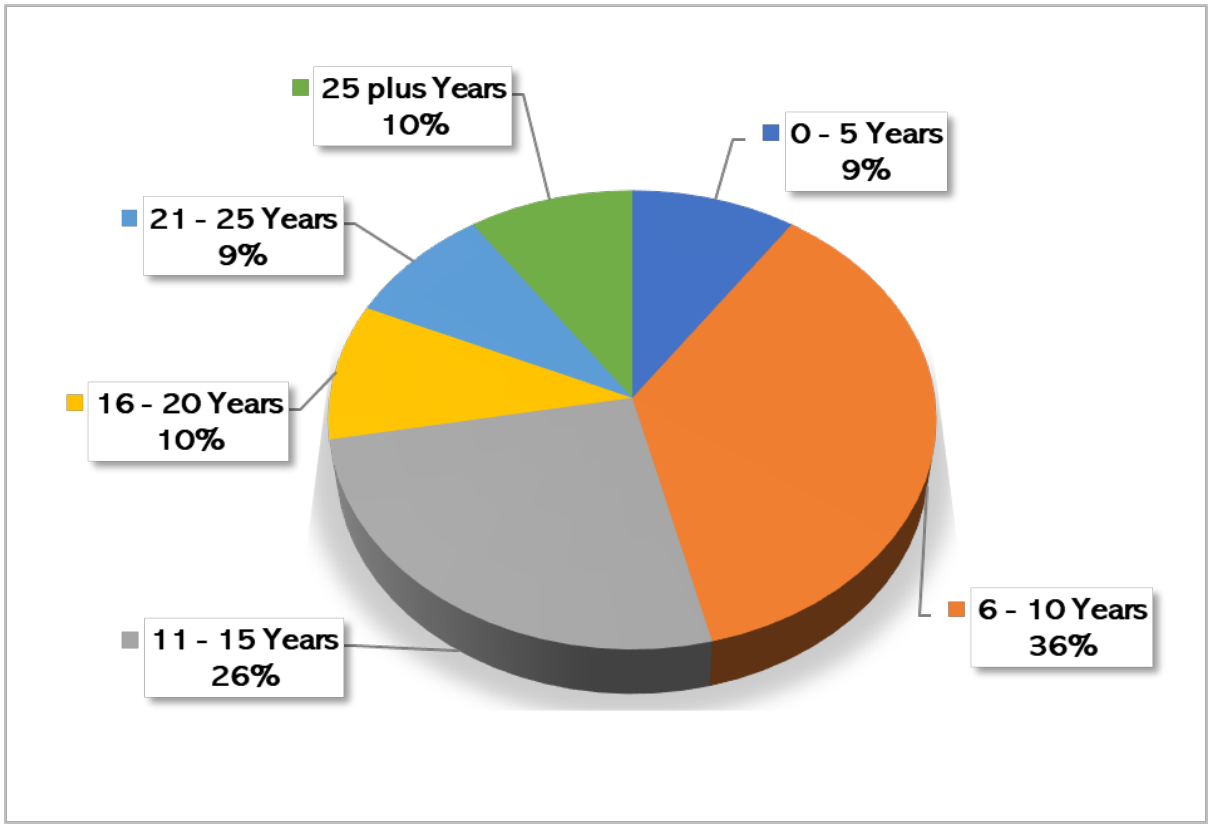

Figure 5.1: Respondents Experience

presence of expert professionals who bring a wealth of knowledge and expertise to the construction sector. Another noticeable group is 9 percent of respondents have 21- 25 years of experience, have a deep understanding of the industry's complex nature, and hold senior positions in the field of the construction sector. Additionally, 10 percent of respondents had 16-20 years of experience, The survey results show that 26 percent of respondents had 11-15 years of experience which indicates mid-career professionals. This group is large and most likely to progress into more responsible roles, handling the complexity of the construction real estate and contributing to the decision-making of the organizations, 36 percent of respondents, which is the largest proportion of the respondents, had 6-10 years of experience, and 10 percent of respondents had 0-5 years of experience. Overall, Figure 5.1 illustrates the distribution of the experts based on their experience ranging from newcomers to highly experienced experts, enhancing the depth of the analysis and covering a wide array of viewpoints.

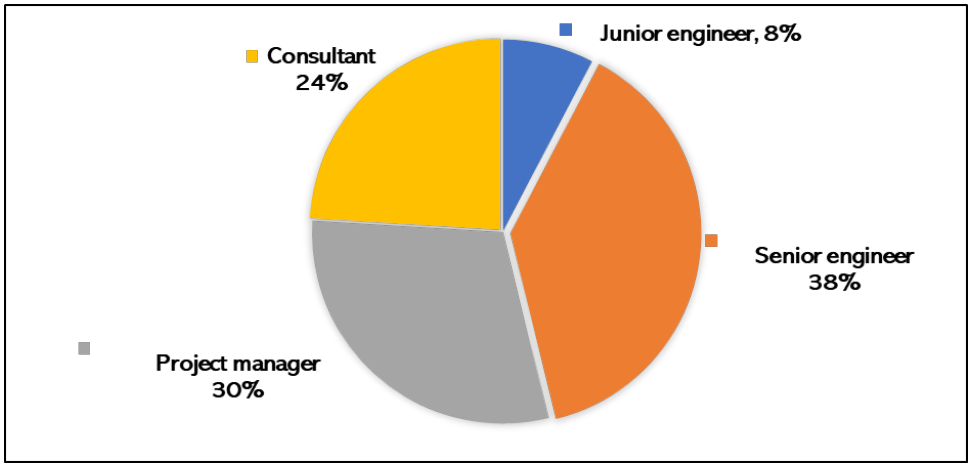

Figure 5.2: Respondents Designation

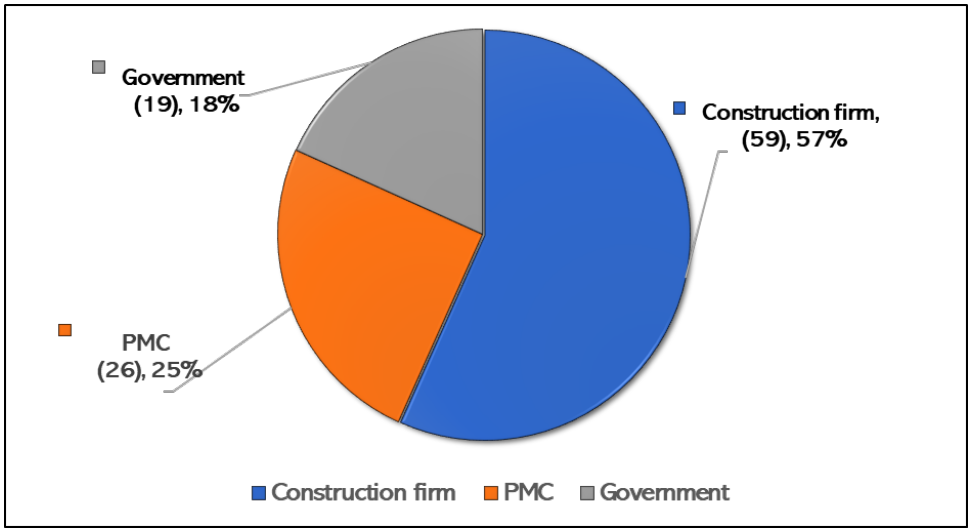

Figure 5.3: Respondents Organization

5.3 Designation of Respondent

As shown in figure 5.2, a total of 8 out 104 were Junior engineers which is 7.69 percent 40 were Senior Engineers which is 38.46 percent, 31 were Project Managers around 29.80 percent and 25 were consultants around 24.03 percent.

5.4 Organization Type of Respondent

As shown in Figure 5.3 19 out of 104 belong to government firms, 59 respondents belong to construction firms and 26 respondents belong to construction consultants.

Chapter 6

Analysis

6.1 Background

To analyze the collected data IBM Statistical Package of Social Sciences (SPSS) Statistics 27 software as well as MS Excel was used. Cronbach's alpha coefficient test was used in this study for the analysis of the internal consistency to validate the question items in the research.

The main objective of factor analysis, an inter dependency approach, is to identify the fundamental structure among the variables under investigation. By identifying groups of highly related variables known as factors, factor analysis offers the means to analyze the structure of the interrelationships (correlations) among numerous variables (such as test scores, test items, and questionnaire responses). These highly connected sets of attributes, called factors, are thought to indicate dimensions in the data. The dimensions can help us create new composite measures if our main goal is to reduce the number of attributes.The dimensions might have meant what they collectively represent, though if we have an intellectual foundation for comprehending the interactions between qualities. In the latter instance, these dimensions might match ideas that are too complex to be captured in a single measurement. From what we'll see, factor analysis offers multiple approaches to encoding these sets of variables so they can be used with other multivariate methods. Heir et al.,2014.

Although there are specific techniques for using fictional variables, factor evaluation is frequently exclusively conducted on metric variables. A collection of metric variables that are factor analyzed may contain a small number of "fictitious variables." If a study is

being designed to reveal factor structure, strive to have at least five variables for each proposed factor.

For sample size: 1. In the research the sample size must have more respondents than the attributes.

2. The minimum absolute sample size should be 50 observations.

3. Try to get as many responses as possible for variables and also the desired ratio is 5 observations per variable.

To identify the attributes influencing construction disputes, EFA was carried out. Twenty-one observable variables were included in the EFA analysis, which was then reduced using the Varimax rotation and the PCA approach. Before performing an EFA analysis, KMO verification and Bartlett's Test of Sphericity were used to determine the relevance of the data. Heir et al.,2014.

6.2 Cronbach's Alpha

Cronbach's alpha- Reliability is a 0–1 measure, with values between.60 and.70 are considered the bottom bound of acceptability. being the most extensively utilized metric. In an exploratory study, Cronbach's alpha may drop to.60, although the usually accepted lower limit is 70. Kalyan et al, 2022.

Table 6.1: Reliability Statistics

Cronbach's Alpha	**N of Items**
.811	21

The positive correlation between Cronbach's alpha and the scale's item count presents a challenge when evaluating the measure. Researchers need to set stricter criteria for scales with a lot of items because additional items will enhance the reliability value even with the same level of inter-correlation. Reliability metrics obtained through confirmatory factor analysis are also accessible. These metrics include the extracted average variance and composite dependability. Heir et al.,2014.

As shown in Table 6.1 the result for the measure of reliability is 0.8, which is analyzed using SPSS. The N of items in the figure denotes the total number of the variable that causes construction disputes in real estate.

6.3 KMO and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were carried out to verify that the data collected was appropriate. The KMO value of 0.630 indicated a significant variance in the components, and the significance threshold for Bartlett's test was 0. The acceptable bounds for Bartlett's test and KMO are less than 0.050 and more than 0.500, respectively. Table 6.1 also shows this. A type of validation test called Bartlett's test of sphericity is used to determine whether the factor analysis results are significant and whether further research work analysis is warranted. Trangkanont et al.,2018.

Factor analysis is acceptable if the results of Bartlett's test of sphericity significance are obtained to a significance level of less than 0.001, indicating a strong degree of correlation between the attributes. Kalyan et al.,2022.

One such measure is the Bartlett test of sphericity, a statistical test for the existence of correlations among the variables. It shows that there are statistically significant correlations between some of the variables in the correlation matrix. However, the researcher should be aware that the Bartlett test becomes more sensitive in identifying correlations between variables as sample size increases. Heir et al.,2014.

Table 6.2: KMO and Bartlett's Test Results

KMO Measure of Sampling Adequacy		0.630
Bartlett's Test of Sphericity	df	210
	Sig.	0.000

As a result, the data may be applied using the factor analysis method. Principal axis factoring with Varimax rotation was employed as the extraction technique. Trangkanont et al.,2018.

6.4 Factor Analysis

The main objective of factor analysis, an interdependency approach, is to identify the fundamental structure among the variables under investigation. By establishing groups of highly related variables, known as factors, factor analysis, in general, offers the tools for studying the structure of the interrelationships (correlations) among multiple variables

(e.g., test scores, test items, questionnaire responses). These highly connected sets of variables, called factors, are thought to indicate dimensions in the data. The dimensions can help us create new composite measures if our main goal is to reduce the number of variables. Techniques for factor analysis might accomplish their goals from an exploratory or confirmatory standpoint. Heir et al.,2014. The analysis of the EFA was conducted with 21 causes which were further reduced by the PCA method using Varimax rotation. Large data sets are broken down into smaller pieces by the statistical process, making it easier to comprehend how particular combinations or patterns come to be. EFA, or grouping of variables together with similarities, is possible based on the interdependency of the variables. In addition to being utilized as a data extraction technique, PCA is frequently used to group several variables, detect correlations, and condense big data into smaller data. Kalyan et al, 2022.

Factor analysis can also be used to reduce data by: (1) selecting representative variables for use in subsequent multivariate analyses from a much larger set of variables; or (2) generating a completely new, much smaller set of variables to replace the original set of variables partially or completely. The goal in both cases is to make the multivariate analysis that follows easier by keeping the original variables' nature and character while decreasing their number. The empirical foundation for factor analysis offers the possibility of developing these composite measures, evaluating the structure of variables, and choosing a subset of representative variables for additional examination. Consequently, the only information available is estimates of the factors and the loadings, or contributions of each variable to the factors. Heir et al.,2014.

6.5 Communality

Total variance a variable has when compared to all other variables in the analysis. Heir et al.,2014. Communality values evaluate each variable's effectiveness and are based on the criteria. The components provide a better explanation for the variable when communality is near to 1. The communalities of the components found are displayed in Figure 6.1. The key to extracting the communalities is found in the variance that determines the distribution of the data set. Covariance indicates how different each variable is from the others, whereas correlation demonstrates how the sources of disagreement are related to one another. Kalyan et al, 2022.

Communalities

	Initial	Extraction
Land acquisition	1.000	.769
Payment problems	1.000	.787
Cost overrun	1.000	.740
Poor Quality	1.000	.787
Rejection for rework (poor-quality work)	1.000	.693
Delay (in terms of Time, Work, Response, and Delivery)	1.000	.768
Conflicting goals and objectives of project parties	1.000	.698
Lack of communication	1.000	.822
Contractual problems-	1.000	.625
Design errors	1.000	.636
Errors in Bid	1.000	.406
Lack of experience as a contractor	1.000	.701
Poor Project management	1.000	.587
Ineffective method	1.000	.773
Inadequate risk identification/allocation	1.000	.415
Lack of knowledge of the client	1.000	.389
Lack of cooperation from the client	1.000	.678
Unrealistic Client Expectations (Time Targets)	1.000	.641
Lack of trust (Behavioural Factors)	1.000	.640
Inclement Weather/ Natural Calamities	1.000	.622
Changes in Government Policy	1.000	.628

Extraction Method: Principal Component Analysis.

Figure 6.1: Communality

6.6 Factors

The goal of data reduction is met by unrotated factor solutions, but the researcher still needs to determine whether or not the information provided by this solution—which satisfies desirable mathematical requirements—offers the most appropriate interpretation of the variables being studied. The majority of the time, factor rotation should make the factor structure simpler, hence the answer to this question is no. Thus, to obtain factor solutions that are both theoretically more relevant and simpler, the researcher then uses a rotational technique. By eliminating some of the uncertainties that frequently accompany first unrotated factor solutions, rotation of the factors typically enhances the interpretation. Method of working with or modifying the factor axis to get a more straightforward and practically significant factor solution. Heir et al.,2014.

Varimax: The goal of the most often used orthogonal factor rotation techniques is to make a factor matrix's columns easier. generally regarded as having an improved factor structure when compared to other orthogonal factor rotation techniques.

Quartimax: a kind of orthogonal factor rotation technique where the columns of a factor matrix are made simpler. In general, the VARIMAX rotation is thought to be more effective. Orthogonal factor rotation: Factor rotation is the process of extracting factors so that their axes remain at ninety degrees. Every factor is orthogonal to or independent of, every other factor. It is concluded that there is no association between the parameters. Oblique factor rotation: To ensure that the extracted components are connected, factor rotation is calculated. The oblique rotation determines how much each component is associated, as opposed to arbitrarily restricting the factor rotation to an orthogonal solution. When analyzing different subsets of variables, VARIMAX rotation is typically more invariant than that produced by the QUARTIMAX approach. An analytical method for achieving an orthogonal rotation of factors is the VARIMAX method, which is successful. There are no set guidelines that the researcher can follow when choosing an orthogonal or oblique rotational approach. Most of the time, the researcher just makes use of the computer program's rotational approach. Although VARIMAX is the default rotation in most systems, all of the main rotational algorithms are readily available. Heir et al.,2014.

Table 6.3: Rotated Component Matrix

	Component			
	1	2	3	4
Payment problems	.869			
Cost overrun	.844			
Poor Quality	.828			
Delay (in terms of Time, Work, Response, and Delivery)	.810			
Ineffective method	.792			
Inclement Weather/ Natural Calamities	.775			
Unrealistic Client Expectations (Time Targets)	.761			
Changes in Government Policy	.760			
Lack of communication		.896		
Lack of experience as a contractor		.836		
Lack of trust (Behavioural Factors)		.795		
Design errors		.793		
Contractual problems		.787		
Poor Project management		.739		
Inadequate risk identification/allocation		.628		
Land acquisition			.846	
Conflicting goals and objectives of project parties			.833	
Errors in Bid			.600	
Lack of knowledge of the client			.512	
Lack of cooperation from the client				.816
Rejection for rework (poor-quality work)				.778

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

In Table 6.3 it is shown that 21 causes are clubbed into factors as well as major attributes are also identified, the cause that has a high value is the cause. In the analysis, PCA is the extraction method employed. Varimax with Kaiser Normalization is the rotation method used. After four repetitions, rotation converged.

Table 6.4: Factors

Causes of Disputes	Factor
Land acquisition	
Conflicting goals and objectives of stakeholders in the project sector	Initiation Phase
Errors in Bid	
Lack of knowledge of the client	
Lack of communication	
Lack of experience as a contractor	
Lack of trust (Behavioural Factors)	
Design errors	Planning Phase
Contractual problems-	
Poor Project management	
Inadequate risk identification/allocation	
Payment problems	
Cost overrun	
Poor Quality	
Delay	Execution Phase
Ineffective method	
Inclement Weather/ Natural Calamities	
Unrealistic Client Expectations	
Changes in Government Policy	
Lack of cooperation from the client	Closeout Phase
Rejection for rework (poor-quality work)	

Based on the analysis, using EFA in SPSS software, in Figure 6.2 the attributes were clubbed into groups which form a factor. As a result, the 21 causes were clubbed into 4 groups, which were termed the phases of the project which are the Initiation phase, Planning phase, Execution phase (monitoring and controlling), and closeout phase. The 21 causes clubbed into factors are shown in Table 6.2.

In Figure 6.2 it is shown that 21 causes are clubbed into factors as well as major attributes are also identified, the cause that has a high value is the cause. In the analysis, PCA is the extraction method employed. Varimax with Kaiser Normalization is the rotation method used. After four repetitions, rotation converged.

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Payment problems	.869			
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Rejection for rework (poor-quality work)				.778

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 4 iterations.

Figure 6.2: Rotation Component Matrix

Chapter 7

DRM

7.1 Preparation of DRM

In Figure 7.1 Dispute resolution model is shown which is in the form of a framework or flowchart. For model preparation following steps were done:

1. Literature Survey: A brainstorming literature review was done of good quality journal papers. The continuum Model was taken for guidance which is shown in Figure 2.1 continuum model.

2. Causes of disputes: 42 causes were identified which were later compacted into 21 after the pilot study. Also, case studies were preferred in the literature papers which gave causes as well as which appropriate methods were selected for dispute resolution.

3. Data collection and analysis: A questionnaire survey was done, from the respondent data given in the survey analysis in which with the help of factor analysis the 21 attributes were compacted and grouped into 4 factors which were termed as the phases of the project which are initial, planning, execution, monitoring and controlling and at last closeout phase.

Based on the factor analysis and literature review model prepared, RERA cases were also studied for a better understanding of the dispute resolution methods.

7.1.1 DRM: Explanation

How the DRM works will be explained in detail, in Figure 7.1 as shown it is in the form of a flowchart, in which each symbol has a specific meaning to be understood.The flowchart presents a structure DRM designed to address disputes that may arise during or after the

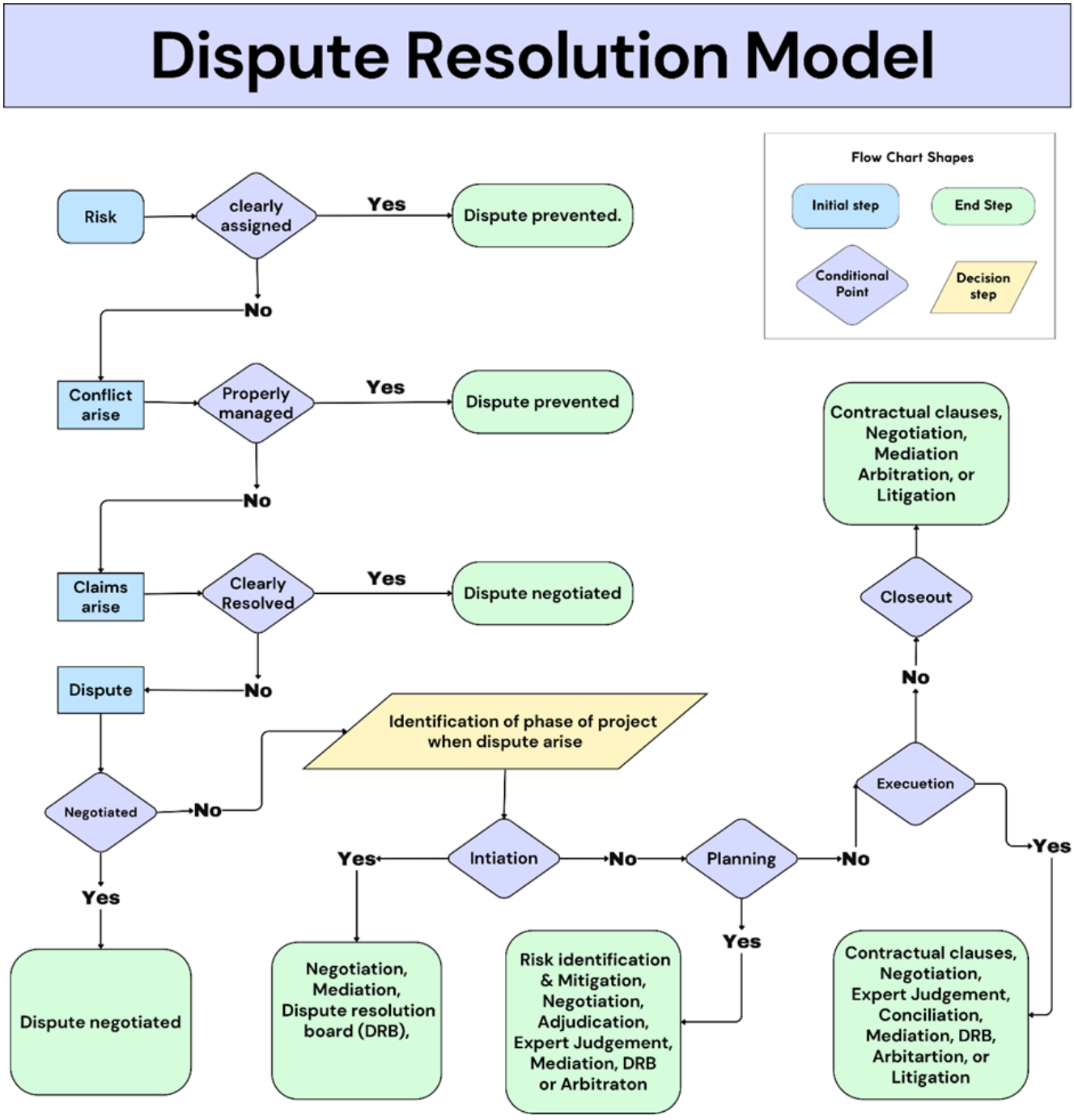

Figure 7.1: Dispute Resolution Method

completion of the project. There are following steps in the DRM which are as follows:

1. Risk assessment: Identification of risk will be the initial step in the DRM, as prevention will be always better than dispute resolution as the resolution of the disputes consumes time and cost and may damage the business relationship between various stakeholders. If the answer is yes, then the dispute can be prevented but if no, then it means that risks are not assigned in the project and then proceed to the next step.

2. Conflict management: if the risk is not assigned and conflicts arise which may be because of not agreement of the parties on the same decision then there will be a conditional point of Determining if the arising conflict is properly managed. If the answer is yes, then the dispute can be prevented but if no, then it means that the conflict is not properly managed, proceed to the next step.

3. Claims Resolution: Claims are one of the major causes of the dispute in the project. If the claims are negotiated and both parties agree on the decision, then it will prevent the situation from being turned into a dispute. If the conditional point answer is yes then the dispute will be negotiated but if the answer is no, then the dispute is not negotiated, identify the phase of the project when the dispute arises.

4. Project phase: Identification of the phase of the project when a dispute arises:

Identification of the project phase will be a decision step based on the symbol interpretation. The project phase identification is a decision step. As the output of analysis has given 4 phases of the project, if a dispute arises in any phase of the project suite methods need to be adopted, the methods are discussed in the action below as follows-

1) Initiation Phase:

Actions: Prevent disputes at the first stage by doing risk identification and mitigation as disputes can be minimized but can be avoided if a dispute arises in the initial phase than use the following methods negotiation, adjudication, expert judgment, mediation, Dispute Resolution Board (DRB), or arbitration to resolve the dispute.

2) Planning Phase:

Actions: Like the initiation phase, engage in risk identification and mitigation. if a dispute arises in the planning phase, then use the following methods negotiation, adjudication, expert judgment, mediation, DRB, or arbitration.

3) Execution Phase:

Actions: if a dispute arises in the execution phase, then use the following methods con-

tractual clauses, negotiation, expert judgment, conciliation, mediation, DRB, arbitration, or litigation.

4) Closeout Phase:

Actions: if a dispute arises in the closeout phase the causes of the dispute may vary for example related to the quality or not rectifying the work and more than use the following methods contractual clauses, negotiation, mediation, arbitration, or litigation.The flowchart's aim is an early resolution of the claims and conflicts to prevent disputes and if the situation turns into disputes in the project, then provide multiple dispute resolution methods which are assigned to specific phase of the project where the dispute arises.

7.1.2 Flow Chart Shapes Key

The flow chart consists of the four shapes shown in Figure 7.1 which are as follows:

1. Initial Step (Rounded Rectangle): Start of a process, as per the flowchart the initial step is risk identification in the project.

2. End Step (Rounded Rectangle): Conclusion of a process, in which the methods of resolution of disputes as well as the result of the resolution is shown in figure 7.1.

3. Conditional Point (Diamond): A decision point that determines the next step as per Figure 7.1 flowchart condition node is provided and based on Yes/No they continue to the next step.

4. Decision Step (Parallelogram): Identifies the phase of the project and after selection of the phase using conditional point the end step is provided.

7.1.3 Process Flow

If risks are assigned in the project and conflicts are managed properly in the project, then disputes are prevented at the earliest stages. If claims arise and are resolved by both parties efficiently, the dispute is negotiated without escalation of time and cost in the project. If a dispute is identified and not resolved through negotiation (which saves time and cost without making data public) due to some reason the parties do not accept the decision. Phases of the project needed to be identified for accuracy as per the flow chart which are divided into four parts. Each project phase has specific resolution actions ensuring that disputes are addressed with suitable methods according to the stage of the project. The model aims to systematically prevent disputes or resolve them efficiently to maintain the project's progress.

Chapter 8

DRM: Validation

8.1 Background

The DRM validation was done by identifying experts in the construction domain, and a questionnaire survey was done. The flow chart was changed in the form of the question using a 5-point Likert scale which consists of scales ranging from strongly disagree, disagree, moderate, agree, and strongly agree. The respondent data was also collected which included the experience of the respondent in the domain, designation of the respondent, and organization type they are working with. Respondents who contributed to the questionnaire survey on construction disputes in real estate included senior engineers, project managers, government employees, and consultants.

8.2 Experience of Respondent

In Figure 8.1 the experience of the respondents in years of the construction sector in real estate is shown. A total of 3 out of 12 respondents, which is 25 percent, had over 25 years of experience, a group which is small but significant as it highlights the presence of expert professionals who bring a wealth of knowledge and expertise to the construction sector.

Another noticeable is that 1 respondent has 21- 25 years of experience, has a deep understanding of the industry's complex nature, and holds senior positions in the field of the construction sector. Additionally, 10 percent of respondents had 16-20 years of experience, The survey results show that 26 percent of respondents had 11-15 years of experience which indicates mid-career professionals. This group is large and most likely

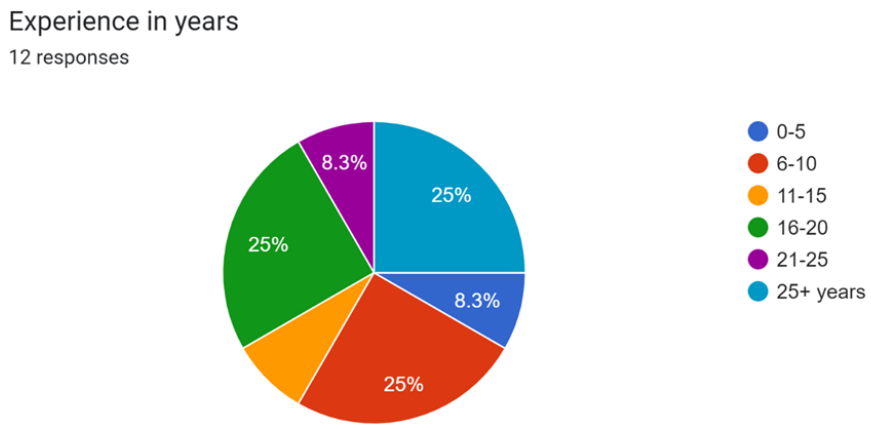

Figure 8.1: Experience of Respondent

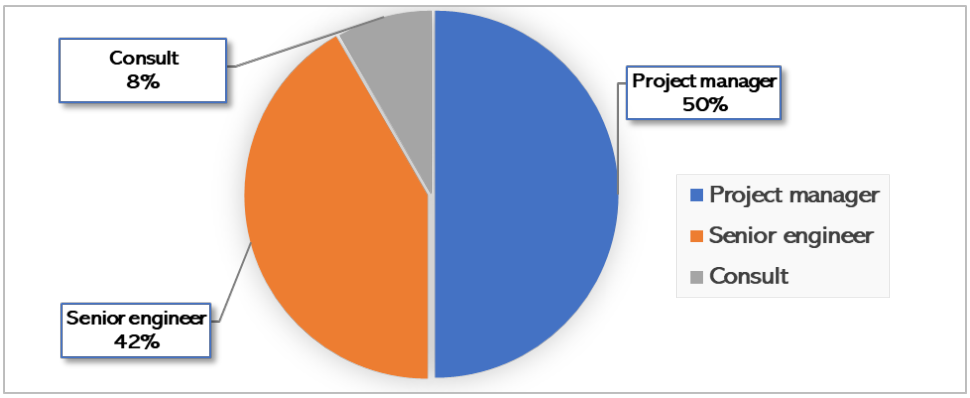

Figure 8.2: Designation of Respondent

to progress into more responsible roles, handling the complexity of the construction real estate and contributing to the decision-making of the organizations, 3 respondents had 6-10 years of experience, and 1 respondent had 0-5 years of experience. Overall, Figure 8.1 shows the distribution of the experts based on their experience ranging from newcomers to highly experienced experts, enhancing the depth of the analysis and covering an array of viewpoints.

8.3 Designation of Respondent

As shown in Figure 8.2, a total of 6 out of 12 were Project Managers which is 50 percent, 5 were Senior Engineers which is 41.7 percent, and 1 was from consultants around 8.3 percent.

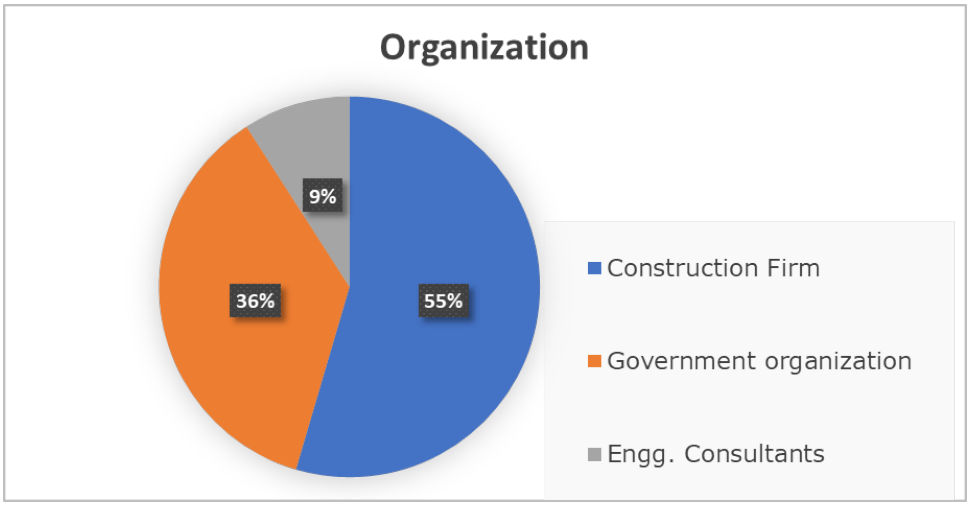

Figure 8.3: Organization of Respondent

8.4 Organization Type of Respondent

As shown in Figure 8.3, 4 out of 12 belong to government firms, 6 respondents belong to construction firms and 1 respondent belongs to construction consultants.

In the respondent detail, the type of projects in which respondents are involved was also taken. 11 respondents are involved in both residential and commercial projects and 1 2 numbers of the respondents are involved with government and industrial projects.

8.5 Validation: Result

In Table 8.1 the questions that were asked to the respondents are shared as well as the responses given on the Likert scale are also mentioned. The total number of responses for each question and each Likert scale unit is mentioned. A 5-point Likert scale was used which measurement units were strongly disagree, disagree, moderate, agree, and strongly agree.

Table 8.1 Validation Questions

Total responses in the Likert scale						
Question		**Strongly dis-agree**	**disagree**	**Moderate**	**agree**	**Strongly agree**
Q-1	If risks are not clearly assigned in the project, will it cause conflict?		1	3	6	2
Q-2	If conflicts are not properly managed in the project, then it will arise claims.				3	9
Q-3	If those claims are not resolved it will turn out to be a dispute				2	10
Q-4	In the initial phase will Negotiation, Mediation, or (Dispute resolution board)DRB will be suitable for resolution			2	8	2
Q-5	In the planning phase risk identification & mitigation, negotiation, adjudication, expert judgment, mediation, DRB, or Arbitration will be suitable for resolution		1		3	8

Total responses in the Likert scale			
Q-6	In the execution stage will contractual clauses, negotiation, expert judgment, conciliation, mediation, DRB, arbitration, or litigation will be suitable for resolution	2	8
Q-7	In the closeout phase will contractual clauses, negotiation, arbitration, or litigation be suitable for resolution	2	8

Based on the respondent data and by using statistical analysis: In the Q-1 If risks are not clearly assigned in the project, will it cause conflict? After analysis, it was found that 75 percent of the respondents agreed with it. In the Q-2 If conflicts are not properly managed in the project, then will arise claims? After analysis, it was found that 95 percent of respondents agreed with it. In the Q-3 If those claims are not resolved it will turn out to be a dispute? After analysis, it was found that 96.67 percent of respondents agreed with it. In the Q-4 In the initial phase will Negotiation, Mediation, or (Dispute resolution board) DRB be suitable for resolution? After analysis, it was found that 80 percent of respondents agreed with it. In the Q-5 In the planning phase risk identification mitigation, negotiation, adjudication, expert judgment, mediation, DRB, or Arbitration will be suitable for resolution? After analysis, it was found that 90 percent of respondents agreed with it. In the Q-6 In the execution stage will contractual clauses, negotiation, expert judgment, conciliation, mediation, DRB, arbitration, or litigation will be suitable for resolution? After analysis, it was found that 96.67 percent of respondents agreed with it. In the Q-7 In the closeout phase will contractual clauses, negotiation, arbitration, or litigation be suitable for resolution? After analysis, it was found that 96.66 percent of respondents agreed with it.

Chapter 9

Discussion

Conceptualization: Conceptualization helps in understanding the importance and basics of the work. The Objectives of the research are set. The literature review is investigated thoroughly. The formulation of the research topic, the study's aims, and its purpose defined the conceptual phase. Literature review: The main aim is to gather information and understand the topic - disputes in the construction sector. Based on the literature survey factors were identified that eventually provided 21 attributes of causing construction disputes, also it proved dispute resolution methods as well as the effects of the disputes on the projects. Identifying causes: 20 Literature papers were taken to identify causes that cause disputes in the construction sector. Questionnaire preparation: Based on the 21 attributes, effects, and dispute resolution methods questionnaire was prepared using a five-point Likert scale where 1 indicates very low to 5 which indicates very high. Similarly, the most effective method for dispute resolution was also given a Likert scale as well and the most severe effect of the dispute on the project was given a 5-point Likert scale. Data collection: Data for this study were gathered via a questionnaire. The questionnaire is created by the issues or difficulties that the literature has brought to light. The analytic tools were selected, and 104 data were collected. Analysis of data: The EFA analysis was conducted with 21 attributes which were further reduced by the PCA method using Varimax rotation. KMO Measure of Sampling Adequacy as well as Bartlett's Test of sphericity were conducted. The analysis was done SPSS software. DRM: Framework was prepared using the literature review and the analysis outcome. DRM is discussed in Chapter 7 in detail. Validation: Analyzed using the statistical method which gave outcomes in respondent approval in percentage.

Chapter 10

Conclusion

The title is " Identify and Evaluate the Key Indicators of Construction Disputes in the Real Estate". As we know disputes may change from place to place and from project to project. Disputes are an unavoidable situation for any construction project. As it consumes resources as well as damages business relationships among shareholders.
Based on the literature review total of 42 causes were identified which later compacted into a total of 21 causes, and a structured questionnaire was designed. Also from the literature review, it was found that on average globally how much time and cost is spent for resolving disputes in the sector, as well as the effects of the disputes on the projects is known as well as the effective methods for dispute resolution. A questionnaire was designed which was circulated and 104 responses were collected. Statistical Package of Social Sciences (SPSS) software Microsoft Excel were used for analysis work. The EFA analysis was conducted with 21 causes which were further reduced by the PCA method using Varimax rotation, KMO measure of Sampling Adequacy as well as Bartlett's Test of sphericity. The 21 causes were clubbed into 4 variables which are named phases of the project, initial phase to the closeout phase.The DRM was prepared based on the literature survey and the analysis of the Data collected by the survey. The validation of the DRM was done using a questionnaire survey, 12 responses were collected. Dispute prevention should be the priority and litigation should be the last step for dispute resolution. For future work, actual case studies can be taken for validation of the model and also less amount of the work is done on the cost of the dispute resolution so that past or current case studies can be preferred which will provide strong output and give knowledge about how much a dispute can cost to the project in the construction sector.

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Annexure

Annexure A

Appendix
Questionnaire

Annexure A has the Questionnaire Form for the data collection of the causes of the disputes. while the Annexure B Questionnaire Form is used for the validation of the Dispute Resolution Model which is discussed in Chapter - 7.

Construction Disputes in the Construction sector.

Questionnaire survey (Nirma University)

Respected Sir/Madam

Greetings,

As we know, **dispute** is a strong barrier to the successful completion of the project, which will cause loss of time, money, and relationships. The problem of disputes in the construction industry is a global and inevitable phenomenon.

The objective of this questionnaire is to collect data for identifying the factors causing disputes in the construction sector. The parameters are outline based on the literature review.

We recognize you as an expert having considerable experience in construction projects and request you to provide your response to the questions and statements given in the questionnaire.

We assure the confidentiality of all responses and information provided by you. **This information will be used purely for academic purposes.** We are bound to preserve the rights and interests of the projects and your organization. **We kindly appreciate your valuable input and time for this study.**

Sincerely,

Mehul Patel, 22MCLT10, M. Tech - CTM, Nirma University

Part A – Respondent's profile

1	**Date of survey**	
2	**Name of respondent** (Optional)	
3	**Email** (Optional)	
4	**Contact Number** (Optional)	
6	**Total experience (years)-**	
7	**Current position-**	Junior engineer/Senior engineer/Project manager/Arbitrator/Lawyer/Professor/Other _____
8	**Select the type of company, you are associated with-**	Construction Firm/Engineering Consultancy Firm/Academic Institute/Legal Consultancy Firm/Government Organization/Others _____
9	**Type of projects involved-** (Residential, Commercial, Infrastructure, Others)	

Part B – Causes of disputes.

According to your project experience, please indicate 1 (Very Low) to 5 (Very High) for each factor to reflect its significance in causing disputes in the construction sector.

Scale 1-5 denotes-

1=Very Low, 2=Low, 3=Moderate, 4=High, 5=Very High **[kindly mark ✓]**

Sr.no	Factor	1	2	3	4	5
1	Land acquisition					
2	Payment problems					
3	Cost overrun					
4	Poor Quality					
5	Rejection for rework (poor-quality work)					
6	Delay (in terms of Time, Work, Response, and Delivery)					
7	Conflicting goals and objectives of project parties					
8	Lack of communication					
9	**Contractual problems-** Unclear Scope of work & specifications, Change orders Variations, Disagreement over agreed contractual terms and conditions, Ambiguities in Documents					
10	Design errors					
11	Errors in Bid					
12	Lack of experience as a contractor					
13	**Poor Project management-** Ineffective planning and scheduling, Poor site management, Poor productivity and control, Unforeseen problems Resource shortage (Man, Material, Money)					
14	Ineffective method (Inadequate methodology and causing problems to surrounding structure)					
15	Inadequate risk identification/allocation					

Sr.no.	Factor	1	2	3	4	5
16	Lack of knowledge of the client					
17	Lack of cooperation from the client					
18	Unrealistic Client Expectations (Time Targets)					
19	Lack of trust (Behavioural Factors)					
20	Inclement Weather/ Natural Calamities					
21	Changes in Government Policy					

Part C – Most suitable Method for dispute resolution [kindly mark ✓]

According to your project experience, please indicate **1(very low) – 5(very high)** for each method of dispute resolution based on their **effectiveness**.

Method	1	2	3	4	5
Negotiation					
Mediation					
Arbitration					
Litigation					
Any other (Kindly mention the method)					

Part D– Major effect of construction disputes- [kindly mark ✓]

According to your project experience, please indicate 1 - 5 for each effect produce due to dispute in the construction projects.

Effect	1	2	3	4	5
Time overrun					
Undermine team spirit					
Cost overrun					
Damage business relationships					
Any other (Kindly mention the effect)					

Part E– Feedback/ Any Comments -

Annexure B

Appendix
Questionnaire

The survey questions for the validation of the DRM:

Construction Disputes in the Construction Sector.

Questionnaire survey

Respected Sir/Madam

Greetings,

As we know, the dispute is a strong barrier to the successful completion without the hurdle of the project, which will cause loss of time, money, and relationships. Disputes in the construction sector are a widespread and unavoidable occurrence.

The objective of this questionnaire is to collect data for the Dispute resolution model. The parameters are outlined based on the literature review. We acknowledge that you are an expert with an extensive amount of experience working on construction projects, and we would like to know your thoughts on the statements and questions included in this survey.

We guarantee the privacy of all your comments and supplied information. This data will only be utilized for educational reasons. We protect the rights and interests of it as well as the initiatives. We sincerely appreciate your time and insightful comments on this study.

Sincerely,

Mehul Patel, 22MCLT10, M. Tech - CTM, Nirma University

Part A – Respondent's profile

1	**Date of survey**	
2	**Name of respondent**	
3	**Contact Number**	
4	**Email**	
6	**Total experience (years)-**	
7	**Current position-**	Junior engineer/Senior engineer/Project manager/Arbitrator/Lawyer/Professor/Other _____
8	**Select the type of company, you are associated with-**	Construction Firm/Engineering Consultancy Firm/Academic Institute/Legal Consultancy Firm/Government Organization/Others _____

9	**Type of projects involved-** (Residential, Commercial, Infrastructure, Others)	

Part B – Dispute Resolution.

According to your project experience, please indicate 1 (Strongly disagree) to 5 (Strongly agree) for each question to reflect its significance in resolving disputes in the construction sector. Scale 1-5 denotes-

1= Strongly disagree, 2=Disagree, 3=Moderate, 4= Strongly agree, 5=Agree

[kindly mark ✓]

Que. no	Factor	1	2	3	4	5
1	If risks are not clearly assigned in the project, will it cause conflict?					
2	If conflicts are not properly managed in the project, then it will arise claims.					
3	If those claims are not resolved it will turn out to be a dispute					
4	In the initial phase will Negotiation, Mediation, or (Dispute resolution board)DRB will be suitable for resolution					
5	In the planning phase risk identification & mitigation, negotiation, adjudication, expert judgment, mediation, DRB, or Arbitration will be suitable for resolution					
6	In the execution stage will contractual clauses, negotiation, expert judgment, conciliation, mediation, DRB, arbitration, or litigation will be suitable for resolution					
7	In the closeout phase will contractual clauses, negotiation, arbitration, or litigation be suitable for resolution					

Part C– Feedback/ Any Comments-