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Dispute Causes Analysis Using Analytical Hierarchy Process for Capstone Projects

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Abstract: ***A disagreement, conflict, or subjective matter that leads to a legal process is termed as a dispute. The likelihood of a dispute arising in a loosely framed large scale construction project is high, which has an impact on project progress and can be considered a type of project risk. When different parties associated with the project are unable to resolve the disputes arising during the contract period it can be resolved by applying Alternate Dispute Resolution (ADR) technique which includes Arbitration, Litigation, Mediation and Conciliation. There are several types of construction disputes in construction projects like price escalation claim, change of work order claim, extra item claim, variation claim, loss of profit claim, delay claim which can be differentiate in various categories of dispute causes.***
This paper aims to identify the prime causes of dispute which occur in the construction industry. To identify the most prevalent construction disputes, a literature review was conducted. From the literature review the primary categories of disputes and sub-categories of disputes were identified. To determine their relative importance, an analysis was conducted using the analytical hierarchy process (AHP) approach.
Keywords: Analytical Hierarchy Process (AHP), Disputes Resolution, Alternate Dispute Resolution (ADR), Construction Dispute

I. INTRODUCTION

Construction industry is a complex industry to handle involving numerous agencies and working together for a developmental large-scale project. In this kind of agreements, disputes are likely to happen. A dispute is a disagreement, argument, or controversy often one that gives rise to a legal proceeding. When the cost is not estimated accurately, there is always a chance of dispute. Disputes are a common occurrence between parties to construction contracts all over the world (Jagannathan et al., 2019). The increasing complexity of construction projects necessitates the use of relatively complicated contracts with plausible clauses that are seldom clear to avoid disagreement. Consequently, the likelihood of dispute occurrence between parties becomes more frequent, and its resolution on site is no longer viable. Many challenges and risks are associated with international contracts that can lead to disputes, such as differences in economic conditions, specifications and standards of material and craftsmanship (Gad & Shane, 2012). Disputes hinder the project's pace, leading to major conflicts and delaying project performance (Gad et al., 2017).

A. Construction conflicts, claims & disputes

There are confusions among construction professionals about what are the differences between risks, conflicts, claims and disputes. All of these terms are used interchangeably. Conflict can be managed possibly to the extent of preventing a dispute resulting from the conflict. Dispute is associated with distinct justiciable issues (Acharya et al., 2006). Disputes are one of the primary factors preventing the successful completion of the construction project. Disputes are associated with distinct justiciable issues and require resolution such as mediation, negotiation, arbitration, etc. (P. I. Cakmak & Cakmak, 2013), (E. Cakmak & Irlayici, 2014)

B. Types Of Construction Disputes

Construction projects are a set of contracts and legal obligations and can be broken down into three main categories: (i) Infrastructure (ii) Industrial (iii) Buildings. The prime stake-holders are usually the owner, contractors, sub-contractors, and sometimes the government depending on the type of project. There are several types of construction claims which generally occur in different type of projects. i.e. Delay claims, Price escalation claim, Change of work order claim, Extra item, Variation claim, Difficult site condition claim, Damage claim, Loss of profit claim, Wrongful withholding of deposits claims etc.

C. *Dispute Resolution Techniques*

There are a few methods that are available for resolving disputes between two parties. The first and most important method is arbitration. When a dispute arises between two parties belonging to the same country, there is an established forum available for the resolution of the same. The parties can get the said dispute resolved through the courts established law in that country. Generally, this has been the most common method employed by the citizens of a country for the resolution of the in disputes with the fellow citizens. When the parties fail to resolve disputes during or soon after the contract period, the traditional resolution mechanism, litigation might be used. Alternatively, disputes can be resolved more quickly and at less cost by applying the Alternative Dispute Resolution method (ADR). Consequently, dispute resolution strategies such as litigation, arbitration, mediation, dispute advisor boards, and negotiation are all widely practiced. (Haugen et al., 2010)

D. *Causes Of Dispute In The Construction Industry*

A Construction Claim is a request for reimbursement from either party to the contract, generally the Contractor, for damages caused by the other party's failure to perform his portion of the contract's responsibilities. During the execution of a project, several issues arise that cannot be resolved among project participants. Such issues typically involve contractor requesting for either time extension or for additional cost, or sometimes both. Such requests by the contractor are referred as Claims.

However, if the owner is in disagreement to the claims put by the contractor and differences arise in the interpretations, the issue takes the form of dispute. There are many reasons for claims viz. timely completion of work, machinery, material, manpower, money, price escalation, accident on site, change in design and many other are major reasons for dispute between two parties which results into disputes.

II. LITERATURE STUDY

The approach to selecting key factors has been critical in matters of construction management for a long time, mainly because many construction problems often require the consideration of multiple factors at the same time and rely on the subjective judgments made by experts.

A. *Selection Of Dispute Resolution Methods*

Conflict is simply an incompatibility of interests, whereas dispute is a later stage involving the resolution of legitimate issues. When the contracting parties fail to resolve a conflict, it becomes a dispute. In reality, conflict and disagreement are unavoidable occurrences in all aspects of construction projects. The following discussion focuses on the most commonly used dispute resolution methods. (Chong, 2012)

The controversial and adversarial nature of the dispute between the contracting parties increase, as well as the consumption of cost or resources and time, once a higher stage of dispute resolution is applied as illustrated in **Error! Reference source not found.**

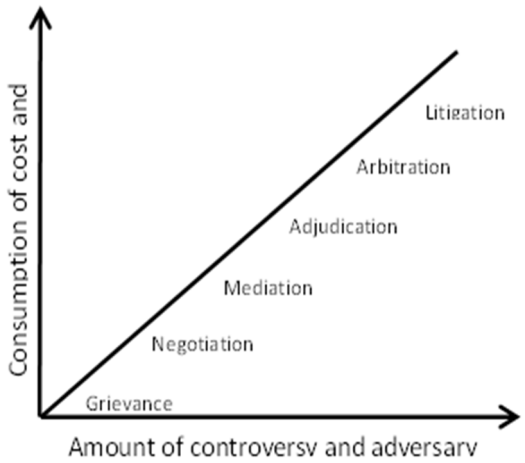

Figure 1 Stages of dispute resolution

Management of construction disputes in an effective way requires mapping the dispute with the most appropriate dispute resolution method (Chan et al., 2006)

B. Analytical Hierarchy Process Approach

Analytic Hierarchy Process (AHP) approach has been widely applied in multi attribute decision making situations(Saaty, 1990). AHP is a method for organizing and analysing complex decisions, using math and psychology. AHP provides a rational framework for a needed decision.

1) Procedural of AHP steps

AHP distinguishes three stages in the decision-making process, i.e., (Stage 1) Structuring the decision problem to solve, (Stage 2) Evaluating the decision criteria and the decision alternatives, and (Stage 3) Categorizing, rank ordering, or prioritizing the decision alternatives.

Figure 2 shows the three decision-making stages. The eight procedural steps of AHP are explained and illustrated in

Figure 2

2) Problem Structuring

In the evaluation stage, each group member judges the relative value of the alternatives on the decision criteria, and judges the relevance of the criteria and sub-criteria. The individual judgments are aggregated into group judgments, and feedback is provided on the consistency in judgments. These four AHP steps that belong to the evaluation stage are explained and illustrated hereafter. (Hummel et al., 2014). In the last stage of the decision-making process, overall priorities are calculated for the alternative technologies

The overall priorities can be used to select the most preferred alternative; to rank order the alternatives from most preferred to least preferred; or to determine the relative value of these alternatives. Subsequently, in a sensitivity analysis, the robustness of the preferences for the alternatives can be analysed. This final decision does not need to be made by the group panel. It can be made by another formal decision-making body, being informed by the results of the AHP analysis. (Hummel et al., 2014).

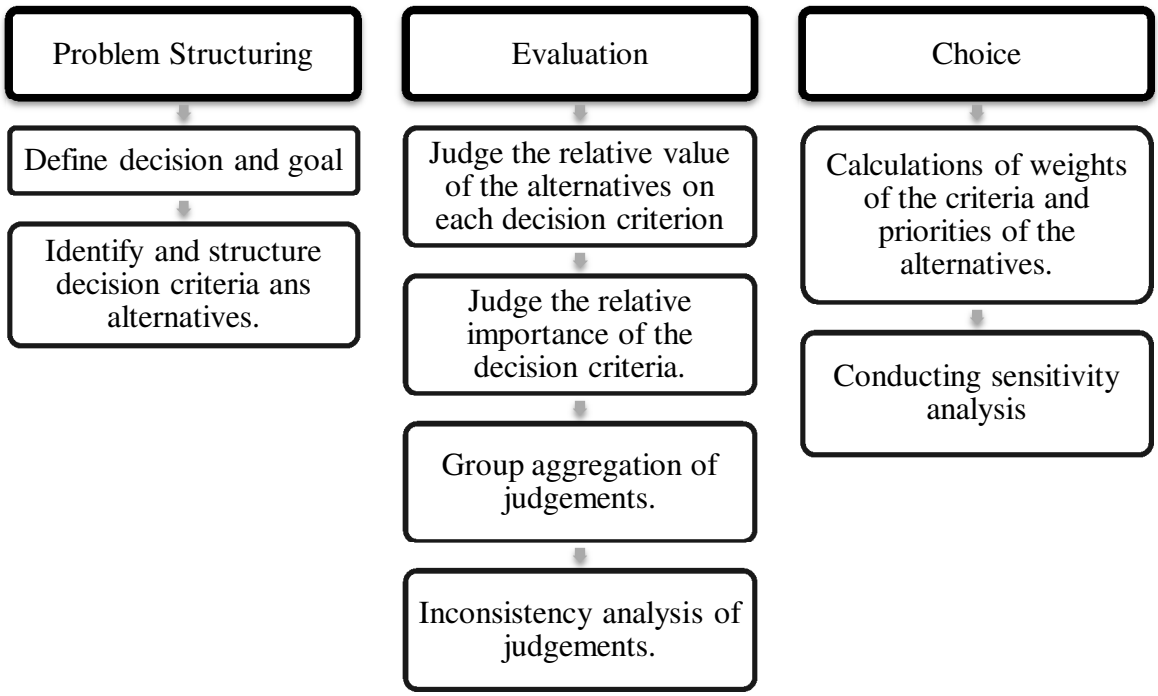

Figure 2 Procedural of AHP steps

The AHP method to calculate priority weights as a decision support system has been implemented successfully in different areas of construction management, such as the evaluation of advanced construction technologies. (Lee, 2015)

C. *Dispute resolution methods from International Construction projects*

International projects are found not only in developed countries, but also developing countries, such as China, South Africa and Vietnam. Disputes are common in international projects because of contractual, cultural, and legal factors.

The dispute resolution methods currently adopted in international projects are varying, including litigation, arbitration, adjudication, mediation, expert determination, dispute resolution board, and minitrial. (Chan et al., 2006) The causes of disputes in international projects are largely two fold. First, the parties' knowledge and experiences in construction law and project management are not homogeneous. Much time is needed for them to get used to the local construction practices, law, and local politics (Chan et al., 2006)Second, as each party has its own set of goals and objectives, it would become a difficult task to align parties' differences and to ensure that they all work toward the same set of objectives. (Chan et al., 2006)

III. METHODOLOGY, DATA COLLECTION AND DATA ANALYSIS

A. *Data Collection*

Data collection has been done from well-known capstone projects stipulated in Gandhinagar, Gujarat. Two well-known projects were taken having average cost of Rs. 800 Cr. The contractors who have worked on these projects are AA class contractor. The financial bid capacity of the contractor is enough to work on any capstone projects in India.

B. *Category Of Dispute Causes*

The causes of disputes are first examined and identified through a relevant literature review. Although researches have concentrated on various causes of disputes, there is a certain level of commonality in the causes of disputes. (P. I. Cakmak & Cakmak, 2013)

Table 1 - Common causes of disputes by categories

Category of Disputes	Causes of Disputes
Owner related (A)	Variations Initiated By The Owner (A1)
	Change Of Scope (A2)
	Late Giving Of Possession (A3)
	Acceleration (A4)
	Owner expecting Extreme Construction Pace (A5)
	Payment Delays (A6)
Contractor related (B)	Delays In Work Progress (B1)
	Time Extensions (B2)
	Financial Failure Of The Contractor (B3)
	Technical Inadequacy Of The Contractor (B4)
	Tendering (B5)
	Quality Of Works (B6)
Design related (C)	Design Errors (C1)
	Inadequate / Incomplete Specifications (C2)
	Quality Of Design (C3)
	Availability Of Information (C4)
Contract related (D)	Ambiguities In Contract Documents (D1)
	Different Interpretations Of The Contract Provisions (D2)
	Risk Allocation (D3)
	Other Contractual Problems (D4)
Project related (E)	Site Conditions (E1)
	Unforeseen Changes (E2)
External factors (F)	Weather (F1)

	Legal And Economic Factors (F2)
	Fragmented Structure Of The Sector (F3)

The data in Table 1 is used in the process of analytical hierarchy process (AHP) approach for determining disputes' relative importance. (E. Cakmak & Irlayici, 2014)

C. Analytical Hierarchy Process

AHP is a strong and flexible multi-criteria decision analysis approach. The analytical network process (ANP) is a generalisation of AHP. After constructing the hierarchy pair-wise comparison is to be done

Table 2 - AHP pair-wise comparison matrix for procurement selection criteria

Intensity of importance	Definition
1	Requirement of A and B are of equal value
3	Requirement of A has a slightly higher value than B.
5	Requirement of A has a strongly higher value than B.
7	Requirement of A has a very strongly higher value than B.
9	Requirement of A has an absolutely higher value than B.
2,4,6,8	These are intermediate scales between two adjacent judgments.
Reciprocals	If requirement A has a lower value than B.

AHP is used in order to identify the relative importance of the causes of disputes. The model is built from the top down, starting with the major sources of disputes, then moving on to the more specific (sub-categories of disputes). Six major categories of disputes and seventeen sub-categories of disputes were identified from the collected data.

A pair wise comparison has been done to analyse the prime causes of disputes. Table 3 shows an example for owner related causes, their comparative values and relative importance of each value. From this matrix, the normalized relative importance value of the four owner related dispute causes can be computed. The relative importance values are shown in the last column of Table 3.

Table 3 - Pair-wise comparison for owner related disputes

	Project Acceleration	Variations initiated by the owner	Change of scope	Owner expecting Extreme Construction Pace	Relative importance
Project Acceleration	1	1/7	1/7	5	1.5714
Variations initiated by the owner	7	1	1/3	1/2	2.1333
Change of scope	7	3	1	5	4.0000
Owner expecting	1/2	5	1/2	1	1.6000

Extreme Construction Pace					

Table 4 lists all of the major dispute categories, their subcategories and their relative relevance values.

Table 4 - Relative importance of disputes causes by categories

Main Categories	Relative importance of main categories (M)	Sub-categories	Relative importance of sub-categories (N)	Global weightage of relative importance (M x N)
Contractor related	0.1368	Different interpretations of the item description	0.3294	0.0451
		Technical inadequacy of the contractor	0.0579	0.0079
		Delays in work progress	0.2735	0.0374
		Contractor's negligence in reading bid documents	0.3392	0.0464
Contract related	0.1188	Different interpretation of contract provisions	0.2114	0.0251
		Ambiguities in contract documents	0.6864	0.0815
		Other contractual problems	0.1022	0.0121
Project related	0.0854	Site condition	0.1250	0.0107
		Unforcen changes	0.8750	0.0747
Owner related	0.1881	Acceleration	0.1533	0.0288
		Variations initiated by the owner	0.1967	0.0370
		Change of scope	0.4579	0.0861
		Unrealistic expectations	0.1922	0.0361
External factors	0.1268	Legal and economic factor	1.0000	0.1268
Design related	0.3441	Design errors	0.6070	0.2089
		Inadequate / incomplete specifications	0.0897	0.0309
		Design changes	0.3033	0.1044

As per the Table 4 "Design related disputes" has the highest relative importance value of 0.3441 means that "Design related disputes" are the most common type of disputes. The sub-dispute causes are: Design errors (0.2089), Inadequate / Incomplete drawings (0.0309) and Design changes (0.1044). Out of these sub categories it can be seen that "Design errors" has the highest value of global relative importance with the value of 0.2089. In the unique type of projects, design errors are creating major disputes in the construction industry. "Legal and economic factor" has the second highest impact for the sub-causes of disputes.

IV. CONCLUSION

The prime causes of construction disputes were identified and analysed for unique type of design projects. From the literature review, the prime causes of disputes were identified which impacts majorly in construction industry, the major disputes being classified in to five major categories: viz. Contractor related disputes, Contract related disputes, Owner related disputes, External factor related disputes and Design related disputes. All the five main categories have their sub-categories of dispute causes. Based on data analysis, "Design related disputes" has highest relative importance. The relative importance of design

related disputes are 34.41%. From the sub-categories of the disputes, "Design errors" have highest relative importance. Relative importance for the Design error is 20.89%. Therefore, it can be concluded that the detailed design analysis to be carried out before the execution works starts.

At the preliminary stage of the project, designs have to be detailed and error less to reduces the disputes. Second highest relative importance from the sub categories are "Legal and Economic factor". The relative importance of this factor is 12.68%.

In the government projects, the contract documents are to be prepared in such a manner that the disputes between client and contractor shall be reduced or are negligible. The AHP model identifies the relative importance of main categories of dispute causes and then identifies the global weightage of relative importance of the different type of dispute causes and sub-causes. Based on the analysis it was identified that design related disputes and their sub-categories of disputes are the major disputes which are happening in the construction project when the design was unique.

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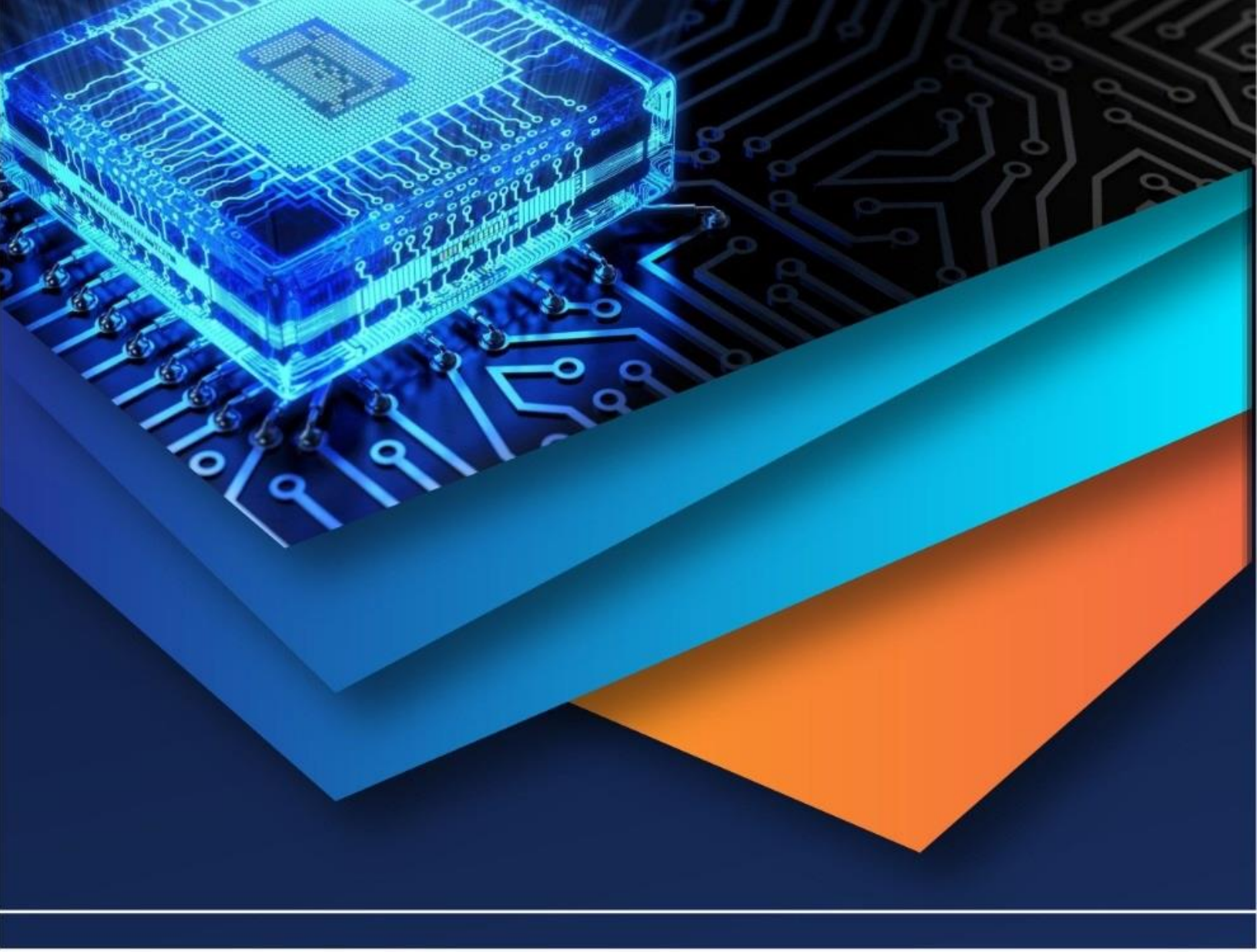

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