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Practical Investigation of Factors Affecting Selection of Dispute Resolution Methods in Construction Projects

Tanmay Dnyaneshwar Patil[1], Prof. Swati B.[2]

1.PG Student, RMD Sinhgad School of Engineering Pune,India
2. Assistant Professor, Department of Construction Management, RMD Sinhgad School of Engineering Pune,India

ABSTRACT: Construction projects are increasingly complex, resulting in complex contract documents. Complex construction can likewise result in complex claims and disputes. Disputes have become an endemic feature of the Indian construction industry. If they are not resolved promptly they can escalate causing schedule delays, lead to claims that require litigation proceedings for resolution and destroy business relationships. The competitive nature and contractual complexity inherent within construction can aggravate the incidence of disputes. Research over the last two decades has revealed that factors such as scope changes, poor contract documentation, restricted access, unforeseen ground conditions, and contractual ambiguities are contributors of disputes. This study provides an insight into the factors which impact upon the selection of dispute resolution methods for construction in the Indian industry. The 12 factors used Bindingness, Economy, Confidentiality, Control, Remedy, Enforceability, Fairness, Flexibility, Privacy, Speed, Relation, Creative etc. Through questionnaire survey, the relative importance of these factors in the selection of dispute resolution methods is examined and through interviews, the efficiency of the current alternative dispute resolution methods operating in India is compared with each other.

KEYWORDS: Disputes, Dispute Resolution Methods, Litigation, Arbitration, Dispute Resolution Board, SPSS, Principal component Analysis, etc

I. INTRODUCTION

Today, India is the second fastest growing economy in the world. The Indian construction industry is an integral part of the economy and a conduit for a substantial part of its development investment, is poised for growth on account of industrialization, urbanization, economic development and people's rising expectations for improved quality of living.
In India, construction is the second largest economic activity after agriculture. Construction accounts for nearly 65% of the total investment in infrastructure and is expected to be the biggest beneficiary of the surge in infrastructure investment over the next five years. Investment in construction accounts for nearly 11 per cent of India's Gross Domestic Product (GDP). $ 239.68 billion is likely to be invested in the infrastructure sector over the next five to 10 years - in power, roads, bridges, city infrastructure, ports, airports, telecommunications, which would provide a huge boost to the construction industry as a whole.
The construction industry is a complex and competitive environment in which participants with different views, talents and levels of knowledge of the construction process work together. In this complex environment, participants from various professions, each has its own goals and each expects to make the most of its own benefits. In the construction industry, since differences in perceptions among the participants of the projects, conflicts are inevitable. If conflicts are not well managed, they quickly turn into disputes. Disputes are one of the main factors which prevent the successfully completion of the construction project. Thus, it is important to be aware of the causes of disputes in order to complete the construction project in the desired time, budget and quality.
During the last two decades the Indian construction industry has been in an intense period of introspection, specifically examining how it can improve its performance and productivity. Time and cost overruns in construction projects has become a ubiquitous feature of the industry. Significant factors that have been identified as contributing to time and cost overruns in Indian construction projects are rework, variations, incorrect design and incomplete documentation, and late authority approvals. As a result of such issues arising in projects, conflict and disputes may occur, which can lead to the disruption of construction schedules, increased project costs, and even adversely influence relationships

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between project participants. If a dispute is not resolved promptly, then it may escalate, and ultimately require litigation proceedings, which can be extremely costly for the parties concerned.

Surveys, experiments and unobtrusive techniques are all different research tools that yield somehow different perspectives of a research question. Each has its specific problems of validity and reliability, and limits to generalize ability. Thus, a thorough investigation of the options available and what best achieves the researchers goals are necessary.

Research methods

Surveys, experiments and unobtrusive techniques are all different research tools that yield somehow different perspectives of a research question. Each has its specific problems of validity and reliability, and limits to generalize ability. Thus, a thorough investigation of the options available and what best achieves the researchers goals are necessary.

Quantitative research

Quantitative research focuses on testing a hypothesis or a theory proposed deductively at the beginning of the research. The study is composed of variables, measured with numbers, and analyzed using statistical procedures. Thus, data generated from quantitative research are countable, tangible, and objective in nature. Using this type of research method is preferred when researching a fact about a concept or a question by collecting factual evidence and studying the relationships between these facts.

Qualitative research

Qualitative research focuses on attitudes, behaviors, meanings, and experiences through obtaining an in-depth opinion from the respondents. Since it involves a deeper look at people's opinions, it involves a less number of people compared to the quantitative method and is subjective in nature. Since construction engineering research involves studying aspects that involve people, social science research methodologies are usually inherited. This becomes especially true when studying topics involving human behaviors, such as trust and culture.

Qualitative research can be categorized to exploratory and attitudinal. Exploratory is used when there is a limited amount of knowledge on the topic. Thus, it is used to diagnose the problem, screen alternatives, and discover new ideas. Attitudinal research subjectively evaluates the opinion or perception of a person towards a particular question/problem.

Statistical analysis

Statistical methods are tools that distinguish between results compatible with chance and those no longer explained by chance. It is a method of analyzing data in a more objective manner. Statistical analysis could be achieved descriptively and inferentially. Descriptive statistics summarize the information in a collection of data to make it easier to assimilate, yet not distort the information. Examples are mean, median, and mode to measure central tendency of a variable or variance, standard deviation, and range to measure dispersion. Inferential methods are used to make predictions about characteristics of a population, based on information in a sample from that population, compare, and relate between the variables in question. The statistical test used is usually dependent on the types of variables and the distribution of the data set.

Statistical Package for the Social Sciences (SPSS) Software

SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more

II. LITERATURE REVIEW

In [1] EmreCakmak and Pinar IrlayiciCakmakproposed a An analysis of causes of disputes in the construction industry using analytical network process. This system aims to analyze the main causes of disputes which occur in the construction industry. In order to reach this aim, a literature review was undertaken to identify the common construction disputes. The disputes derived from a cross-section of the literature, were classified into main categories and the main causes of construction disputes were determined. Finally, an analysis was carried out using the analytical network process (ANP) approach to determine their relative importance.

A.A. Elziny et al.,[2], concentrated on problem of dispute management in Egyptian construction projects. This study presents a comprehensive review of the available literature on analysis of disputes. The objective of this study was to

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provide an expert system can evaluate the overall dispute settlement procedures at company's projects. The most important source of disputes was ''contract management'', the second was ''contract documents'', the third was financial issues, the fourth was ''project related issues'', and the lowest one was ''other sources'' such as force majeure, and loose of construction laws The study indicates that the contract management can be considered the main factor that can affect the existence of disputes due to many reasons such as the issues related to the owner and the contractor, their management of the contract, time schedule prepared by the contractor and required update.

The Zhang Yang [3], contracts are main part of dispute management system. Constructional project contracts are the agreements made by construction project owners (contract issuing parties) and construction enterprises (contractors) according to basic construction procedures in order to complete specific construction and installation projects and to define the rights and obligations of both parties.

Mitkus S. et al., [4] analyzed the causes of conflicts arising between client and contractors in the construction industry. Having analyzed publications addressing disputes in construction projects, the researchers arrived at the conclusion in this study that externally visible circumstances of conflict are usually identified in the contemporary scientific literature as the causes of conflicts. In this study, a construction contract agreement is analyzed as a product of communication between the parties to a construction contract agreement. The research has revealed that a contract allowing a room for being differently (subjectively) interpreted by the parties constitutes the main cause of conflicts in construction projects. It means that the most frequent cause of construction conflicts is unsuccessful communication between the parties to a construction contract agreement. Due attention to the drawing up of construction contract agreements would create strong immunity against pandemic conflicts and disputes. Other causes of conflicts in the construction industry identified in this article include unfair behavior of construction participants and psychological defense mechanisms.

The main goal of **A. H. Abdul Tharim et al., [5]** was to overview the factors of conflict in construction industry. The study highlighted three types of conflict factors which are conflict factors due to behavioral problems, contractual problems and technical problems. Factors of conflict due to behavioral factors includes reluctant to check for constructability, clarity and completeness and poor communication among project team. Meanwhile the factors of conflict which is due to contractual problems are such as late giving of possession, delay interim payment from client and unclear of contractual terms. Whereas, contractor fails to proceed in a competent manner and late instructions from architect or engineer are the factors of conflict which arise due to technical problems.

Output of study made by **K.C. Iyer et al., [6]** is the issues which prompted to develop the current system are mainly the gaps in contract documents leading to disputes. While a foolproof contract document might reduce the issues drastically, it is practically near to impossible to have such a foolproof contract. There are reasons for inconsistencies and discrepancies in large contracts which are beyond the control of the drafter of the contract,

III. MODELING AND ANALYSIS

Model **Principal Component Analysis**

Principal Component Factor analysis was performed on the set of data obtained from scale rating to identify a relative small number of factors that can be used to represent relationships among sets of many interrelated attributes.

Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables.

It is a way of identifying patterns in data, and expressing the data in such a way as to highlight their similarities and differences. Since patterns in data can be hard to find in data of high dimension, where the luxury of graphical representation is not available, PCA is a powerful tool for analysing data. The other main advantage of PCA is that once you have found these patterns in the data, and you compress the data, i.e. by reducing the number of dimensions, without much loss of information.

SPSS (Statistical Package for Social Science)

Statistical Package for Social Science is a software package used for statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2015) are officially named IBM SPSS Statistics. Companion products in the same family are used for survey authoring and deployment (IBM SPSS Data Collection), data mining (IBM SPSS Modeler), text analytics, and collaboration and deployment (batch and automated scoring services).

SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much

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more. SPSS is commonly used in the Social Sciences and in the business world, so familiarity with this program should serve you well in the future.

We use SPSS software for making all the analysis. SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more.

Step 1: You need to interpret the results from your **assumption tests** to make sure that you can use PCA to analyse your data. This includes analysing: (a) the scatter plots that you should have created to check for the **linearity** of your variables (b) **sampling adequacy**, based on the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy for the overall data set and the KMO measure for each individual variable; (c) **data suitable for reduction** with Bartlett's test of sphericity; and (d) the standard deviations of components scores to check for significant **outliers**.

Step 2: You need to inspect the **initial extraction of components**. At this point, there will be as many components as there are variables. You should focus on the **Initial Eigenvalues** to get an initial sense of the major components you have extracted and how much of the total variance each component explains. However, at this stage, you should not only be aware that you don't have sufficient information to select components, but also that the output produced is based on default options in SPSS Statistics (i.e., you may later have to alter these default options, and then reassess the initial eigenvalues based on the new SPSS Statistics output that is produced).

Step 3: You need to determine the number of **'meaningful' components** that you want to **retain**. To do this, you have a number of options: (a) use the **eigenvalue-one criterion** (the SPSS Statistics default); (b) use the **proportion of total variance** accounted for; (c) use the **scree plot test**; or (d) use the **interpretability criterion**. You need to consider why you would use one of these options over another, as well as the implications that these choices might have for the number of components that are extracted. You also have to consider the type of **rotation** you selected - whether Varimax, Direct Oblimin, Quartimax, Equamax or Promax - and how this will influence how your components 'load' onto different variables. The goal is to achieve a **'simple structure'**; that is, a structure where you have a readily explainable division of variables onto separate components, with a component loading onto at least three variables.

Step 4: If you have not chosen to retain the number of components initially presented by SPSS Statistics (i.e., based on the eigenvalue-one criterion, which is the SPSS Statistics default, mentioned in Step 3), you will need to carry out **Forced Factor Extraction** using SPSS Statistics. This simply involves a number of additional steps where you instruct SPSS Statistics to retain a specific number of components (i.e., the number of components you have arrived at based on your choices in Step 3 above). You will then have to re-analyse your data accordingly (i.e., SPSS Statistics will provide you with new numbers based on your new criteria).

Step 5: You need to interpret the final, rotated solution. To do this, you will need to interpret the final (revised) **Total Variance Explained** output from SPSS Statistics and **Rotated Components Matrix**.

Step 6: You are now in a position to **report your results**. This should include all 'relevant' decisions you made during your analysis (e.g., the criteria you used to extract components, which type of rotation you used, etc.). This is particularly important in PCA because so many subjective judgements are made along the way, all of which could have led to different results from the same data. We show you how to do this, as well as how to report your **Rotated Component Matrix** scores, in our enhanced guide.

Step 7: Finally, after you have completed your main analysis, you will often want to **assign a score to each component for each participant**. For example, based on the example we used in this guide, questions regarding motivation loaded strongly on Component 1, so you might want to have a score that reflects an individual's 'motivation'. You might also want to use these scores for further analyses, such as in multiple regressions. We show you two common methods to achieving a score that reflects the variables that are associated with each of your components: component scores and component-based scores.

IV. RESULTS AD DISCUSSIONS

General

Thedata analysis will be carried out using SPSS (Statistical Package for Social Sciences) a statistical software tool for data analysis.

Principal component analysis

Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observation of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables.

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Following table 1 shows varimax rotation output in that four factor are eliminated. In which hilighted values are highest values for each component. That hilighted values lies in which factor colum are related to that factor sub group.

Table 1 : Rotated Component Matrix calculation

Rotated Component Matrix				
	Factors			
	1	2	3	4
Fairness	.677	-.204	-.267	-.010
Confidentiality	.583	-.012	.411	.271
Privacy	.580	.101	.095	-.140
Economy	.266	.770	.054	.002
Control	.219	-.714	.232	-.100
Bindingness	.310	-.375	-.720	.138
Enforceability	-.047	-.084	.645	-.091
Flexibility	.184	-.264	.624	.046
Remedy	-.170	.190	-.049	.748
Relation	-.101	.473	.052	-.642
Creative	.465	.131	-.207	.513
Speed	.352	.314	-.191	-.353

KMO and Bartlett's Test

Following table shows Kaiser-Meyer-Olkin Measure of Sampling Adequacy test results greater than 0.5 that is 0.507 and signifivance 0.000 hence data is acceptible.

Table 2: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.507
Bartlett's Test of Sphericity	Approx. Chi-Square	119.653
	Df	66
	Sig.	0.000

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Mean Score Analysis

Component	Mean	Std. Deviation	Analysis N
Economy	4.5224	0.58668	67
Speed	4.2687	0.68716	67
Relation	4.0149	0.66270	67
Flexibility	3.8358	0.68749	67
Confidentiality	3.6567	1.21296	67
Enforceability	3.6418	0.68978	67
Privacy	3.5970	0.87143	67
Fairness	3.4478	0.72370	67
Bindingness	3.3433	0.47839	67
Control	3.2239	0.79431	67
Remedy	2.8209	0.86909	67
Creative	2.7015	0.95370	67

Table 3: Mean Score Analysis

Above table shows descriptive statistics of twelvw components in that economy, speed, relation and flexibility components shows higher values and remedy and creative components shows lower values. Following matrix shows correlaton of components with each other in that corelation with same components is 1 hence study is acceptible.

Table 4 : Correlation Matrix

Correlation Matrix													
		Economy	Speed	Relation	Flexibility	Confidentialit y	Enforceability	Privacy	Fairness	Bindingness	Control	Remedy	Creative
Correlation	Economy	1.000	0.173	0.291	-0.122	0.085	-0.017	0.033	0.119	-0.217	-0.320	0.008	0.202
	Speed	0.173	1.000	0.157	-0.066	0.003	-0.114	0.259	-0.032	0.084	-0.084	-0.096	0.055
	Relation	0.291	0.157	1.000	-0.161	-0.125	0.078	0.011	-0.077	-0.255	-0.208	-0.232	-0.281

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	Flexibility	-0.122	-0.066	-0.161	1.000	0.240	0.194	0.116	-0.002	-0.195	0.179	-0.075	-0.099
	Confidentiality	0.085	0.003	-0.125	0.240	1.000	0.014	0.254	0.195	-0.055	0.207	0.085	0.146
	Enforceability	-0.017	-0.114	0.078	0.194	0.014	1.000	-0.017	-0.099	-0.356	0.232	-0.109	0.019
	Privacy	0.033	0.259	0.011	0.116	0.254	-0.017	1.000	0.146	0.082	-0.021	-0.017	0.017
	Fairness	0.119	-0.032	-0.077	-0.002	0.195	-0.099	0.146	1.000	0.381	0.192	-0.160	0.328
	Bindingness	-0.217	0.084	-0.255	-0.195	-0.055	-0.356	0.082	0.381	1.000	0.114	0.077	0.261
	Control	-0.320	-0.084	-0.208	0.179	0.207	0.232	-0.021	0.192	0.114	1.000	-0.139	-0.050
	Remedy	0.008	-0.096	-0.232	-0.075	0.085	-0.109	-0.017	-0.160	0.077	-0.139	1.000	0.136
	Creative	0.202	0.055	-0.281	-0.099	0.146	0.019	0.017	0.328	0.261	-0.050	0.136	1.000

V. CONCLUSION

In this study twelve compontes which effects the selection of dispute resolution methods were identified. Principal component analysis tool of SPSS analysis softwear was uesd to study them. According to descriptive satastics of study which shows mean frequencies for each compont. In which economy, speed, relation and fexibility shows higher frequencies and remedy and creativity shows lower frequencies. Four facters were extracted using principal component analysis that is factor analysis. Factor1 contains fairness, speed, bindingness, confidentiality and privacy which is

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related to nature of proceeding of dipute resolution methods, so it is named as factor nature of proceeding of DRM. Fcator2 contains economy and relation which is related to benefit of dupute relation method, so it is named as benefit. Factor3 contains enfoceability, flexiability and control which is related to settlement of agreement, so it is named as settlement of agreement. Factor4 contains remedy and creative which is related to outcome of process, so it is named as outcome of process. So four factors that are extracted from the study are

Fcator 1 : Nature of proceeding of DRM
Fcator 2 : Benefit
Factor 3 : Settlement of agreement.
Factor 4 : Outcome of process.

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