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# Discerning Recurrent Factors in Construction Disputes through Judicial Case Studies—An Indian Perspective

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**Abstract:** Construction disputes have become a recurrent phenomenon in the industry, due to which progress is halted. From a bird's eye perspective, the most frequent cause of a dispute might be payment issues. However, when observed keenly, it has an inter-relationship with almost every other cause, such as contractual changes, delays in project completion, compromising on the quality of construction, etc. Therefore, analyzing the factors which cause a dispute is important. It is also essential to understand the interrelationship of the factors. In this study, judicial construction disputes, along with judgements in different domains, were collected. The most frequent causes of disputes are identified among these cases. Sixty-five cases were considered for the analysis, which constitutes the writ petition, response and final judgment. These items were collected to gain the perspective of the petitioners and respondents over the cause of the dispute and the final judgment to analyze the factors responsible for decision-making. Factor analysis is done to find out the influencing factors, interrelationships and similarities of the disputes respectively. Among the 8 major factors identified, a strong, positive correlation was found between Poor Performance related issues and Payment related issues. By performing Principal Component Analysis (PCA), causes were classified into 3 domains based on their variables.

**Keywords:** construction disputes; contractual changes; delays; factor analysis; judicial cases



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## 1. Introduction

The construction industry faces many problems, which can be either technical or managerial. Technical difficulties have often been addressed and even been solved with adaptations according to the time and industry situation [1]. When it comes to managerial constraints, their presence does affect progress but often has been given a blind eye [2–4]. To confine it to being just a human behavioural issue and no active measures to deal with it has to be considered a major hurdle [5–7].

Contractors, especially in India, have to deal with the noncompliance of local people as well as the governments. It is a well-known fact that the payment delays caused by the governments citing issues related to poor performance and time delays in handing over play a major role in hindering the morale of the contractor [8]. Not only is the record of the contractor getting spoiled, but also sustainability is ambiguous as to what is the time of completion of the project [9].

Construction of any kind has to follow certain rules and regulations to ensure safety, quality and uniform development [10,11]. Noncompliance with those rules leads to disasters. This holds true for all the aspects and phases of the construction process, starting from tendering and execution to completion. The care taken during the initial stages to make sure each intrinsic factor is in tandem with the other is of paramount importance [12]. The way a contract is drafted and the necessary steps to be taken while execution to follow the contractual rules is vital [13,14]. Despite knowing its prominence, not many in the industry make a constant effort to follow all the rules. One of the main reasons for this is that no construction project is similar with different stakeholders, different costs etc., and therefore, apart from a few, common rules are minimal [7,15].

Although it is up for an entirely separate discussion, the perception of dispute settlement only in a court of law seems to bring no change in the resolution process. It is heavily burdened, requires abundant monetary fueling and takes a significant amount of time [16–18]. A strong foundational study based on the types of construction disputes, the causes that lead to a dispute and the possible combination of causes may be fruitful in making people aware of this and counter accordingly in a quick and efficient manner [19–21].

## 2. Dispute Arousal

Conflicts are useful in bringing out the best output in any organization [22]. Constructive criticism does lead to retrospection and has a better impact on the work progress. However, conflicts should be curtailed to the point that they give positive returns. Conflict management, therefore, has paramount importance in controlling conflicts and terminating them before they manifest into disputes [23–27]. Contract drafts which in a way clearly recognize the managerial process and dispute resolutions process in case of arousal, shall minimize the impact of the disputes on a project [28–30].

Based on the literature, disputes can be categorized into 6 distinctive scenarios with respect to the contractual structures.

1. Contracts are sometimes misinterpreted in a way that confuses understanding the details of the contract. These are most often seen in situations where the contractor and owner are not knowledgeable of the contractual norms [31–33].
2. Commitments made in contracts are sometimes evaded in a strategical method, which might benefit only a particular party [34–36].
3. Inefficiency in collaborating with respect to a single party's working process. The contractual provision is not given importance due to the rigidity of the working process [10,37,38].
4. Insufficient information is provided by parties by imposing restrictions in the working process [39–41].
5. Contract drafting is made in such a way that aids in taking undue advantage of a situation by a particular party. This is the case of deliberate sabotaging [42–44]
6. Aspects are not mentioned in the contract and most often are a result of a conflict of interest [45,46].

While the first three are aspects that fall under the category of "mentioned in the contract", the latter comes under "not mentioned in the contract".

It is known that until the dispute is resolved, it is difficult to prevent the conflict from manifesting into another dispute. Therefore, it becomes necessary to understand the combinations of disputes which usually occur in the construction industry [47,48]. While the constraints are repetitive in nature and often observed in combinations, it is important to cluster them with their commonalities such that it offers an understanding with respect to the possible future occurrences of disputes [48,49]. The above-mentioned aspects, such as managerial constraints, non payments, poor performance, contractual changes, etc., are often interrelated with each other. Commonalities among those causes are to be identified to group (cluster) them.

## 3. Research Framework and Methodology

### *3.1. Framework of the Study*

A framework is developed using research on the various causes of disputes in the construction sector as well as the idea of uncertainty. This conceptual framework tries to identify trends in the fundamental causes of construction disputes [50–52]. This framework has been used to examine the research's data, which consists of 65 numbers of construction litigant cases heard by the various State High Courts as well as a few cases by the Supreme court of India. Data collection based on keyword identification, such as construction quality, contractual changes, nonpayment of funds etc., was done. From the obtained results, citations of previous cases given in those cases were traced back and incorporated

as well. Lawyers (advocates) were approached with this base data, and further data was collected.

### 3.2. Case Study Analysis

The framework offers a way to understand how disagreements are caused, in addition to offering a causal analysis of disputes. The parties involved in these disputes were from the public sector and private sector, as well as governments under their jurisdiction. Table 1 shows the cases, their disputed causes, the point of argument and the verdict.

**Table 1.** Litigation cases studied.

| Multiple Causes | | | |
|---|---|---|---|
| **Case No.** | **Point of Argument** | **Causes Categorized** | **Judgment** |
| WP No. 17337 of 2022 | Seeking demolition of unsafe construction. | Performance, payment, contractual, demolition of building | The authorities are made responsible for approvals. Demolition is justified as it holds a threat to the safety of residents. The payments need to be returned. |
| WP No. 17952 of 2022 | Compensation for poor construction quality | Performance, compensation, payment, demolition of building | The contractor is held responsible for repair works or new construction according to the will of the petitioner. |
| WP No. 17707 of 2022 | Illegal construction causing problem, | Land acquisition, contractual, illegal, demolition of building, | The authorities are made responsible for maintaining legality of the construction work causing no inconvenience to the petitioner are accordingly demolish any illegal construction. |
| WP No. 178 of 2020 | Construction affecting the soil fertility, compensation demanded | Land acquisition, contractual, illegal, demolition of building, | Since the construction is temporary and no evidence shows the damaged quality of land, the petition is dismissed. |
| Co. PET 759 of 2014 | Compensation for poor construction quality | Performance, compensation, payment, demolition of building | Contractor is held responsible for repair works or a new construction according to the will of the petitioner. This was based on the corruption charges being true. |
| WP (MD) No. 13460 of 2014 | Usage of workers violating contractual norms | Payment, contractual, illegal, demolition of building | Laborers have to be used only for construction purposes and should be paid more if they are employed for any other works. |
| WP No. 4042 of 2004 | Compensation for poor construction quality | Performance, compensation, payment, demolition of building | Compensation is not justified as the fault in construction is not identified during an early stage which is the primary job of the petitioner. Hence, contractor cannot be held responsible for compensation. |
| **Triple Causes** | | | |
| WP No. 18223 of 2022 | No clearance of bills for the works executed | Performance, payment, contractual | Based on the evidence, payment for the works carried out has to be made with adequate compensation for the delays. |
| WP No. 18245 of 2022 | Demolition of deviation structure | Performance, contractual, demolition of building | Local authorities are held responsible for the approval of deviation structure. Ordered to demolish and compensate the affected party. |
| WP No. 16460 of 2022 | Construction by deviation of sanctioned plan | Compensation, Land acquisition, demolition of building | Changes in the plan are in accordance with the revised by-laws. However, inconvenience to the petitioner has to be compensated by the authorities |

**Table 1.** *Cont.*

| Multiple Causes | | | |
|---|---|---|---|
| **Case No.** | **Point of Argument** | **Causes Categorized** | **Judgment** |
| **Triple Causes** | | | |
| WP No. 17962 of 2022 | Contractual discrepancies | Performance, payment, contractual | Fault in the contract is a false claim. Norms are satisfied and therefore payments are to be made. |
| WP 328 of 2002 | Denial of payment citing poor performance | Performance, payment, contractual | Contractual clauses being ambiguous cannot be attributed to poor performance on part of the contractor. Therefore, payment has to be made as per the contract. |
| WP No. 16626 of 2022 | Non release of bill amounts worth 1500000 | Performance, compensation, payment | Unjustified delays in payments citing lack of funds are unacceptable. Payments with 12% interest have to be made. |
| WP No. 17975 of 2022 | No clearance of bills for the works executed | Performance, payment, contractual | Based on the facts of the evidence, payment for the works carried out has to be made with adequate compensation for the delays. |
| WP No. 17722 of 2022 | Compensation for poor construction quality | Performance, compensation, Payment | Since the authority has taken up the responsibility of poor construction, compensation in the form of rents are to be paid. |
| WP No. 15067 of 2022 | The compensation amount for land acquisition is insufficient | Compensation, Land acquisition, contractual | The compensation process aided deficit payment as middlemen were involved. The payments need to be completed and only then can construction take place. |
| WP No. 18751 of 2022 | Deduction from the amount of refund. | Performance, compensation, contractual | Although poor quality construction is observed, the compensation demanded is way too high. Hence, deduction is allowed. |
| WP No. 15195 of 2022 | Compensation for contractual breach. | Compensation, contractual, illegal | Contractual norms not followed in construction. Therefore compensation needs to be paid. |
| WP No. 17697 of 2022 | Reconstruction due to poor quality | Performance, payment, demolition of building. | The claim that construction was done by using poor quality materials doesn't have evidence as such compensation is not liable. |
| AP 24 of 2020 | Compensation for poor construction quality | Performance, compensation, payment | Material shortage is identified during technical examination. Balance work is not satisfactory, therefore compensation has to be paid. |
| WP No 161 of 2020 | Flats delivered after long postponement | Performance, payment, demolition of building. | Compensations are to be paid as the delay is not justified with an interest of 15% p.a |
| AP 130 of 2017 | Construction is poor with prolonged delays | Performance, compensation, payment | Government authorities couldn't justify the delays as a result; compensation needs to be paid. |
| CA No. 4921 of 2016 | Demolition of illegal construction. | Compensation, contractual, illegal | Illegal construction is to be demolished. Irrespective of the lapse in time, compensation cannot be claimed as it is a violated construction. Hence demolition is justified. |
| CS (COMM) 914 of 2016 | Land acquired used for other purpose than contractually stated | Compensation, Land acquisition, contractual | Although the acquired land is given by consent, it is being used for the construction of a flyover rather than a bypass road. This is unacceptable and has to be stopped. |

**Table 1.** *Cont.*

| Multiple Causes | | | |
|---|---|---|---|
| **Case No.** | **Point of Argument** | **Causes Categorized** | **Judgment** |
| **Triple Causes** | | | |
| WP. No. 12809 of 2015 | Arbitral award being challenged. | Performance, payment, contractual | Arbitral award being challenged which states that payment has to be made is upheld. Along with which interest also has to be paid for the escalated amount. |
| WA. No. 88 of 2012 | Seeking exemption from compensating amount that is insured. | Performance, insurance, demolition of the building | Due to the lack of evidence that argues opposing the insured amount, the case has been dismissed and amount needs to be paid accordingly. |
| Arbitration petition No. 6 of 2009 | Arbitral award being challenged | Performance, payment, contractual | Adding to the faulty construction, which was not the fault of the contractor, bills were not cleared. Therefore the arbitral award is wrong and has to be changed. |
| RP No. 1147 of 2007 | Contractual clause violation | Performance, compensation, contractual | The contractual clause states that the construction shouldn't be done on the first floor. Hence breach of contract is observed and hence needs to be demolished. |
| OMP 152 of 1984 | Un satisfactory arbitral award | Performance, payment, contractual | Arbitral award was challenged but evidence wasn't present to support the claim. Hence the award is valid and need no objections for the same. |
| **Dual Causes** | | | |
| WP No. 18232 of 2022 | Supply of low quality materials | Performance, payment | Materials supplied with respect to the payments made in accordance with the contract. The contractor is found not guilty. |
| WP No. 18224 of 2022 | Contractual clause violation | Contractual, performance | Since the contract specifies avoidance of certain materials in construction, breach of contract is identified. Reconstruction ordered. |
| WP No. 18234 of 2022 | Non payment of bills citing poor performance | Performance, payment | Compensations are to be paid as the delay is not justified with an interest of 12% p.a |
| WP No. 16663 of 2022 | Usage of materials not mentioned in the contract | Performance, contractual | Work needs to be done with quality materials. Repair work needs to be carried out and compensation to be paid accordingly. |
| WP No. 16824 of 2022 | Payment denial due to poor quality construction | Performance, payment | No evidence with respect to poor performance was found. Therefore, payments have to be done as per the arbitrational award. |
| WP No. 17957 of 2022 | No clearance of bills for the works executed | Performance, compensation | Based on the evidence, payment for the works carried out has to be made with adequate compensation for the delays. |
| WP No. 15062 of 2022 | Quality of construction termed faulty. | Performance, contractual | Contractual clauses being ambiguous cannot be attributed to poor performance on part of the contractor. |
| WP No. 15065 of 2022 | Illegal construction causing problem, seeking approval for demolition | Contractual, illegal | The authorities are made responsible for maintaining the legality of the construction work causing no inconvenience to the petitioner and accordingly demolishing any illegal construction. |

**Table 1.** *Cont.*

| Multiple Causes | | | |
|---|---|---|---|
| **Case No.** | **Point of Argument** | **Causes Categorized** | **Judgment** |
| | | **Dual Causes** | |
| WP No. 15203 of 2022 | Illegal construction causing problems, seeking approval for demolition | Illegal, demolition of building | The authorities are made responsible for maintaining legality of the construction work causing no inconvenience to the petitioner are accordingly demolish any illegal construction. |
| WP No. 15203 of 2022 | Road widening issue. | Land acquisition, contractual | In view of public interest, land acquired is justified as the petitioner also agreed before. |
| WP No. 15219 of 2022 | Legality of construction | Contractual, illegal | As long as the construction is according to norms, which in this case is, the legality cannot be questioned. |
| WP No. 17713 of 2022 | No clearance of bills for the works executed | Performance, payment | Based on the facts of the evidence, payment for the works carried out has to be made with adequate compensation for the delays. |
| WP No. 15068 of 2022 | Contractual breach | Land acquisition, contractual | Land acquired more than that specified in the contract. Excess land needs to be handed over. |
| WP No. 17706 of 2022 | Contractual breach with respect to poor construction quality | Performance, contractual | Work quality is un satisfactory and not according to contractual norms. Work has to be redone. |
| CA. 304–306 of 2004 | Contract norms being challenged | Contractual, demolitions of building | Fault in the contract is a false claim. Norms have to be satisfied irrespective of anything for awarding the contract. |
| WP. No. 748 of 2017 | Payment denial due to poor quality construction | Performance, payment | No evidence to prove that the quality of work was unsatisfactory. Therefore, payment has to be made. |
| C.A No. 9128 of 2003 | Dispute about material quality used in construction. | Performance, contractual | Work needs to be done with quality materials and arbitration wasn't performed at the right time. |
| OMP 208/2006 | Compensation amount for land acquisition is insufficient | Land acquisition, compensation | Compensation process aided deficit payment as middlemen were involved. The payments need to be completed and only then construction can take place. |
| WP No. 35782 of 2016 | Petition for need of arbitration | Performance, contractual | Arbitrational requirement is cancelled as there is no evidence for poor quality of work as per petitioner. |
| WP No. 35879 of 2017 | Poor performance claim being challenged | Performance, payment | No evidence with respect to poor performance was found. Therefore, payments have to be done as per the arbitrational award. |
| OMP 75 of 2006 | Reconstruction / compensation due to poor quality | Performance, compensation | The claim that construction was done by using poor quality materials doesn't have evidence as such compensation is not liable. |
| WP No. 12773 of 2013 | Rejection of contract unjustified | Performance, contractual | Expertise is required to execute such work which is not with the petitioner (contractor). Hence the contract not being awarded to the petitioner is justified. |

**Table 1.** *Cont.*

| Multiple Causes | | | |
|---|---|---|---|
| **Case No.** | **Point of Argument** | **Causes Categorized** | **Judgment** |
| | | **Dual Causes** | |
| CS (OS) 503 of 2009 | Local authority obstruction for construction | Contractual, illegal | Work being executed following norms and according to the contractual clauses, need not be halted. Authorities shall not interfere in the process as the construction is not illegal. |
| CA No. 99 of 2017 | The legality of the construction being challenged | Illegal, demolition of building | Approvals took during the time of construction 40 years ago as per laws and regulations. Citing the same for the present scenario is unfair. Hence construction is legal. |
| AP No. 9 of 2019 | Unjustified reasoning over shifting of construction | Land acquisition, contractual | Place shifted from disputed area as it falls under forest land. Therefore it is shifted and hence the petition is approved. |
| WP No 16715 of 2021 | Flats delivered after long postponement | Performance, payment | Compensations are to be paid as the delay is not justified with an interest of 12% p.a |
| AP 12 of 2020 | Construction is poor with prolonged delays | Performance, payment | Irresponsible delays adding to increase in prices which are unjustified. Citing increase in prices, low quality materials were used. Compensation has to be paid. |
| AP 12 of 2019 | Contractual breach with respect to poor construction quality | Performance, contractual | Even after repeated complaints, performance is not improved. Therefore, arbitrational award is revised in favour of buyer. |
| WP No. 17714 of 2022 | Contractual breach with respect to poor construction quality | Performance, contractual | Work quality is un satisfactory and not according to contractual norms. Work has to be redone. |
| | | **Singular Cause** | |
| WP No. 18470 of 2022 | Contractual clause violation | Contractual | Since the contract specifies avoidance of certain materials in construction, breach of contract is identified. Reconstruction ordered. |
| WP No. 17361 of 2022 | Award of the contract is restricted | Contractual | For awarding the contract, various parameters have to be considered. Failure to meet them will cause losing the contract. Hence no fault was found. |
| WP No. 18090 of 2021 | Demand for a refund due to changes in plot allotment. | Contractual | Irrespective of the previous confirmations, due to the changes in plot allotment, refund has to be given. Contractual clauses are not to be amended at a later stage. |
| WP No. 526 of 2020 | Payment issues due to delays. Compensation expected | Payment | The buyer is not responsible for the delay. Therefore, construction according to previous rates needs to be compensated accordingly. |
| WA 1498 of 1990 | Award of contract being restricted | Contractual | For awarding the contract various parameters have to be considered. Failure to meet them will cause loosing the contract. Hence no fault found. |
| WP No. 17711 of 2022 | Payment issues due to delays. Compensation expected | Payment | The buyer is not responsible for the delay. Therefore, construction according to previous rates needs to be compensated accordingly. |
| WP No. 17721 of 2022 | Compensation for poor construction quality | Performance | No evidence found with regard to poor quality construction. Therefore, compensation need not be paid. |

This particular study was conducted by collecting judicial cases for the pretext of identifying the major causes of disputes in the construction industry. Because of the peculiarity of the disputes (i.e., most of the disputes are different from each other), it is also important to understand the various factors for dispute arousal. By collecting the judicial cases along with the petitions, responses as well as judgements, factors leading to the arousal of disputes can be identified. The significance of collecting petitions and responses is understanding the perspective of conflict from both the disputed parties involved [53]. In Table 1, a simplified description of the point of argument is presented, which is versions of both disputed parties clubbed together. The judgment is also similar to the point of argument. From both of these, major causes are identified and categorized. Some of the cases have multiple causes for disputes while others might have only a singular cause. In this study, it ranged from as many as 4 causes in one dispute and descending to one cause per case. Table 1 shows a total of 65 cases which were analyzed for the present study.

From the case studies, the different causes of disputes are broadly classified into 8 types. The various intrinsic factors for causes are listed in Table 2. Intrinsic factors are attributes (variables) based on which the causes are affected by one another. These attributes are obtained from the case study analysis. Based on the versions of both disputed parties, these attributes are identified, some of which are inter related. Exploratory Factor Analysis (EFA) is done to identify the relationship among the causes and how they can be clubbed into groups which happen to have similarities among each other.

**Table 2.** Attributes of disputed causes.

| Cause | Attributes |
| --- | --- |
| Poor performance | Delays on part of the contractor<br>Unsatisfactory work quality<br>Changes incorporated apart from contractual agreements.<br>Material discrepancies |
| Non Payment | Changes in contractual agreements<br>Adamant non payment<br>Deductions<br>Non releasing of deposits<br>Unjustified delays for payment by the owner |
| Land Acquisition | Unjust acquiring of land<br>Unfair Compensation<br>Occupation without consent |
| Illegal | - |
| Contractual | Intermediate changes in contract<br>Delays in approvals<br>Insufficient documents<br>Ambiguities in contracts |
| Insurance | - |
| Demolition of building | Illegal construction<br>Lack of communication between the authorities and owners<br>Differences between neighbors and owners<br>Personal vengeance |
| Compensation | Denial of compensation<br>Delays in compensation<br>Compensated amount not satisfactory<br>Increase interest rates for compensation |

### 3.3. Statistical Analysis

To analyze the interrelationship between the disputed causes, statistical analysis is done using Statistical package of Social Sciences (SPSS v19). Among all the identified factors causing the disputes, which factors influenced the dispute in a particular case are categorized and are inputed accordingly. Multiple column structure is used for this purpose. The variables (factors) are coded as dichotomies with a single value of 1 or 0. Unlike, likert scale, which is used to represent the collected data that might have a particular range in this study, due to the judicial data being more theoretical, the factors (attributes) are identified in each case and are interpreted in the form of a multiple choice response system. Therefore, each case can be attributed to any of the eight identified causes from the case studies. Figure 1 shows the input of data for analysis.

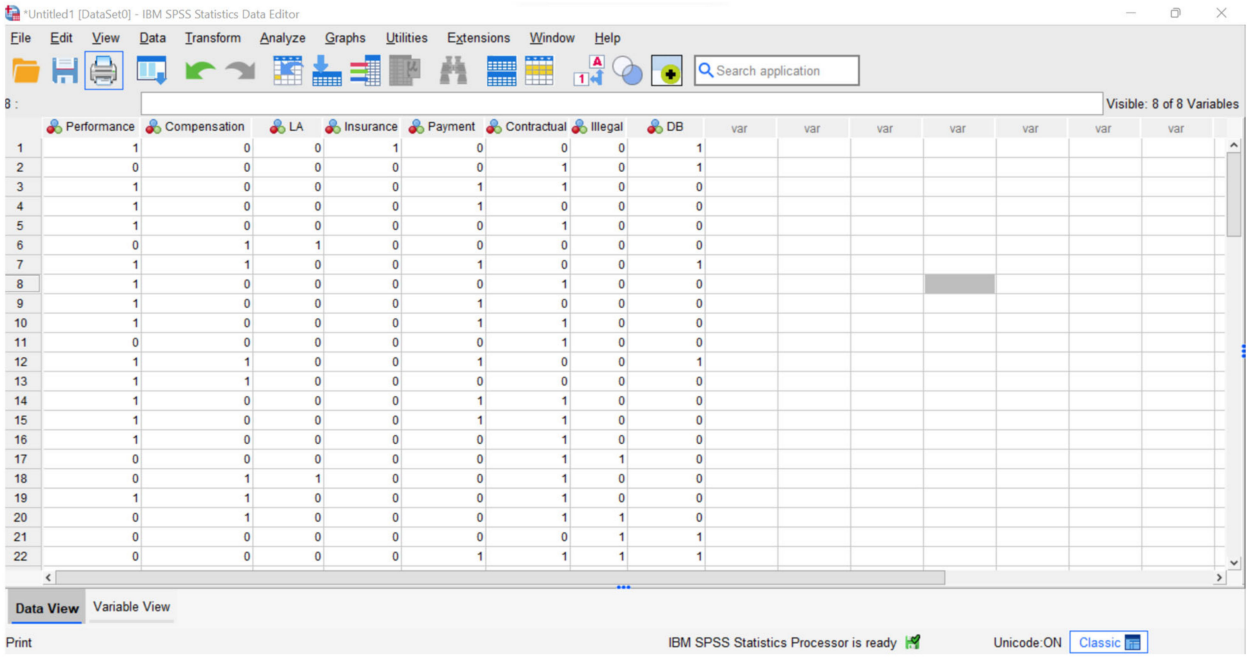


**Figure 1.** Data input into SPSS software.

Table 3 shows the no. of occurrences of each cause in the whole data set. As it is a multiple-response kind of interpretation, repetitions are observed in the occurrences of disputes. Out of the 65 cases studied for this research, the individual occurrence of each cause is observed, as shown in Table 3. Due to these repetitions and the combinations of causes having certain similarities, it is necessary to understand the relationship as well as the difference between the causes. Diverse data sets might help understand the problems in depth, but the surety of data being precise is not guaranteed. Therefore, while performing factor analysis using Principal Component Analysis (PCA) extraction method, commonalities are identified. It is done to analyze the permissible amount of information loss that might not affect the overall result. From the ranking of causes in Table 3, it is clearly understood that poor performance-related issues were in the majority of the cases. It does not mean it is the primary cause of that particular dispute, but it can be a contributing cause.

**Table 3.** Ranking of Cause of Disputes.

| Causes | Occurrence (No. of Times) |
|---|---|
| Performance | 41 |
| Contractual | 36 |
| Payment | 30 |

**Table 3.** *Cont.*

| Causes | Occurrence (No. of Times) |
|---|---|
| Compensation | 18 |
| Demolition of building | 15 |
| Illegal | 10 |
| Land Acquisition | 8 |
| Insurance | 2 |

## 4. Research Findings and Discussions

The analysis consisted of correlation using Spearman's rank order correlation between the disputed causes. Exploratory Factor Analysis (EFA) using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO test) along with Bartlett's Test of Sphericity. Principal Component Analysis (PCA) extraction method was used for factor extraction.

### *4.1. Descriptive Statistics and Correlation*

Statistical analysis is initiated by finding the descriptive statistics like mean and standard deviation as shown in Table 4, which are initial steps for further analysis. Performance cause has the highest mean among other causes and insurance has the least. This was evident with the number of occurrences of those causes in case study analysis.

**Table 4.** Descriptive Statistics of Cause of Disputes.

| Causes | Mean | Standard Deviation |
|---|---|---|
| Performance | 0.631 | 0.486 |
| Compensation | 0.277 | 0.451 |
| Land Acquisition | 0.123 | 0.331 |
| Insurance | 0.031 | 0.174 |
| Payment | 0.462 | 0.502 |
| Contractual | 0.554 | 0.501 |
| Illegal | 0.154 | 0.363 |
| Demolition of building | 0.231 | 0.424 |

Once the majority of causes are identified, the relation of individual causes needs to be understood. The correlation of causes helps to identify the connections each cause has with one other. By identifying the interrelationship among causes, a clear understanding of the implications each cause has on others is obtained.

A Spearman's rank-order correlation, to determine the relationship between components (i.e., performance to demolition of the building) was done in SPSS. There was a strong, positive correlation between Performance-Payment, Insurance-Demolition, strong negative correlation between performance-land acquisition, performance-contractual, performance-illegal, compensation- contractual, payment-land acquisition, payment- contractual which was statistically significant (highlighted in red colour) as shown in Table 5.

Positive correlation shows heavy interdependency among those causes, thus implying that disputes are more often than not a combination of those causes. Whereas negative correlation is the exact opposite. The negative values indicate minimum to no interdependency among the causes. It can be seen in Table 5, the significance of correlation was done in two stages at 0.01 and 0.05 levels. Significance level at two stages is identified by the star marks as superscripts next to the values. It is It is to be noted that these correlation results are considered for the causes when they are seen through individual spectrum. Once they are combined with another cause of dispute, the domain and interpretation might change.

Based on the values obtained for both 0.01 level and 0.05 level (2-tailed) there is a significant correlation among the various causes of disputes. The pictorial representation of the correlation can be seen in Figure 2. The chord diagram interpretation is to show the

interdependency of causes (individually) with one another. Chords with thicker width conveys stronger relation. Similarly narrow chords interpret less interdependability. However, in the case of insurance, the thin line does not mean it has insignificant correlation. Within the present data set, it is comparitively less in a number of occurrences as opposed to other causes.

**Table 5.** Correlation matrix of causes.

| | | | Performance | Compensation | Land Acquisition | Insurance | Payment | Contractual | Illegal | Demolition of Building |
|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Performance | CC | 1.000 | 0.046 | −0.490 ** | 0.136 | 0.453 ** | −0.302 * | −0.557 ** | −0.035 |
| | | Sig. (2-tailed) | - | 0.716 | 0.000 | 0.279 | 0.000 | 0.015 | 0.000 | 0.782 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Compensation | CC | 0.046 | 1.000 | 0.187 | −0.110 | −0.021 | −0.275 * | −0.073 | −0.013 |
| | | Sig. (2-tailed) | 0.716 | - | 0.136 | 0.382 | 0.867 | 0.027 | 0.562 | 0.921 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Land Acquisition | CC | −0.490 ** | 0.187 | 1.000 | −0.067 | −0.347 ** | 0.148 | 0.100 | 0.128 |
| | | Sig. (2-tailed) | 0.000 | 0.136 | - | 0.597 | 0.005 | 0.240 | 0.429 | 0.309 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Insurance | CC | 0.136 | −0.110 | −0.067 | 1.000 | −0.165 | −0.199 | −0.076 | 0.325 ** |
| | | Sig. (2-tailed) | 0.279 | 0.0382 | 0.597 | - | 0.189 | 0.113 | 0.548 | 0.008 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Payment | CC | 0.453 ** | −0.021 | −0.347 ** | −0.165 | 1.000 | −0.411 ** | −0.224 | −0.068 |
| | | Sig. (2-tailed) | 0.000 | 0.867 | 0.005 | 0.189 | - | 0.001 | 0.073 | 0.593 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Contractual | CC | −0.302 * | −0.275 * | 0.148 | −0.199 | −0.411 ** | 1.000 | 0.211 | −0.096 |
| | | Sig. (2-tailed) | 0.015 | 0.027 | 0.240 | 0.113 | 0.001 | - | 0.091 | 0.447 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Illegal | CC | −0.557 ** | −0.073 | 0.100 | −0.076 | −0.224 | 0.211 | 1.000 | 0.171 |
| | | Sig. (2-tailed) | 0.000 | 0.562 | 0.429 | 0.548 | 0.073 | 0.091 | - | 0.173 |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| | Demolition of building | CC | −0.035 | −0.013 | 0.128 | 0.325 ** | −0.068 | −0.096 | 0.171 | 1.000 |
| | | Sig. (2-tailed) | 0.782 | 0.921 | 0.309 | 0.008 | 0.593 | 0.447 | 0.173 | - |
| | | N | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |

CC—Correlation Coefficient, ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

### *4.2. KMO and Bartlett's Test*

KMO test and Bartlett's Test of Sphericity were conducted to check the suitability of the collected data. Significant variance in the factors were identified as the KMO value was found to be 0.509 significance level of for the Bartlett's test was 0. The permissible limits of both KMO and Bartlett's test are above 0.500 and below 0.050 respectively. Table 6 indicates the same. The Bartlett's test of sphericity is a kind of validation test to confirm whether the results of factor analysis are considerable and whether we should continue with the analysis of research work. If the Bartlett's test of sphericity significant is obtained to a level of significance which is <0.001, then it is an indication that there is a high level of correlation between variables, which makes it sufficient enough to apply factor analysis.

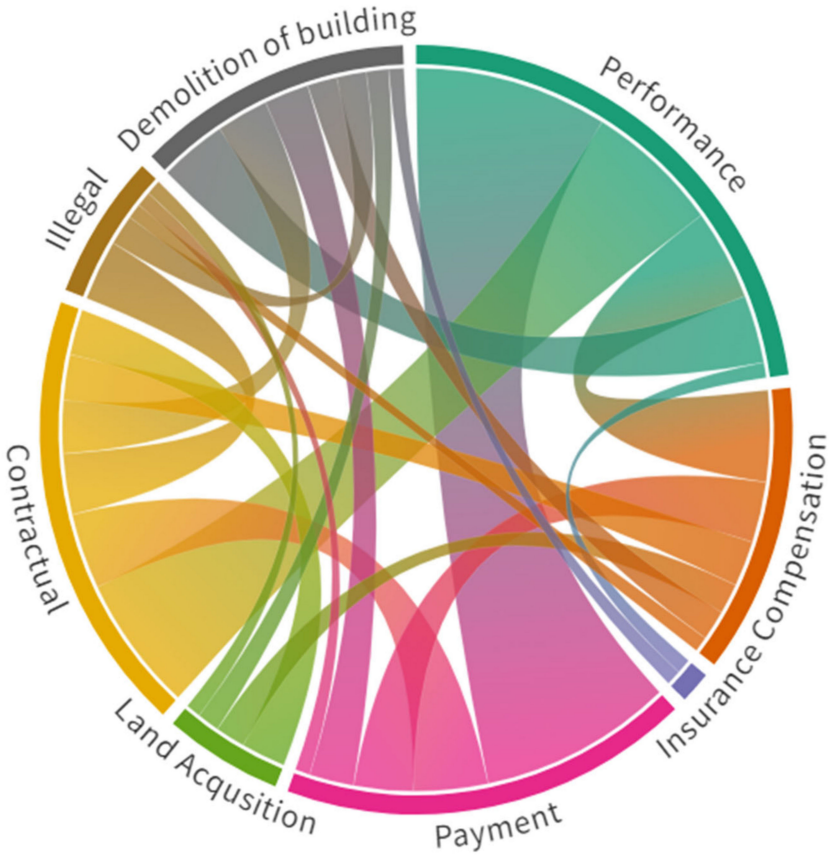


**Figure 2.** Chord diagram representation of correlation of various causes of disputes.

**Table 6.** KMO and Bartlett's Test.

| Test | | Values |
|---|---|---|
| **Kaiser-Meyer-Olkin Measure of Sampling Adequacy.** | | 0.509 |
| **Bartlett's Test of Sphericity** | Approximate. Chi-Square | 106.112 |
| | df | 28 |
| | Sig. | 0.000 |

Kaiser-Meyer-Olkin measure is the index which is useful in defining the sample adequacy. The obtained KMO test value is 0.509 which is more than 0.500. Therefore, it can be considered as good/suitable to conduct a data reduction technique.

### *4.3. Principal Component Analysis (Factor Analysis)*

The statistical procedure to consolidate large data into smaller components to easily understand by the formation of certain patterns or combinations. Based on the interdependency of the variables, grouping of variables together with similarities can be achieved, which is called as Exploratory Factor Analysis (EFA).

#### 4.3.1. Communalities

Communality values assess the efficacy of each variable is explained by the factors. When communality is close to 1, there is a better explanation of the variable by the factors. Table 7 shows the communalities of the factors identified. The variance determining the spread of the data set becomes the key in extracting the communalities. While correlation shows the interdependency of the causes of dispute, covariance gives the amount of difference each variable has with respect to each other.

**Table 7.** Communalities of factors.

| Causes | Initial | Extraction |
|---|---|---|
| Performance | 1.000 | 0.741 |
| Compensation | 1.000 | 0.764 |
| Land Acquisition | 1.000 | 0.632 |
| Insurance | 1.000 | 0.717 |
| Payment | 1.000 | 0.534 |
| Contractual | 1.000 | 0.646 |
| Illegal | 1.000 | 0.414 |
| Demolition of building | 1.000 | 0.620 |

#### 4.3.2. Total Variance

The total variance is the summation of the variances. All individual principal components and their variances are used for this. Table 8 shows the total variance of the components. Total 8 components are obtained out of which only 3 components have eigen values greater than 1. Thus, even though results are obtained for a cumulative total of 100% variance, only those components which have eigen values greater than 1 are considered. Therefore, the total variance, constituted into 3 components is found to 63.3% as shown in Table 8. This is above the acceptable level (minimum threshold value is 50%), hence the analysis can be proceeded.

**Table 8.** Total Variance.

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| **Component** | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** |
| **1** | 2.364 | 29.552 | 29.552 | 2.364 | 29.552 | 29.552 | 2.361 | 29.511 | 29.511 |
| **2** | 1.426 | 17.829 | 47.381 | 1.426 | 17.829 | 47.381 | 1.423 | 17.786 | 47.297 |
| **3** | 1.278 | 15.975 | 63.356 | 1.278 | 15.975 | 63.356 | 1.285 | 16.059 | 63.356 |

#### 4.3.3. Rotated Component Matrix

The rotated component matrix aids in determining representation of components. Adopting the varimax with the kaiser normalization rotation method, the three components with eigen values more than one are considered. In these rotation matrix, in the process of grouping the variables with similarities on a rotation bases, component 1 is found to have grouped 5 causes (performance, payment, land acquisition, illegal and contractual). Component 2 has two causes clubbed together (insurance and demolition of building). While the third component has only one cause, compensation. To interpret the data in simpler terms, the rotation was done in 5 iterations. The values shown in the table are loading to the cause that is being factored. The values of loading for all the causes are greater than 0.4 which is to show that all the values are relevant. Negative values of the loading (in the case of performance and payment) is due to the grouping of variables through 5 iteration process and due to the presence of bipolar dimension i.e., having the same factor in positive and negative dimensions. The negative or positive sign of the loading is irrelevant as the value of the loading is greater than 0.4. The values are shown in Table 9.

Pie chart representation of the components is shown in Figure 3. The pie chart is divided as per the component grouping obtained by rotated component matrix. Out of the whole data set, 21% of causes of dispute are categorized into 2 components (component 2 with insurance and demolition of building) and component 3 with compensation. The remaining causes are categorized from component 1 containing performance, payment, land acquisition, illegal and contractual related problems.

**Table 9.** Rotated Component Matrix.

| Causes | Component 1 | Component 2 | Component 3 |
|---|---|---|---|
| Performance | −0.854 | | |
| Payment | −0.713 | | |
| Land Acquisition | 0.624 | | |
| Illegal | 0.623 | | |
| Contractual | 0.556 | | |
| Insurance | | 0.834 | |
| Demolition of building | | 0.768 | |
| Compensation | | | 0.868 |

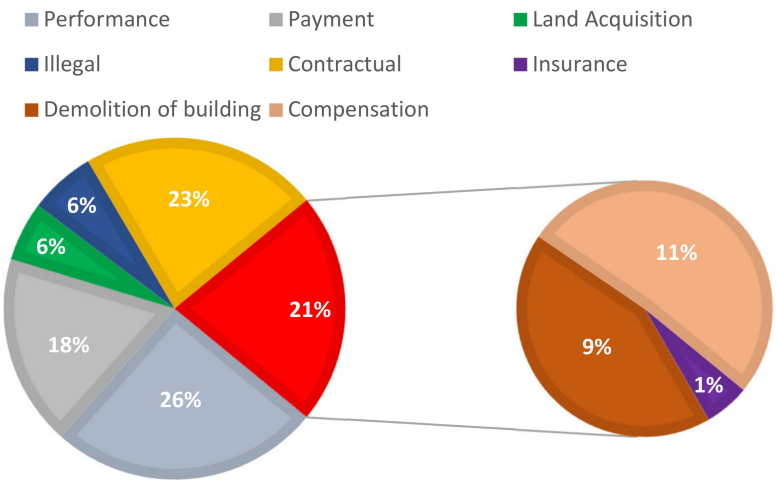


**Figure 3.** Pie chart representation of components and causes.

The Scree plot for total variance is shown in Figure 4 which indicates the factors that can be retained based on eigen values. The scree plots show the components as the x axis. Y axis is the representation of eigen values for the components. 3 components are considered (first 3) whose eigen value are greater than 1. These 3 components, because of having eigen values greater than 1 as well as sharing maximum variance, they are crucial in the study. Scree plot is generally used to find out the retainable factors out of the whole lot. Studies where there are many factors, it becomes easy through scree plot to identify the retainable factors. Since the present study has eight factors with all of them being grouped into 3 components with eigne values greater than 1, it is readily identifiable.

Exploratory factor analysis reduced 8 factors into 3 components based on co variance patterns. As mentioned earlier, all the factors are possessing factor loading greater than 0.4 which is acceptable. Total variance was found to 63.356% which is acceptable. Table 10 shows exploratory factor analysis with component score and percentage loading.

**Table 10.** Exploratory Factor Analysis.

| Attribute/Variable Name | Factor Loading (Component Score) | % of Loading |
|---|---|---|
| Performance<br>Payment<br>Land Acquisition<br>Illegal<br>Contractual | 0.854 | 29.511% |
| Insurance<br>Demolition of building | 0.834 | 17.786% |

**Table 10.** *Cont.*

| Attribute/Variable Name | Factor Loading (Component Score) | % of Loading |
|---|---|---|
| Compensation | 0.868 | 16.059% |
| Total Variance Explained | | 63.356% |

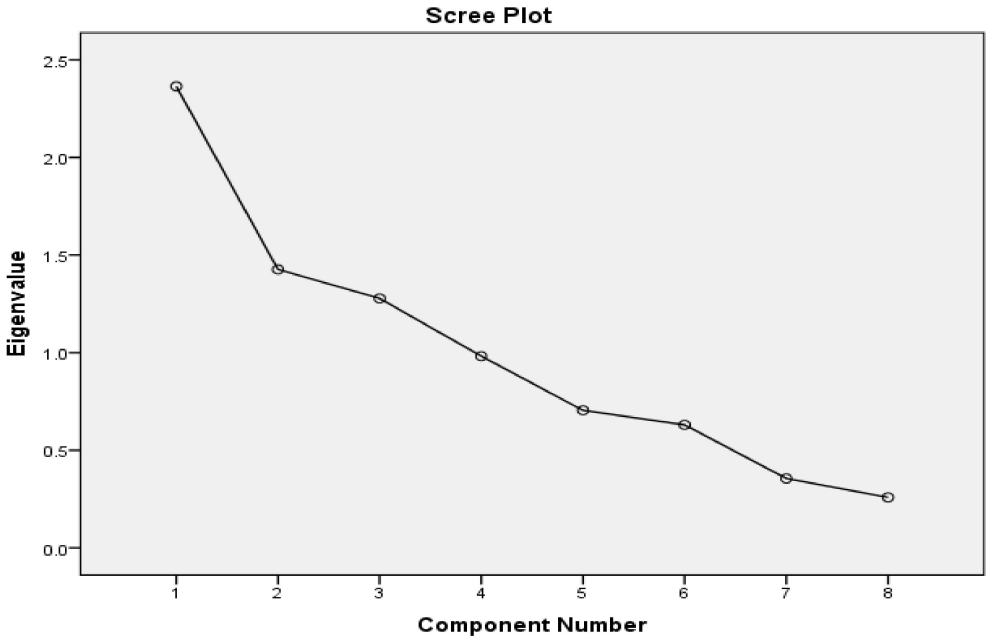


**Figure 4.** Scree plot causes of disputes.

## 5. Conclusions

Dispute-causing factors or causes, if identified, the scope for mitigating disputes is more. Broadly classified causes can give a wide picture, but in-depth analysis can be useful in recognizing the repetitive factors that are responsible for disputes in the construction industry. In this study, judicial cases were gathered, which form the data set to gain perspective from both the disputed parties as well as a judgment from the court. Case studies revealed that 8 major causes were responsible for the disputes. These include poor performance, payment, land acquisition, demolition of buildings, contractual, compensation, insurance and illegal. Upon thorough statistical analysis consisting of correlation and factor analysis by means of principal component analysis, it was found that poor performance of the contractors combined with payment delays constituted the majority of disputes and is one of the most recurring causes. Intrinsic factors such as delays on the part of the contractor, unsatisfactory work quality, changes incorporated apart from contractual agreements, and material discrepancies accounted for poor performance. At the same time, changes in contractual agreements, adamant non payments, deductions, non-releasing of deposits, and unjustified delays for payment by the owner come under payment.

Exploratory Factor Analysis was used to group the causes into 3 different components. The first group consists of performance, payment, land acquisition, and illegal and contractual-related problems. Other components consisted of the demolition of buildings and insurance clubbed together, and the final component had compensation alone. The grouping of causes suggests that the interdependency of those causes is high. A particular construction project having the possible factors might manifest into another cause pertaining to the same group. Future studies can be explored in the area with a larger and more diverse data set.

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