Perception of Construction Participants in Construction delays: A case study in Tamilnadu, India.

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Abstract. Delays in the construction industry are universal fact, which affects the construction participants. The research work spotlights on determining the prevailing delays in the cities of Tamil Nadu, as perceived by the participants. After a few field level interactions, a questionnaire was framed and administered to the participants i.e., Consultants (50 Nos.), contractors (50 Nos.) and clients (150 Nos.) to understand their perception on the causes of delays. The factors for delay was categorized into 4 groups say Improper project planning, Design related issues, Finance related issues and Resource related issues. The responses were analysed using the SPSS software by applying ANOVA and Regression analysis. From the analysis, it was found that the personal financial problems of the client dominantly affect the entire construction progress and the subsequent design changes by the clients, Inadequate early project planning, labour related issues. Also, the delay groups were found to be the improper project planning and the Resource related issues.

1. Introduction
In India Construction Industry is the second largest growing, dominant, and ever green field next to agriculture, in which delay is the most enveloping factor in it. Delay may be pronounced as the let down to far-reaching the task in assured phase and projected cost. Delays are foreseeable and may take place at any stage of the construction progress and leads to the delay in the project delivery. Hence delay in a particular activity may also influence the initiation of another activity and it creates adversarial relationship, mistrust, litigations, mainly dissatisfaction, and finally leads to overall project delay. Delays in construction project are very pricey since that engages the financial investments of the clients and the resources of contractors and consultants.

1.1. Necessity of the Study
The intend of this research paper is to address the major factors influencing delay in the construction project and the relationship between the project delay and satisfaction of the respondents in the construction delivery based on the perception of the participants namely clients, consultant, and the contractor, which helps them to know the lively delays allied to the construction projects.

2. Causes and effects of delay
2.1. Causes of Delay
From the various literature studies, it is evident that a practical study is needed to know the actual scenario in the industry.
In [1] depicted the various successes and failure attributes for a project from the survey. The various success attributes are effectual monitoring, advice from the Project Manager and team, ethical attitude of the project participants, and PM's technical capability. The failure attributes include poor human resource management, negative attitude of the participants, inadequate early planning and conflicts between participants. Hence both are clearly pointed out in order to increase the success factors and decrease the failure attributes. And important result obtained is found to be the coordination among the project participants' which is found to be common irrespective of boundaries.

In [2] described the various dominant reasons for the causes for the project delay and suggests some practical strategies for the effective on time completion of the project. They are proper investigation of the ground conditions, good communication and proper management by the supervisors, contractors, and consultants, updated and resourceful man power at both technical and managerial level execution, effective and strong decision on the material specification, apt contractual system with efficient financial planning.

In [3] clearly portrayed the importance of the human resource planning and the various factors influencing the same form the interview from the construction industry. And they also present the important issues to be the uncomfortable environment, lack of protection and safety, unpredictable work with lower wages. Also suggests the importance of improving the project quality and completion of work on time.

In [4] suggested the various impacts of delay from the survey from the construction participants, which states slow decision by the owners, consultant's or architect's reluctance for change, poor labour productivity, poor site management and supervision, and reworks due to error in execution from the statistical regression model. From the research, they also mention that lack of commitment, and training to the site professionals, are to be the major reason for the delay.

In [5] declared the various factors that grounds for the construction delay and overriding among all is the finance related problem, also other important factors are found to be frequent design changes, slow delivery of materials, shortage of resources, failure to pay the completed works, price fluctuations, important of all is that the contractor's inability to complete in promised time.

In [6] declared that delays are organized into excusable and non-excusable delays from literature studies and categorizes delays to contractor related, client related, material related, and labour related with parameters that fall in it. Also, they assess the construction industry to know various delays that should be taken under consideration so that the non-excusable delay can be minimized. They conclude that selection of proper sub contractors, management of these parameters will reduce the indirect value, and harm the name and fame of organization.

In [7] stated some 73 causes of delays and categorizes those into 9 major groups as project, owner, contractor, consultant, design, material, equipment, labour, external group. And from the survey conducted from the construction industry the suggest keys to the major participants to avoid delay, i.e. to the owners, contractors, consultants, architect/design engineers. The common stricture found was the proper payment to the parties at correct time, frequent reviewing of activities to happen in correct time throughout.

In [8] have taken a case of the railway project that delayed for 135 months and identifies a new method of simulation to analyze and quantify the impact of delay factors. The critical path method and the delay analysis system is useful to know the duration of the project, critical activities that are done on time which are affected by the critical resources and to know the critical delay factor respectively. The results also reflect that the contractor rather than the consultant, and the owner are responsible for
the construction delay. The sensitivity analysis also shows delays in material delivery, financial problem, man power shortage, slow site clearances are highly sensible.

In [9] clearly stressed that the cost and time over run are dominant in the construction industry and major reason for those are found to be delay in land acquisition, equipment erection, forest clearances, change in scope, cancellation of tender, law and order problem, price inflation. And also portrays the various roles of the consultants, contractors and clients for the effective completion of the project with the least delay, which signifies that there should also be coordination among the parties.

In [10] have taken two cases to know the various delay causes in the construction industry, effects of the delays, and various strategies to minimize the delays. The findings were that delay in the payment by the head office, poor site management, frequent staff changing, delay in supply of material, improper management by the engineers, and lack of man power. The effects of the delays were time over run, negative social impact, wastage of resources, and finally disputes. Hence depending on the various causes and the ill effects of the delay various commendations were proposed.

2.2. Effects of delay
The role of client, contractor, and consultant, infrastructure of the company, sudden change in environment and socio-political changes is very significant in the delay of the construction. The effect of these delays clearly reflects on the performance of construction project. Various common effects observed from the literature are the cost overrun, idling of resources, disputes, negative impact on the name and fame of the parties. In [5] stated various effects as the cost overrun due to inflations and fluctuation, extension of time, wastage of man power and resources, under-utilization of the equipment’s, loss of confidence over one another, reduction in employment opportunities, arbitration, abandonment, etc. In [6] clearly declared that time overrun, cost overrun, dispute, arbitration, total abandonment, and litigation as the effects of delay. In [10] identified time overrun and cost overrun are the major recurring effect of the construction delay. From the survey conducted by [11] it is evident that the various effects of the delays are negotiations, cause of disputes, lawsuit, total desertion, abandonment. And also states in general that is the loss of wealth, time and capacity, resources.

3. Methodology
3.1. Population and sample
A comprehensive filed survey was conducted to collect the data from the respondents practicing in Trichy and Thanjavur. The selection of these two towns based on the category of participants in the survey in which a unique diversity was observed among them. Trichy and Thanjavur is located in delta region of Tamil Nadu with the latitude and longitude of 10.8050° N, 78.6856° E and 10.7825° N, 79.1313° E respectively. Tiruchirappalli is an Industrial town where we able observer lot of Industrial structures and the participants in this is region is capable to handle heavy and light structures. Thanjavur is an agricultural town in which Residential construction is prominent, the participants in Thanjavur have adequate knowledge in construction of both small, medium and high budget residential buildings. The primary data is obtained from the three main important construction participants namely the Client, the Contractor and the Consultant, and the information related to the causes of the delay were obtained from the literature. The sample size of consultants and contracts is fixed as 50 whereas 150 for the clients. The bigger sample size for clients is fixed based on to determine the margin of satisfaction when the construction was delayed. The first part contains the general information of the respondents and second part contains the general causes of the delays obtained from the study. A detailed demography was obtained from the participants including their age, education, experience in construction, budget of their construction. For any participant, experience plays a crucial role in construction, in this survey lot of contractors doing their practice with their immense of knowledge in their field which lead the path for their success. It is also
observed that client is having more interest in their construction, apart from their working area. Good alignment was opinions were found between client and consultant which are taken as a good sign for our construction industry.

4. Analysis of questionnaire

4.1. Causes of delays

The opinions received from the participants of the construction are analyzed using the SPSS software, in which the Frequencies are obtained using the Descriptive Statistics tools, ANOVA, and Regression tools are used for obtaining the influencing causes on the Project Delay period and Satisfaction of the participants, and the percentage of dominant causes taken under the study respectively. Furthermore, the factors taken for the study is categorized into four groups namely, Improper Project Planning, Design Related issues, Finance Related issues and Resource Related issues, from which the percentage of influence of each category is determined using the Regression tool.

The test was carried on the perception of the construction participants on the roots of the delays in the project delivery. From the significant values obtained, various causes of the delays are mentioned in such a way that the causes with significant values less than 0.05 (5% significant level) are considered.

5. Discussions

5.1. One-way ANOVA

Based on the values obtained from the ANOVA on comparing the Demography and the Satisfaction of the Client the factors having significant values less than 0.05 were, Budget of the project, Number of floors, Purpose of the building (Own use, Rental, Both), Modes of loans taken (Bank, Jewel, Employer, Finance, Other Loans), Age of the client, Annual Income of the family has the influence. On matching up the Demography of the Client to the Project delay period, all the above mentioned causes on comparing with satisfaction do the same and also add the Number of children in the family as shown in Table 1.

| S. No. | Content                          | Delay | Satisfaction |
|-------|----------------------------------|-------|--------------|
| 1     | Budget of the project            | 0.000 | 0.000        |
| 2     | Location of the project          | 0.720 | 0.473        |
| 3     | Number of floors                 | 0.000 | 0.000        |
| 4     | Purpose of the building          | 0.000 | 0.000        |
| 5     | Modes of loans taken             | 0.000 | 0.003        |
| 6     | Age of the client                | 0.000 | 0.008        |
| 7     | Gender of the client             | 0.248 | 0.086        |
| 8     | Education Qualification          | 0.918 | 0.301        |
| 9     | Occupation of the client         | 0.060 | 0.251        |
| 10    | Spouse Working condition         | 0.559 | 0.761        |
| 11    | Annual Family income             | 0.000 | 0.000        |
| 12    | Number of Children in family     | 0.005 | 0.143        |
| 13    | Children Being Employed          | 0.402 | 0.835        |

Based on the values attained from the ANOVA on comparing the Demography of both Consultant and the Project Delay, Demography of Contractor and the Project Delay period, Demography of the Contractor and their Satisfaction the common and influencing parameter scrutinized was the Budget of the project as shown in Table 2. Budget of the project plays significant
role in enhancing the features of the project thereby giving necessary clear cut dimensions towards its streamlined process and smooth progress of the projects under consideration. The values from the table inferring that, there exists a hold on the factors such as number of projects handled, Experience of the respondents, and also in certain cases location of the projects also plays significant role in contributing the desired value among the factors so taken for consideration.

| Table 2. Significance values based on respondent’s profile to that of project delay and satisfaction |
|---------------------------------|----------------|-----------------|----------------|
| Content                        | Consultant     | Contractor      |
|                                | Delay          | Satisfaction    | Delay          | Satisfaction |
| Budget of the Project          | 0.000          | 0.935           | 0.000          | 0.000         |
| Location of the project        | 0.174          | 0.875           | 0.174          | 0.116         |
| Age of the respondent          | 0.651          | 0.182           | 0.621          | 0.255         |
| Experience                     | 0.633          | 0.102           | 0.861          | 0.595         |
| Number of projects             | 0.613          | 0.459           | 0.276          | 0.542         |
| Qualification                  | 0.779          | 0.375           | 0.709          | 0.674         |

5.2. Regression Analysis
On client's perception, considering the Project Delay period and all the causes taken for the study, it is found that 78.7% of the causes are superseding. The causes with the significant values less than 0.05 are Climatic factors, Inadequate planning by the construction participants, Government Bureaucracy, Traffic control and regulations on site, Reworks during construction, Subsequent design changes by the clients, Material Change in type and specification, Financial Constraints of the Client, Labour Availability, Equipment productivity, Demography of the labour are alleged to be overriding as shown in Table 3.

The main purpose of intending regression analysis is to shape the variables which are considered initially and thereby giving a best fit which contains ample construct among the initial variables. These constructs will have majority of impact over all other variables considered in this study. Since this research has major focus on the perspectives of client, it will have objective pattern of dependents which contributes significant relation towards delay in the construction projects. The various factors are shaped by matching it with other critical and viable factors which plays significant level in completing the projects without the delay factor. Those constraints are prioritized based on their relative importance over other factors adopted in the research tool.

On client's views, considering the Satisfaction of the client and all the causes taken for the study, it is found to that 54.9% of the causes are foremost. The causes with the significant values less than 0.05 are Climatic factors, Inadequate planning by the construction participants, Subsequent design changes by the clients, Financial constraints of Client are prevailing as listed in Table 3.
**Table 3.** Significance values on causes of delays to the participants Delay and Satisfaction

| Content | Client Delay | Client Satisfaction | Consultant Delay | Consultant Satisfaction | Contractor Delay | Contractor Satisfaction |
|---------|--------------|---------------------|------------------|--------------------------|-----------------|-------------------------|
| REGRESSION (%) | 78.7% | 54.9% | 55.4% | 44.8% | 65.8% | 69.1% |
| ANOVA b | .000a | .000a | .048a | .266a | .003a | .001a |
| Climatic Factors | .000 | .000 | .204 | .005 | .164 | .642 |
| Lack of communication b/w parties | .727 | .553 | .601 | .144 | .541 | .186 |
| Inadequate planning by the Contractor Consultant & Client | .002 | .015 | .498 | .192 | .411 | .332 |
| Government Bureaucracy | .002 | .479 | .332 | .068 | .802 | .881 |
| Slow decision by the client | .321 | .664 | .683 | .540 | .007 | .048 |
| Traffic control and regulations | .000 | .320 | .754 | .701 | .509 | .186 |
| Reworks | .000 | .244 | .343 | .065 | .340 | .153 |
| Subsequent design changes by clients | .000 | .011 | .589 | .044 | .136 | .036 |
| Material change in type and specification during the construction | .021 | .736 | .527 | .950 | .497 | .664 |
| Financial Constraints of Client | .001 | .047 | .753 | .106 | .899 | .208 |
| Price Inflation | .210 | .917 | .802 | .677 | .365 | .770 |
| Labor Availability | .001 | .509 | .329 | .321 | .121 | .022 |
| Low Labor productivity | .665 | .656 | .144 | .527 | .019 | .009 |
| Material Availability | .267 | .853 | .424 | .955 | .770 | .803 |
| Slow delivery of materials | .147 | .582 | .582 | .084 | .668 | .953 |
| Site storage facilities | .262 | .236 | .889 | .092 | .265 | .254 |
| Equipment productivity | .041 | .112 | .528 | .397 | .407 | .150 |
| Demography of Labor | .021 | .102 | .486 | .954 | .083 | .423 |
| Poor Organization of the contractor or consultant | .103 | .754 | .979 | .588 | .084 | .015 |

The individual groups based on the client's view are the Improper Project planning influences the project delay period and the satisfaction of the client by 63.5% and 45% respectively. The design related issues influence the delay period and the satisfaction by 40.9% and 32.6% respectively. The finance related issues influence the delay and the satisfaction by 17.9% and 10% respectively. Similarly, the resource related issues influence the same by 48% and 28.6% respectively. Hence the dominant factors less than 5% significant level under each category is tabulated in the Table 4 and Table 5.
Table 4. Significance values on categories with respect to Delay and Satisfaction of the participants

| Content                          | Client Delay | Client Satisfaction | Consultant Delay | Consultant Satisfaction | Contractor Delay | Contractor Satisfaction |
|----------------------------------|--------------|---------------------|------------------|-------------------------|-----------------|-------------------------|
|                                  |              |                     |                  |                         |                 |                         |
| IMPROPER PROJECT PLANNING        |              |                     |                  |                         |                 |                         |
| REGRESSION                       |              |                     |                  |                         |                 |                         |
| ANOVA<sup>a</sup>               |              |                     |                  |                         |                 |                         |
| Climatic Factors                |              |                     |                  |                         |                 |                         |
| Lack of communication between the parties |              |                     |                  |                         |                 |                         |
| Inadequate planning by the Contractor Consultant & Client |              |                     |                  |                         |                 |                         |
| Government Bureaucracy          |              |                     |                  |                         |                 |                         |
| Slow decision by the client     |              |                     |                  |                         |                 |                         |
| Traffic control and regulations |

| DESIGN RELATED ISSUES            |              |                     |                  |                         |                 |                         |
| REGRESSION                       |              |                     |                  |                         |                 |                         |
| ANOVA<sup>a</sup>               |              |                     |                  |                         |                 |                         |
| Reworks                          |              |                     |                  |                         |                 |                         |
| Subsequent Design changes by the client |              |                     |                  |                         |                 |                         |
| Material change in type and specification during the construction |              |                     |                  |                         |                 |                         |

On consultant's perception, considering the Project Delay period and all the causes taken for the study, it is found that 55.4% of the causes are governing. On considering the Satisfaction of the consultant and all the causes taken for the study, it is found to that 44.8% of the causes are foremost. The causes with the significant values less than 0.05 are Climatic factors, Subsequent design changes by the clients are main as described in Table 3.

The individual groups based on the consultant’s opinion are the Improper Project planning influences the project delay period and the satisfaction of the consultant by 44.9% and 11.6% respectively. The design related issues influence the delay period and the satisfaction by 27.7% and 6.1% respectively. The finance related issues influence the delay and the satisfaction by 21.7% and 2.7% respectively. Similarly, the resource related issues influence the same by 45.5% and 1.2% respectively. Hence the dominant factors less than 5% significant level under each category is tabulated in the Table 4 and Table 5.
Table 5. Significance values on categories with respect to Delay and Satisfaction of the participants

| Finance Related Issues | Delay       | Satisfaction | Delay       | Satisfaction | Delay       | Satisfaction |
|------------------------|-------------|--------------|-------------|--------------|-------------|--------------|
| REGRESSION             | 17.9%       | 10.0%        | 21.7%       | 2.7%         | 27.2%       | 29.2%        |
| ANOVA<sup>b</sup>      | .000<sup>a</sup> | .000<sup>a</sup> | .003<sup>a</sup> | .528<sup>a</sup> | .001<sup>a</sup> | .000<sup>a</sup> |
| Financial Constraints of Client | .175 | .061 | .617 | .288 | .014 | .008 |
| Price Inflation        | .000        | .007         | .002        | .956         | .913        | .809         |

**RESOURCE RELATED ISSUES**

| REGRESSION | 48.0% | 28.6% | 45.5% | 1.2% | 9.6% | 11.6% |
|------------|-------|-------|-------|------|------|-------|
| ANOVA<sup>b</sup> | .000<sup>a</sup> | .000<sup>a</sup> | .003<sup>a</sup> | .690<sup>a</sup> | .817<sup>a</sup> | .713<sup>a</sup> |
| Labor Availability  | .000 | .000 | .291 | .694 | .534 | .682 |
| Low Labor productivity | .522 | .355 | .175 | .790 | .463 | .659 |
| Material Availability  | .003 | .022 | .489 | .252 | .550 | .557 |
| Slow delivery of materials | .000 | .003 | .781 | .442 | .710 | .635 |
| Site storage facilities  | .181 | .831 | .003 | .551 | .920 | .523 |
| Equipment productivity  | .003 | .086 | .619 | .151 | .910 | .532 |
| Demography of Labor     | .190 | .014 | .311 | .903 | .823 | .646 |
| Poor Organization of the contractor or consultant | .058 | .778 | .778 | .799 | .969 | .968 |

While examining contractor’s viewpoint on Project Delay period, all the causes taken for the study, it is found that 65.8% of the causes are superseding. Table 3 reveals that Slow decision by the client, and Low labour productivity are suspected to be intervening. On contractor’s belief, considering the Satisfaction of the contractor and all the causes taken for the study, it is found to that 69.1% of the causes are prime. The causes with the significant values less than 0.05 are Slow decision making by the client, Subsequent design changes by the clients, Labour availability, Low labour productivity, and Poor organization of the consultant or the contractor are prevailing as illustrated in Table 3.

Based on the results from contractors for dominant groups, Improper Project planning influences the project delay period and the satisfaction of the contractor by 42.9% and 39.5% respectively. The design related issues influence the delay period and the satisfaction by 18.2% and 26.9% respectively. The finance related issues influence the delay and the satisfaction by 27.2% and 29.2% respectively. Similarly, the resource related issues influence the same by 9.6% and 11.6% respectively. Hence the dominant factors less than 5% significant level under each category is tabulated in the Table 4 and Table 5.

5.3. Correlation analysis

From Table 6, it is witnessed that there is an affinity between the satisfaction of the participants and the project delay period. And also, the results are significant based on the level of significance, the project delay period is significantly influencing the satisfaction of the client and the contractor at 1% percent level of significance and the same influences the consultant at 5% level of significance.
Table 6 Correlation between Project Delay Period and Satisfaction of the Participants

| Participant | Level of Significance(%) | Significance Value | Delay Period | Satisfaction Correlation Output |
|-------------|--------------------------|--------------------|--------------|--------------------------------|
| Client      | 1%                       | 0.000              | .784**       | Significant                   |
| Consultant  | 5%                       | 0.018              | .332*        | Significant                   |
| Contractor  | 1%                       | 0.000              | .892**       | Significant                   |

**. Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

6. Conclusions
Clients stipulate the well-timed delivery of the project without cost swarming. The causes of delays are improper project planning and finance related issues, on which the consultants and the contractors mainly depend on. Also, the clients accept that they make frequent design changes during the construction process and there arises the delay.

On analyzing the views of the consultant, it is frozen that they concentrate on the satisfaction of their work as the percentage is lower when compared to the impact on the project delay period. Hence there is an affinity between the participants that they want their construction to be sound and durable irrespective of the delay. Another important problem noticed was the non-usage of the building codes as the normal values followed thoroughly is taken. Importance of analyzing the soil conditions on every area of construction, its importance, also their effects should be known. Information collected from the contractor displays that causes of impact over both the satisfaction and the project delay are close enough, and the dominant cause are found to be frequent design changes by the clients, the availability of the labour and their productivity and they also accept that due to the improper organization by their groups and the consultant due to the other compulsion factors. It is quite evident that the project delay period influences the satisfaction of the construction participants. Hence the consultant wants higher level of quality so that the satisfaction can be at the higher levels. It is not a limitation that only few parts of the districts were taken as sample, because these are the important and highly developing part of the state with huge commercial activities and agricultural activities with good water resources. The future study will focus on the detailed study about the each and every cause of the delay and their effects.

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