

Coordination: A Vital Tool for Successful Completion of Projects in the Indian Scenario

Annette Joseph* and Lilly Rose Amirtham

Department of Architecture, Sathyabama University, Jeppiaar Nagar, Sholinganallur, Chennai - 600119, Tamil Nadu, India; annjoseph54@gmail.com, lillyini@gmail.com

Abstract

Objectives: Construction is a result oriented organization; however, some projects are completed unsuccessfully due to the lack of efficient coordination. This paper aims to study the importance of coordination in construction as a vital tool for successful completion of projects. **Methods/Statistical Analysis:** The present scenario of coordination in the Indian construction industry has been analyzed and a detailed study has been carried out to understand how coordination is being achieved in Architectural/ Project Management Consultant (PMC) firms through questionnaire surveys targeted at Architects and Project Managers. Finally, with the help of SPSS tool, various aspects of coordination are prioritized with regards to the three major phases of a construction project. **Findings:** The findings of the study would act as a framework for all stakeholders in a project in creating an awareness of what should be done, when and how to achieve effective coordination, thus helping in successful completion of the project. **Applications/Improvements:** This study can be applied for the preparation of a model/manual for effective coordination in the Indian construction sector which can be a guideline to coordinate projects effectively in India.

Keywords: Coordination Activities, Coordination Methods, Coordination Techniques, Coordination Tools, Successful Project Completion

1. Introduction

Construction industry covers a wide range of projects and every construction project is unique in nature as it involves myriads of interrelated activities, tasks, work packages and stakeholders. Coordination between participants is a major challenge in construction as well as a pre-requisite to build up effective and efficient processes of construction. This paper explores the need to study the importance of coordination in construction as a vital tool by identifying the potential barriers in achieving coordination, the challenges faced during coordination, various coordination techniques and methods used, the common coordination issues and methods to solve them, most important activities to be performed for achieving coordination and for successful completion of a project.

2. Background Literature

Several researchers have highlighted the significance of coordination as a tool in construction projects. In¹ identified some of the frequently occurring issues in coordination as procedural knowledge with senior level people, use of different technology by organizations, service coordination, professional differences in quality of deliverables and complex design issues. Researchers have proposed several tools for coordination. They include Screens of technology scenario¹, Building Dashboard tool²; Information coordination systems³ and Process protocol model⁴. Studies suggest that using basic management techniques, boundary spanning, providing slack resources, squad checks and coordination committees could be used as techniques to achieve coordination. In⁵ identified

* Author for correspondence

activities required to achieve day to day coordination in a project namely implementation of all contractual commitments, arrangement for timely carrying out of all tests for inspections and approval by the engineer and maintaining records of the same, arranging submission of samples of materials for approval by the engineer etc. In⁶ identified six goals of coordination namely instruction, clarification, facilitation, control, information sharing and maintenance of relationships.

3. Research Objectives and Methodology

The objectives of the study include:

- To identify various co-ordination techniques and methods commonly used in the construction industry.
- To study the present scenario of coordination in construction industry and how it is being achieved in architectural/PMC firms.
- To prioritize various aspects of coordination.

Questionnaire surveys were used to collect the sample data and were compared with literature review to identify the similarities and methods of achieving coordination was in projects. The responses received were statistically analyzed through SPSS software and were prioritized for various phases of construction viz. pre-construction, construction and post-construction. In the present study, two types of questionnaire surveys (open and closed-ended) have been used to collect data on coordination.

4. Design of Questionnaire and Responses

The T1 (open-ended/subjective) type of questionnaire survey was conducted to analyze in general, the Architects and Project Managers (PMs) views on coordination in the present construction industry. Questions were formulated so as to get an overall picture of coordination in the present scenario. Data was collected with the objective of prioritizing various aspects and the relative importance of coordination during different phases of construction. The sample for the purpose of the study included ten senior level Architect Project Managers' (ArPMs) having more than ten years of experience in the field and working in large PMCs in India. The data was

collected through face-to-face discussions and telephonic interviews.

The T2 (closed-ended/objective) type of survey analyzed the extent of implementation of coordination and how it is actually performed in large architectural/PMC firms. A sample of 30 professionals (17 Architects and 13 ArPMs) was identified who were working in large architectural/PMC firms handling high-rise projects in India. The data was collected through online surveys. Of the 17 Architects who attempted the survey, 12 persons were having experience between 0-5 years, 4 persons in the range of 5-10 years and 1 person having more than 10 years of experience. Also, 7 ArPMs having experience more than 10 years and 6 ArPMs having less than 10 years experience took part in the survey. Majority of the respondents (86.7%) handled commercial projects, around 56.7% people residential projects and less than 50% were in charge of educational and financial buildings. More than 50% of the interviewees worked in large architectural/PMC firms having greater than 200 staffs employed.

A total of 10 responses were received from type T1 and 30 numbers from T2 Table 1. Most of the type T2 questionnaire has been framed with a view to elicit the answers on a Likert scale of 1 to 5 bases. Analysis of the responses and the results drawn are addressed in the following sections of this paper.

Table 1. Response data from questionnaire surveys

	Category of stakeholder	Numbers distributed	Number of responses
Type T1	ArPMs	20	10
	Total	20	10
Type T2	Architects	20	17
	ArPMs	20	13
	Total	40	30

5. Analysis and Results

5.1 Type T1 Questionnaire Survey

The responses were collected and prioritized using graphical representations like pie charts and bar diagrams. The various responses of the interviewees were analyzed and the results are presented below:

- Many of them defined project coordination as a task which starts from the inception stage of a project till the very end, but there are no set standards defined to achieve it.

- All the respondents said that coordination as a tool was very vital for the successful completion of any project and that it had a large effect on the project success parameters like completion schedule, project cost, project quality and non-occurrence of disputes.
- The Project Manager along with the other stakeholders in a project together achieves coordination of various tasks and activities.
- It was ascertained that the major barrier to achieve effective coordination in all the three phases of a project were multiple stakeholders, their attitudes and practices.
- Majority of the respondents used AutoCAD and BIM as coordination tools in their firms in the pre-construction and construction phases whereas in the post-construction phase, BIM, excel sheets, PowerPoint presentations and online web links were commonly used as tools for coordination.
- The study revealed that service coordination and dispute resolution was found to be the major coordination issue in pre-construction and construction phases while communication issues between stakeholders and lack of proper documentation caused issues in the post-construction phase. Everyone pointed out that the best method to resolve coordination issues were through weekly coordination meetings with the stakeholders.
- Respondents mentioned that the most important coordination activities to be performed in each phase of a project were: Design coordination with all the consultants (pre-construction), site coordination with the contractors, suppliers and consultants (construction) and coordinating technical and commercial closeout with vendors and consultants (post-construction).

5.2 Type T2 Questionnaire Survey

To analyze the survey findings, SPSS tool has been used. The Pareto analysis test has been conducted to identify the influential priorities of various aspects of coordination during the different phases of construction. The various responses of the respondents were analyzed.

5.2.1 Challenges faced by Architects/ArPMs during Coordination in Various Phases of a Project

In⁷ identified the challenges which are faced by Architects/ArPMs during the course of a project. Based on this, the

respondents were asked to rank the top three challenges that they faced in different phases of a project. It was found that in the pre-construction phase, poor planning (23.3%) was ranked as the top most challenge which most of them faced, rank 2 was given to poor specification and poor decision making (16.3%) and inappropriate scheduling (13.3%) was rank 3. In the construction phase it was seen that time pressure (63.3%), design alteration (60%) and high level of risk (50%) were the major challenges faced whereas in the post-construction phase, discrepancy in contract forms (33.3%), delay in project delivery (30%) and inadequate payments (13.3%) often hampered with effective coordination.

5.2.2 Key Barriers of Coordination in Different Phases of a Project

In⁸ listed 5 groups of key barriers of project coordination. Based on this, the respondents were asked to classify and prioritize the barriers that they faced most during coordination in the various phases of the project. Thus, the study reveals that in the pre-construction phase, characteristics of organizations (3.3%) was found to be a major barrier, in the construction phase it is Nature of construction (46.7%); Construction participants (46.7%) and Construction management approach (26.7%) whereas in the post-construction phase traditional contractual arrangement (20%) acts as a barrier in achieving good coordination.

5.2.3 People with whom the PM has to Coordinate with in Different Phases of a Project

For ensuring unhindered progress of construction, by smooth transfer of information to the required stakeholders, it is very important to know with whom a PM has to coordinate with in various phases of a project. The respondents were asked to prioritize the people whom they think played a major role in each phase of the project.

The study summarizes that in the pre-construction phase, the following are the people with whom the PM has to coordinate namely: Project Initiation stage-Client (100%) and architect (73.3%); Schematic Design stage-architect (86.7%), client (70%) and MEP consultants (16.7%); Design Development stage-architect (96.7%), client (40%) and MEP consultants (40%); Construction

Drawings stage-architect (93.3%), MEP consultants (86.7%) and client (16.7%) and finally Tendering stage-main contractor (73.3%), client (60%) and architect (53.3%).

In the construction phase, the PM has to coordinate the most with the main contractor (96.7%) and subcontractor (80%) followed by the vendors (70%) whereas in the post-construction phase, the main contractor (80%), client (56.7%) and the subcontractor (43.3%) played a major role.

5.2.4 Techniques used to Achieve Coordination in Different Phases of a Project

Based on the research in various techniques were identified that are commonly used to achieve coordination in organizations. The respondents were asked to classify and prioritize these for various phases of the project. Based on the analysis Figure 1, it can be ascertained that in the pre-construction phase, chain of command (23.3%) is used more frequently when compared to slack resources (10%) for coordination whereas project Manual (56.7%) and Squad checks (36.7%) are used more when compared to Coordination committees (3.3%) and Boundary spanning employee (6.7%) techniques in the construction phase. In the post-construction phase, Management by Walking Around (MBWA) (50%) is commonly used.

It was found that only 57% of the people perform squad checks in their firms and that there is a need to understand its importance and increase its usage in more organizations. This might be due to the problems commonly faced during squad checks like lack of experience and knowledge of other departments, conflicts between different departments, lack of cooperation and mainly lack of awareness of squad checking.

Around 70% of the people claimed that committees were not formed for performing coordination in their firms. This might be due to the problems faced in coordination committees namely conflict between members of the committee, conflicts between different departments due to lack of cooperation, attitude between members of the committee, improper communication link, lack of experience and knowledge of other departments and lack of standard procedures to be implemented for formation of committees.

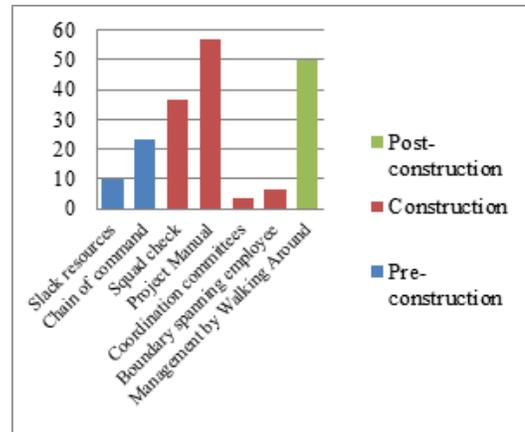


Figure 1. Techniques used to achieve coordination in various phases of a project.

5.2.5 Methods used for Coordination in Different Phases of a Project

In⁹ listed out the various methods used for project coordination. The respondents classified and ranked these for various phases of the project Figure 2a. They also ranked the most effective coordination methods (100% degree of coordination effectiveness) Figure 2b. It can be summarized that most of the respondents had the opinion that schedules (36.7%) were commonly used as a coordination method in the pre-construction phase, meetings (76.7%) and site visits (63.3%) in the construction phase and contract documents (43.3%) in the post-construction phase. The most effective coordination methods are found to be contract documents (36.7%), site visits (33.3%) and meetings (23.3%).

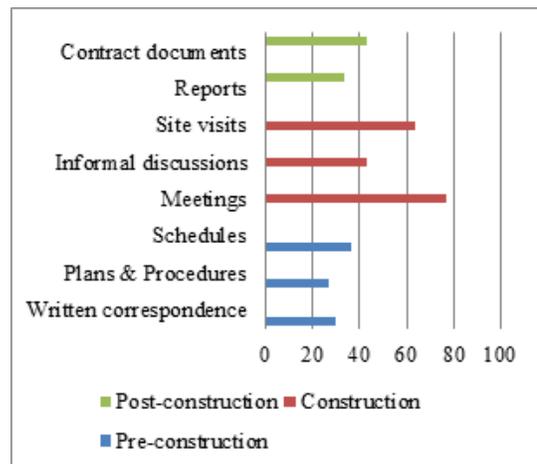


Figure 2a. Methods used for achieving coordination in various phases of a project.

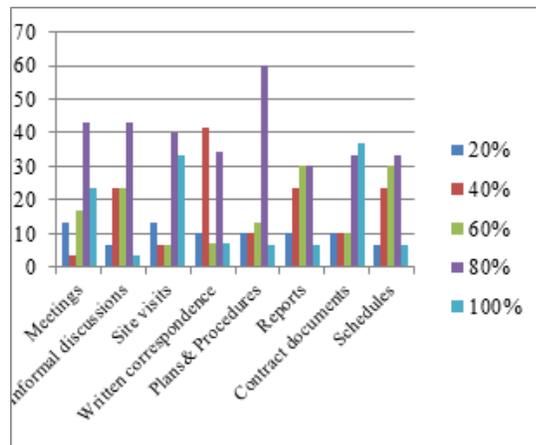


Figure 2b. Methods with their degrees of coordination effectiveness.

5.2.6 Usage of Tools/Softwares for Coordination

It was seen that around 60% of the people did not use any tools/softwares for coordination in their offices. Among the coordination/clash detection softwares used, BIM (13.3%), Project wise Navigator (6.7%) and Tekla (3.3%) were found to be used by very few offices for coordination.

5.2.7 Most Important Coordination Activities to be Performed in various Phases of a Project

In¹⁰ with the help of the analysis of responses of a questionnaire survey identified a set of activities that a coordinator needed to carry out to achieve day-to-day coordination on a general basis and named these activities as “**Coordination activities**”. Based on their study in a study to identify the important coordination activities which contributes to improved project coordination in the Indian construction industry through questionnaire surveys. From the results obtained through the survey, a set of 20 important coordination activities were identified as requiring special attention for achieving coordination.

To determine the top 3 activities to be performed to achieve coordination, the respondents were asked to classify and rank them for the three main phases of a project. It was found that, in the pre-construction phase, arrangement of required inputs like drawings, specifications and technical details on time for execution (86.7%) was ranked 1, Identification of activities on critical path (60%) ranked 2 and Identification of appropriate human resources, materials and equipments for the project (43.3%) and proper assignment of task to the

available human resources for the project (43.3%) as rank 3. Monitoring the overall functioning of each section and department of the project (70%), applying good technical practices (63.3%) and regular monitoring of critical path activities for adhering to schedule (60%) can be prioritized as the most important coordination activities to be performed in the construction phase. In the post-construction phase, Implementation of all contractual commitments (46.7%) was ranked as the most important activity and analysis of the project performances on time, cost and quality, detecting variances (33.3%) and arranging remedial work methods and programs for executing in case of defect or damage (13.3%) were ranked as the other two most important activities.

5.2.8 Coordination Activities which Affect Various Project Success Evaluation Criteria

The major parameters on which the success of any project depends directly or indirectly are cost, time and quality. The respondents prioritized those coordination activities which affect the schedule, cost, quality and non-occurrence of project disputes the most.

5.2.8.1 Project Completion Schedule

From the analysis, the activities that affected the completion schedule the most, can be prioritized as namely:

- Arrangement for timely carrying out of all tests for inspections and approval by the engineer and maintaining records of the same (100%),
- Organizing resources (manpower, plant and material) for effective utilization (90%) and regular monitoring of critical path activities for adhering to schedule (90%),
- Arranging submission of samples of materials for approval by the engineer (73.3%) and proper assignment of task to the available human resources for the project (73.3%).

5.2.8.2 Project Cost

The analysis shows that project cost was affected by:

- Organizing resources (manpower, plant and material) for effective utilization (90%); estimating the optimum resource requirements (90%), identification of appropriate human resources, materials and equipments for the project (90%),

- Regular monitoring of critical path activities for adhering to schedule (86.7%),
- Implementation of all contractual commitments (83.3%).

5.2.8.3 Project Quality

Based on the study, the following activities affect the project quality the most:

- Implementation of all contractual commitments (96.7%); arranging submission of samples of materials for approval by the engineer (96.7%),
- Monitoring the overall functioning of each section and department of the project (93.3%); regular monitoring of critical path activities for adhering to schedule (93.3%),
- Preparing a project quality plan in line with contract specification (90%); applying good technical practices (90%).

5.2.8.4 Non-Occurrence of Disputes

From the study, it can be summarized that the following activities have a great effect on preventing the occurrence of disputes in a project namely:

- Resolving conflicts/differences among participants (96.7%),
- Monitoring the overall functioning of each section and department of the project (90%),
- Agreement on detailed methods of construction with all the parties involved (86.7%); regular monitoring of critical path activities for adhering to schedule (86.7%); implementation of all contractual commitments (86.7%).

6. Conclusions

Coordination is an important function in the building process. Poor or ineffective coordination is due to the presence of a number of barriers and challenges faced by Architects/ArPMs during various phases of a project. Hence, using effective coordination methods and tools will help in reaping more benefits in a project. But, from the study it was found that in the present scenario there is a need to develop specialized tools/techniques for coordination as currently only traditional ones are being used in most offices. There were no tools to measure how much percentage of coordination is done/needs to be done for successful completion of projects as well as to

what extent the coordination presently done in firms is effective enough. Most of the firms were not even aware of useful software's like BIM, Tekla, Vico which can be used for coordination. Through the study, it is also evident that coordination is a vital tool in construction and that the concept is known to everyone, but not much of importance is given to it in many offices. This is because even though there are formats and procedures for each process in every organization, there are no set standards regarding how coordination is to be done between different stakeholders/firms. Hence, this can be taken forward as a further study for preparation of a model/manual for effective coordination in the Indian construction sector which can be a guideline to coordinate projects effectively in India.

7. References

1. Eastman C, His I, Potts C. Coordination in multi-organization creative design projects. Georgia Institute of Technology; 1998. p. 1–9.
2. Kubicki S, Bignon J, Halin G. Building construction coordination by an adaptive representation of the cooperation context. Proceedings of Joint International Conference on Computing and Decision Making in Civil and Building Engineering; 2006 Jun. p. 3324–33.
3. Saram DD, Ahmed SM. Construction coordination activities: What is important and what consumes time. Journal of Management in Engineering. 2001 Oct; 17(1):202–13.
4. Al-Hashash MZ. Process Protocol (PP) as coordination tools between designer, consultant and contractor (Construction Sector in Palestine Case Study). Faculty of Graduate Studies, An-Najah National University; Nablus, Palestine. 2014.
5. Jha KN, Iyer KC. Critical determinants of project coordination. International Journal of Project Management. 2006 May; 24(4):314–22.
6. Shen FY, Chang AS. Exploring coordination goals of construction projects. Journal of Management in Engineering. 2011 Apr; 27(2):90–6.
7. Yadollahi M, Mirghasemi M, Zin RM, Singh B. Architect critical challenges as a Project Manager in construction projects: A case study. Advances in Civil Engineering. 2014 Aug; 2014:1–15.
8. Hai TK, Yusof AM, Ismail S, Wei LF. A conceptual study of key barriers in construction project coordination. Journal of Organizational Management Studies; 2012 Dec. p. 1–14.
9. Chang AS, Shen FY. Effectiveness of coordination methods in construction projects. Journal of Management in Engineering. 2014 May; 30(3):771–8.