

Factors Affecting Success of Construction Project

Nipin Joseph Babu

(School of Building Science Civil Engineering Dept, Hindustan Institute of Technology & Science,
Chennai India)

Abstract: *The construction industry is dynamic in nature due to the increasing uncertainties in technology, budgets, and development processes. Nowadays, building projects are becoming much more complex and difficult. The project team is facing unprecedented changes. The study of project success and the critical success factors ~CSFs! are considered to be a means to improve the effectiveness of project. However the concept of project success has remained ambiguously defined in the mind of the construction professionals. Various attempts were made by different researchers to determine CSFs in construction. A number of variables influencing project success have been proposed. Some variables are common to more than one list, but there is no general agreement on the variables. This Project examines the success factors and determines which success factor is more critical in a successful completion of a project. From literature review and past studies, it was obtained that there were different directions and methodologies used in order to achieve the required target, goals and objectives. A structured questionnaire survey approach is considered to study the impact of various attributes and factors affecting success. The relative importance index method (RII) is used here to determine owners, consultants and contractors perceptions. In this study 63 factors affecting the success of construction projects are selected. These factors are grouped into 10 groups with the help of different literature reviews.*

Keywords: *Critical Success Factor, Relative Importance Index, Owner, Consultant, Contractor, Projects*

I. Introduction

The construction industry is dynamic in nature due to the increasing uncertainties in technology, budgets, and development processes. Nowadays, building projects are becoming much more complex and difficult. The project team is facing unprecedented changes. The study of project success and the critical success factors ~CSFs! are considered to be a means to improve the effectiveness of project. However the concept of project success has remained ambiguously defined in the mind of the construction professionals. Various attempts were made by different researchers to determine CSFs in construction. A number of variables influencing project success have been proposed. Some variables are common to more than one list, but there is no general agreement on the variables.

Construction activity is an integral part of a country's infrastructure and industrial development and must be taken care of for a healthy growth of the economy. It is imperative to put an all-out effort into ensuring that projects are completed as per the stipulated objectives. An experimentation of the recent literature indicates that construction projects are frequently completed with large cost overruns, extended schedules and quality concerns. Delay is defined as the time overruns either beyond the completion date specified in the contract, or beyond the date that the parties agreed upon delivery of the project. A delay in the construction may cause losses, or negatively affect some or all of the project parties. The efforts of delay may include time overrun, cost overrun, disputes, arbitration, litigation, and total abandonment.

During the last four decades a number of studies investigated factors which aid successful completion of projects. Project success can be defined as meeting the required expectation of the stakeholders and achieving its intended purpose. This can be attained by understanding what the end result would be, and then stating the deliverables of the project. Success criteria or a person's definition of success as it relates to a building often changes from project to project depending on participants, scope of services, project size, sophistication of the owner related to the design of facilities, technological implications, and a variety of other factors. On the other hand, common threads relating to success criteria often develop not only with an individual project but across the industry as we relate success to the perceptions and expectations of the owner, designer, or contractor. A building project is completed through a combination of many events and interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment.

This Project examines the success factors and determines which success factor is more critical in a successful completion of a project. This will provide organizations involved in the construction industry with the foundation on which such strategies can be developed in the future. This Study focuses on the building construction projects in India.

II. Literature Review

Increasing uncertainties in technology, budgets and development processes create a dynamic construction industry. Building projects are now much more complex and difficult and the building project team faces unprecedented changes. The study of project success and critical success factors (CSFs) is a means of understanding and thereby improving the effectiveness of construction projects. However the concept of project success remains ambiguously defined in the mind of construction professionals. One of the objectives of this project is to understand and explain, through study of literature, critical success factors.

Literature review about success was reviewed (Albert P.C.Chan; David Scott; and Ada P.L.Chan (2004), Syed ZafarShahibTabish and K N Jha (2012), Arti.J.Jari, Pankaj, P.Bhangale (2013), AfshinPakserest, Dr. Gholamrez aAsgari (2012), D.K.H Chua, Y.C Kog, and P.K Loh (1999), Adnan Enhassi, Sheriff Mohamed, and SalehAbushaban (2000), Muhammad NabeelMirza, Zohreh Pourzolfaghar, MojdeShahnazari (2013), Mohammad Mehdi Mortaheb, Yeganeh Amini, Amir HoseinYounesian (2013), Ann T.W. Yu, Qiping Shen, John Kelly, and Kirsty Hunter (2006), Neringa Gudienea , Audrius Banaitisa, Nerija Banaitienea, Jorge Lopes (2013), SarathGunathilaka, Martin Morgan Tuuli and Andrew R J Dainty, Muhammad Saquib (2008) , WalidBelassi, OyaIcmeliTuckel (1996), Kylindri, Blanas, Henriksen, Stoyan (2012)) to identify the factors affecting the success of construction projects.

60 factors affecting success of construction projects are selected. These factors are grouped in to 10 groups based on literature review. These groups can give a comprehensive summary of the main key performance indicators. The factors, which are considered in the questionnaire, are summarized and collected according to previous studies.

The present study has adopted the Relative Importance Index (RII) method to identify factors affecting the success of construction projects. In this study 60 factors affecting the success of construction projects are selected . These factors are grouped into 10 groups with the help of different literature reviews. A structured questionnaire survey is done to find the impacts of various attributes and factors which affects the success of construction project. In addition, the questionnaire can assist to study the attitude of owners, consultants and contractors towards the factors that affect on performance in the construction industry. The different factors that affects the success of construction projects are shown in table below:

Table:1 Factors affecting success of construction project

S.NO	FACTORS
1	COST FACTORS
2	TIME FACTORS
3	QUALITY FACTORS
4	PRODUCTIVITY FACTORS
5	CLIENT-SATISFACTION FACTORS
6	REGULAR AND COMMUNITY SATISFACTION FACTORS
7	PEOPLE FACTORS
8	HEALTH & SAFETY FACTORS
9	INNOVATION & LEARNING FACTORS
10	ENVIRONMENT FACTORS

III. Research Methodology

A questionnaire survey was used to elicit the attitude of owners, consultants, and contractors towards the factors affecting the success of construction projects . Questionnaires were sent to randomly selected owners, consultants, and contractors. Consultants were identified from the listings of consultants association. 120 questionnaires were distributed as follows: 25 to owners; 35 to consultants; and 60 to contractors. 88 were received (response rate of 73%) as follows: 17 (70%) from owners; 25 (72%) from consultants; and 46 (77%) from contractors as respondents. The respondents were asked to indicate, based on their local experience the level of importance of each one of the identified 63 factors of success on a five-point Likert scale as: not important, slightly, moderately, very, and extremely important. The questionnaire has been validated by the criterion-related reliability test which measures the correlation coefficient between the factors affecting the success of construction projects in one field and the whole field, and structure validity test (Spearman test). The respondents were experienced construction project managers, site engineers/office engineers, and organizations' managers (with average experience of 20 years in the construction industry). 60 factors believed to affect project success were considered in this study and were listed under 10 groups based on the literature reviewed (Okuwoga 1998; Dissanayaka and Kumaraswamy 1999; Reichelt and Lynies 1999; Karim and Marosszeky 1999; Brown and Adams 2000; DETR 2000; Lehtonen 2001; Chan 2001; Samson and Lema 2002; Kuprenas 2003; Cheung et al. 2004; Iyer and Jha 2005; Navon 2005; Love et al. 2005; Ugwa and Haupt 2007). The success factors were summarized and collected according to previous studies and others as recommended by local experts. The main groups considered in this paper are: time, quality, productivity, client satisfaction, regular and community satisfaction, people, health and safety, innovation and learning, and environment. The

relative importance index method (RII) was used herein to determine owners', consultants', and contractors' perceptions of the relative importance of the identified success factors. The RII was computed as (Cheung et al. 2004; Iyer and Jha 2005; Ugwu and Haupt 2007):

$$RII = \frac{\sum W}{A \times N} \quad (1)$$

where W is the weight given to each factor by the respondents and ranges from 1 to 5;

A – the highest weight = 5; N – the total number of respondents.

IV. Results & Discussions

4.1 Factors Affecting Success Of Construction Projects

Table 2 summarizes the computed RIIs and their rank as perceived by the 3 responding groups.

Table:2 Summary of relative importance index and rank for factors affecting the performance of construction projects

SUCCESS FACTORS	OWNER		CONSULTANT		CONTRACTOR	
	RII	RANK	RII	RANK	RII	RANK
(1) Cost Factors						
Market share of organization	0.600	54	0.709	39	0.726	39
Liquidity of organization	0.729	31	0.842	5	0.839	10
Cash flow of project	0.812	14	0.800	11	0.848	9
Profit rate of project	0.694	38	0.776	14	0.739	38
Overhead percentage of project	0.647	48	0.687	49	0.662	47
Project design cost	0.500	63	0.688	43	0.582	63
Material & Equipment cost	0.812	14	0.776	14	0.813	16
Project labor cost	0.741	27	0.744	22	0.739	37
Project overtime cost	0.588	58	0.600	59	0.617	55
Motivation cost	0.600	54	0.584	61	0.609	58
Cost of rework	0.588	58	0.672	51	0.587	62
Cost of variation orders	0.565	62	0.688	43	0.662	46
Waste rate of materials	0.650	46	0.624	57	0.639	51
Regular project budget update	0.638	50	0.742	24	0.743	35
Cost control system	0.725	33	0.728	28	0.765	32
Escalation of material prices	0.847	5	0.832	7	0.889	4
Differentiation of currency prices	0.788	18	0.808	9	0.874	5
(2) Time Factors						
Site preparation time	0.682	4502	0.664	53	0.596	61
Planned time for construction	0.753	26	0.760	18	0.765	30
Percentage of orders delivered late	0.694	40	0.768	17	0.774	29
Time needed to implement variation orders	0.706	35	0.704	40	0.693	43
Time needed to rectify defects	0.659	44	0.672	51	0.639	50
Average delay in claim approval	0.650	46	0.728	28	0.765	30
Average delay in regular payments	0.824	11	0.776	14	0.839	11
Unavailability of resources	0.871	3	0.858	2	0.904	3
Average delay because of closures leading to material shortage	0.941	1	0.896	1	0.943	1
(3) Quality Factors						
Conformance to specification	0.882	2	0.808	9	0.822	13
Unavailability of competent staff	0.859	4	0.848	3	0.865	6
Quality of equipment and raw materials	0.835	9	0.840	6	0.861	7
Quality assessment system in organization	0.706	35	0.712	35	0.743	34
(4) Productivity Factors						
Project Complexity	0.729	31	0.712	35	0.761	33
Number of new projects/year	0.600	54	0.688	43	0.630	53
Management-labor relationship	0.776	22	0.688	43	0.796	22
Absenteeism rate through project	0.776	20	0.688	43	0.743	36
Sequencing of work according to schedule	0.800	17	0.816	8	0.804	20
(5) Client Satisfaction Factors						
Information coordination between owner and project parties	0.729	29	0.792	12	0.809	19
Leadership skills for project manager	0.835	7	0.848	3	0.904	2
Speed and reliability of service to owner	0.718	34	0.744	22	0.822	13
Number of disputes between owner and project parties	0.753	24	0.728	28	0.720	40
Number of rework incidents	0.635	51	0.712	35	0.627	54
(6) Regular & Community Satisfaction Factors						
Cost of compliance to regulators requirementation	0.600	54	0.648	55	0.604	59
Number of non-compliance events	0.635	51	0.624	57	0.614	56
Quality and availability of regular documentation	0.647	49	0.736	25	0.653	48
Site condition problems	0.788	18	0.712	35	0.707	41
(7) People Factors						
Employee attitude	0.682	41	0.728	28	0.795	23

Recruitment and competence development	0.753	24	0.688	43	0.809	17
Employee motivation	0.765	23	0.696	42	0.791	24
Belonging to work	0.835	9	0.736	25	0.849	8
(8) Health & Safety Factors						
Application of health and safety factors in organization	0.700	37	0.728	28	0.787	25
Project location is safe to reach	0.694	38	0.704	40	0.774	28
Reportable accidents rate in project	0.729	29	0.680	50	0.600	60
Assurance rate of project	0.671	43	0.632	56	0.635	52
(9) Innovation & Learning Factors						
Learning from own experience and past history	0.847	5	0.752	20	0.818	15
Learning from best practice and experience of others	0.824	12	0.760	18	0.822	12
Work group	0.776	20	0.736	25	0.787	27
Review of failures and solving them	0.825	12	0.752	20	0.827	17
(10) Environmental Factors						
Air quality	0.588	58	0.592	60	0.671	45
Noise level	0.565	61	0.512	63	0.613	57
Waste around the site	0.635	51	0.584	61	0.649	49
Climate condition	0.729	28	0.656	54	0.707	41

Table:3. The top significant factors affecting the performance of construction projects

FACTORS	OWNER		CONSULTANT		CONTRACTOR	
	RII	RANK	RII	RANK	RII	RANK
Escalation of material prices	0.847	5	0.832	7	0.889	4
Unavailability of resources as planned through project duration	0.871	3	0.858	2	0.904	3
Average delay because of closures leading to materials shortage	0.941	1	0.896	1	0.943	1
Unavailability of personals with high experience and qualification	0.859	4	0.848	3	0.865	6
Quality of equipments and raw materials in project	0.835	9	0.840	6	0.861	7
Leadership skills for project manager`	0.835	7	0.848	3	0.904	2

Table 3 illustrates the top significant factors affecting the success of construction projects. It can be inferred from this table that 3 most important factors according to the perception of owner, consultant, and contractor are: average delay because of closures leading to materials shortage, unavailability of resources, and leadership skills for project manager. According to owners, consultants, and contractors, it seems that the average delay because of closures leading to materials shortage was the most important success factor as it has the first rank among all factors with relative index (RII) = 0.941 for owners, 0.896 for consultants, and 0.943 for contractors. Local construction projects suffer from a number of problems because of closures and materials shortage. These problems can be considered as an obstacle for time performance of projects.

Table 4: Summary of relative importance index and rank of major groups affecting the success of construction projects

FACTORS	OWNER		CONSULTANT		CONTRACTOR	
	RII	RANK	RII	RANK	RII	RANK
Cost	0.679	8	0.724	5	0.726	7
Time	0.753	4	0.757	3	0.769	5
Quality	0.792	2	0.787	1	0.794	3
Productivity	0.736	5	0.718	6	0.747	6
Client Satisfaction	0.734	6	0.765	2	0.779	4
Regular & Community Satisfaction	0.668	9	0.680	9	0.646	10
People	0.759	3	0.712	7	0.812	1
Health & Safety	0.698	7	0.686	8	0.699	8
Innovation & Learning	0.821	1	0.744	4	0.804	2
Environment	0.629	10	0.586	10	0.660	9

As indicated in Table 4, the quality group has been ranked by the owners' respondents in the second position with RII equal to 0.792. It has been ranked by the consultants' respondents in the first position with RII equal to 0.787 and has been ranked by the contractors' respondents in the third position with RII equal to 0.794. This group is the most important one for consultants because consultants are interested in clients and technical factors. Consultants observed that quality of equipment and raw materials in project and availability of personnel with high qualifications strongly affect the quality performance of a project. The people group has been ranked by the owners' respondents in the third position with RII equal to 0.759. It has been ranked by the consultants' respondents in the 7th position with RII equal to 0.712 and has been ranked by the contractors' respondents in the first position with RII equal to 0.812. It is not surprising to observe that the people group is the most important one for contractors because contractors remarked on competence development between employees and belonging to work strongly affect productivity, cost, and time performance of contractors. The

innovation and learning group has been ranked by the owners' respondents in the first position with RII equal to 0.821. It has been ranked by the consultants' respondents in the 4th position with RII equal to 0.744 and has been ranked by the contractors' respondents in the second position with RII equal to 0.804. This group is the most important one for owners because owners remarked that learning from experience and training the human resources with skills demanded by the project strongly affect project performance.

The following is a brief discussion of the ranking of factors in groups, as shown in Table 2.

4.1.1 Group One: Cost Factors

The relative importance index (RII) and rank of cost factors are summarized in Table 4.

Table:5. Summary of relative importance index and rank of cost factors

Cost Factors Group	Owner		Consultant		Contractor	
	RII	RANK	RII	RANK	RII	RANK
Market share of organization	0.600	12	0.709	10	0.726	10
Liquidity of organization	0.729	6	0.842	1	0.839	4
Cash flow of project	0.812	2	0.800	4	0.848	3
Profit rate of project	0.694	8	0.776	5	0.739	9
Overhead percentage of project	0.647	10	0.687	13	0.662	12
Project design cost	0.500	17	0.688	11	0.582	17
Material & Equipment cost	0.812	2	0.776	5	0.813	5
Project labor cost	0.741	5	0.744	7	0.739	8
Project overtime cost	0.588	14	0.600	16	0.617	14
Motivation cost	0.600	12	0.584	17	0.609	15
Cost of rework	0.588	14	0.672	14	0.587	16
Cost of variation orders	0.565	16	0.688	11	0.662	11
Waste rate of materials	0.650	9	0.624	15	0.639	13
Regular project budget update	0.638	11	0.742	8	0.743	7
Cost control system	0.725	7	0.728	9	0.765	6
Escalation of material prices	0.847	1	0.832	2	0.889	1
Differentiation of currency prices	0.788	4	0.808	3	0.874	2

Escalation of material prices has been ranked by the owners' and contractors' respondents in the first position. However, this factor has been ranked by the consultants' respondents in the second position. It is observed that this factor is more important for owners and contractors because escalation of material prices affects the liquidity of owners and the profit rate of contractors. Differentiation of currency prices has been ranked by the owners' respondents in the 4th position. It has been ranked by the consultants' respondents in the 3rd position and by the contractors' respondents in the second position. It is not surprising to find out differentiation of currency prices is more important for contractors than for others because this factor affects contractors' profit rate and cost performance. The cash flow of a project has been ranked by the owners' respondents in the second position. It has been ranked by the consultants' respondents in the 4th position and by the contractors' respondents in the 3rd position. Cash flow is more important for owners and contractors than for consultants, because it can give an important evaluation for the owners' and the contractors' cost performance at any stage of project. Material and equipment cost has been ranked by the owners' respondents in the second position, but it has been ranked by the consultants' and the contractors' respondents in the 5th position. This indicates that this factor is more important for owners than for others. Material and equipment cost is one of the project cost components that affects owners' liquidity and project budget. Liquidity of organisation has been ranked by the owners' respondents in the 6th position. It has been ranked by the consultants' respondents in the first position and by the contractors' respondents in the 4th position. Consultants considered this factor as the most important one because cost performance of any project depends mainly on the organisation liquidity

4.1.2 Group Two: Time Factors

The relative importance index and rank of time factors are summarized in Table 6.

According to owners, consultants, and contractors, the average delay because of closures leading to materials shortage was the most important performance factor, as it has the first rank among all factors with RII = 0.941 for owners, 0.896 for consultants, and 0.943 for contractors. Local construction projects suffer from complex problems because of closures leading to materials shortage. These problems can be considered as an obstacle for time performance of projects. Unavailability of resources as planned through project duration has been ranked by the owners' respondents in the 3rd position. It has been ranked by the consultants' respondents in the 2nd position and by the contractors' respondents in the 3rd one. This factor can be considered as important for 3 parties and scores a similar rank from all of them. This factor directly affects the project success such as time. If resources are not available as planned through project duration, the project will suffer from the

problem of time performance. Average delay in payment from owner to contractor has been ranked by the owners', consultants', and contractors' respondents in the 3rd position. This agreement between parties is traced to disputes that will happen between project parties, when the payment from owner is delayed. This will affect project success, especially time criteria.

Table 5. Summary of relative importance index and rank of time factors

Time Factors Group	Owner		Consultant		Contractor	
	RII	RANK	RII	RANK	RII	RANK
Site preparation time	0.682	7	0.664	9	0.596	9
Planned time for construction	0.753	4	0.760	5	0.765	5
Percentage of orders delivered late	0.694	6	0.768	4	0.774	4
Time needed to implement variation orders	0.706	5	0.704	7	0.693	7
Time needed to rectify defects	0.659	8	0.672	8	0.639	8
Average delay in claim approval	0.650	9	0.728	6	0.765	5
Average delay in regular payments	0.824	3	0.776	3	0.839	3
Unavailability of resources	0.871	2	0.858	2	0.904	2
Average delay because of closures leading to material shortage	0.941	1	0.896	1	0.943	1

Percentage of orders delivered late has been ranked by the owners' respondents in the 6th position and by the consultants' and contractors' respondents in the 4th position. This factor has the same rank for contractors and consultants and it is more important for them because it is related to contractual relationships between them. The contractor cannot implement any stage through a project without having orders from the project consultant. Planned time for project construction has been ranked by the owners' respondents in the 4th position and by the consultants' and contractors' respondents in the 5th position. This factor is more important for owners as they usually want their projects completed as early as possible.

4.1.3 Group Three: Quality Factors

Table 6: Summary of relative importance index and rank of quality factors

Quality Factors Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Conformance to specification	0.882	1	0.808	3	0.822	3
Unavailability of competent staff	0.859	2	0.848	1	0.865	1
Quality of equipment & raw material	0.835	3	0.840	2	0.861	2
Quality assessment system in organization	0.706	4	0.712	4	0.743	4

The relative importance index and rank of quality factors are summarized in Table 6. Unavailability of personnel with high experience and qualifications has been ranked by consultants' and contractors' respondents in the first position and by owners' respondents in the second one. This factor is very important for 3 parties because availability of personnel with high experience and qualifications assist them to implement their project with a professional and successful performance. Conformance to specification has been ranked in the first position for owners, but it has been ranked in the 3rd position for both of consultants and contractors. This factor is more important for owners, as it is significant and related to client satisfaction. The owners usually seek to implement their project according to required specifications. Quality of equipment and raw materials in a project has been ranked by the consultants' and contractors' respondents in the 2nd position and by the owners' respondents in the 3rd one. This factor is more important for consultants and contractors than for owners, as they usually want materials applied in a project to be of good quality and according to specification.

4.1.4 Group Four: Productivity Factors

The relative importance index and rank of productivity factors are summarized in Table 7. Sequencing of work according to schedule has been ranked by owners, consultants, and contractors in the first position. This factor is the most important one for 3 parties because sequencing the work according to schedule assists them to conduct a project according to scheduled time for project completion. Management-labor relationship has been ranked by owners' and contractors' respondents in the 2nd position and by consultants' respondents in the 3rd one. This factor is considered as important for 3 parties as management-labor relationship can assist them by strong coordination and motivation between labour level and managerial level. This will lead to an improvement in productivity and performance of projects. Number of new projects per year has been ranked by owners' and contractors' respondents in the 5th position and has been ranked by consultants' respondents in the 3rd position. This factor is considered more important for consultants. Owners and contractors considered the number of new projects/year rarely affect the performance of projects. Consultants believed that number of new projects/year affect the degree of experiences and skills learned from executed projects and that will affect the degree of project performance based on previous or current experiences.

Table 7: Summary of relative importance index and rank of productivity factors

Productivity Factors Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Project complexity	0.729	3	0.712	2	0.761	3
Number of new projects/year	0.600	4	0.688	3	0.630	5
Management-labor relationship	0.776	2	0.688	3	0.796	2
Absenteeism rate through project	0.776	2	0.688	3	0.743	4
Sequencing of work according to schedule	0.800	1	0.812	1	0.804	1

4.1.5 Group Five: Client Satisfaction Factors

The relative importance index and rank of client satisfaction factors are summarized in Table 8. Leadership skills for project managers have been ranked by owners', consultants', and contractors' respondents in the 1st position. This factor is the most important one for 3 parties because leadership skills for project managers affect the degree of project performance and client satisfaction. Number of reworks has been ranked by owners', consultants', and contractors' respondents in the 5th position. This factor has the same rank for 3 parties because number of reworks affect the relationship between them. Number of disputes between owner and project parties have been ranked by owners' respondents in the 2nd position and by consultants' and contractors' respondents in the 4th position. This factor is more important for owners because disputes between owner and project parties will affect relationships between them and the degree of client satisfaction will be affected. All of that affects the performance of project. Information coordination between owner and project parties has been ranked by the owners' and contractors' respondents in the 3rd position and by the consultants' respondents in the 2nd position.

Table 8: Summary of relative importance index and rank of client satisfaction factors

Client Satisfaction Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Information coordination between owner and project parties	0.729	3	0.792	2	0.809	3
Leadership skills for project manager	0.835	1	0.848	1	0.904	1
Speed and reliability of service to owner	0.718	4	0.744	3	0.822	2
Number of disputed between owner and project parties	0.753	2	0.728	4	0.720	4
Number of rework incidents	0.635	5	0.712	5	0.627	5

4.1.6 Group Six: Regular & Community Satisfaction Factors

Table 9: Summary of relative importance index and rank of regular & community satisfaction factors

Regular & Community Satisfaction Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Cost of compliance to regulators requirements	0.600	4	0.648	3	0.604	4
Number of non-compliance events	0.635	3	0.624	4	0.614	3
Quality and availability of regulator documentation	0.647	2	0.736	1	0.653	2
Site condition problems	0.788	1	0.712	2	0.707	1

The relative importance index and rank of regular and community satisfaction factors are summarized in Table 9. Neighbours and site condition problems have been ranked by the owners' and contractors' respondents in the 1st position and by the consultants' respondents in the second one. This factor is more important for owners and contractors because it is strongly related to client satisfaction and contractors' performance. Quality and availability of regulator documentation has been ranked by the consultants' respondents in the 1st position and by the owners' and contractors' respondents in the 2nd position. Quality and availability of regulator documentation is more important for consultants because it affects the performance of consultants and community satisfaction. It can be understood, that there is a strong agreement between owners and contractors for ranking all regular and community satisfaction factors because they are more related to contractors' performance and client satisfaction. Generally, it can be said that 3 parties are in agreement for ranking these factors.

4.1.7 Group Seven: People Factors

Table 10: Summary of relative importance index and rank of people factors.

People Factors Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Employee attitudes	0.682	4	0.728	2	0.795	3
Recruitment and competent developments	0.753	3	0.688	4	0.809	2
Employees motivation	0.765	2	0.696	3	0.791	4
Belonging to work	0.835	1	0.736	1	0.849	1

The relative importance index and rank of people factors are summarized in Table 10. Belonging to work it has been ranked by the owners, consultants, and contractors respondents in the 1st position. This factor is the most important one for 3 parties because belonging to work usually improves productivity and performance of project. Employees' motivation has been ranked by the owners' respondents in the 2nd position. It has been ranked by the consultants' respondents in the 3rd position and by the contractors' respondents in the 4th position.

4.1.8 Group Eight: Health & Safety Factors

Table 11: Summary of relative importance index and rank of health & safety factors

Health & Safety Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Application of health & safety factors in organization	0.700	2	0.728	1	0.787	1
Project location is safe to reach	0.694	3	0.704	2	0.774	2
Reportable accidents rate in project	0.729	1	0.680	3	0.600	4
Assurance rate of project	0.671	4	0.642	4	0.635	3

The relative importance index and rank of health and safety factors are summarized in Table 11. Application of health and safety factors in organizations has been ranked by the consultants' and contractors' respondents in 1st position, but has been ranked by the owners' respondents in the 2nd one. However, this factor is very important for 3 parties because application of health and safety factors in construction projects will improve overall performance of such projects. Reportable accident rate in project has been ranked by the owners' respondents in the 1st position. It has been ranked by the consultants' respondents in the 3rd position and by the contractors' respondents in the 4th position. Owners considered this factor as the most important one, because reportable accident rate usually affects the safety performance and the client satisfaction degree in construction projects. Ease of access to the site (location of project) has been ranked by the owners' respondents in the 3rd position and by the consultants' and contractors' respondent in the 2nd position. This factor is more important for consultants and contractors because the access to the site is more relevant to them and affects the degree of safety for their employees.

4.1.9 Group Nine: Innovation & Learning Factors

Table 12: Summary of relative importance index and rank of innovation & learning factors

Innovation & Learning Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Learning from own experience and past history	0.847	1	0.752	2	0.818	2
Learning from best practice and experience of others	0.824	2	0.760	1	0.822	1
Work group	0.776	4	0.736	4	0.787	4
Review of failures and solving them	0.824	3	0.752	2	0.809	3

The relative importance index and rank of innovation and learning factors are summarized in Table 12. Learning from own experience and past history has been ranked by the owners' respondents in the 1st position and by the consultants' and contractors' respondents in the 2nd position. This factor is more important for owners than for others. Owners can use their own experience and past history to improve and develop performance of their current and future projects. Learning from best practice and experience of others has been ranked by the owners' respondents in the 3rd position and by the consultants' and contractors' respondents in the 1st position. Contractors and consultants considered this factor as a more important one than owners did. This is because learning from best practice and experience of others can improve and develop consultants' and contractors' performance. Training the human resources in the skills demanded by the project has been ranked by the owners' respondents in the 2nd position. It has been ranked by the consultants' respondents in the 5th position and by the contractors' respondents in the 4th one.

4.1.10 Group Ten: Environment Factors

Table 13: Summary of relative importance index and rank of environment factors.

Environment Factors Group	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Air quality	0.588	3	0.592	2	0.671	2
Noise level	0.565	4	0.512	4	0.613	4
Wastes around the site	0.635	2	0.584	3	0.649	3
Climate condition	0.729	1	0.686	1	0.707	1

The relative importance index and rank of environment factors are summarized in Table 13. Climate condition at the site has been ranked by the owners', consultants', and contractors' respondents in the 1st position. This factor is the most important one for them, because it affects the productivity and time

performance of the project. Noise level has been ranked by the owners', consultants', and contractors' respondents in the 4th position. However, for all parties a noise level is less important than other environmental factors because it is rarely an issue. Generally, noise level affects the productivity performance of construction projects.

V. Conclusion

A questionnaire-based survey was used to elicit the attitude of owners, consultants, and contractors towards factors affecting the performance of construction projects in India. 120 questionnaires were distributed as follows: 25 to owners, 35 to consultants and 60 to contractors. 88 questionnaires (73%) were returned as follows: 17 from owners, 25 from consultants, and 46 from contractors as respondents. The respondents were asked to indicate the level of importance of each of the 60 factors of success as not important, slightly, moderately, very, and extremely important. The results indicated that the average delay because of closures leading to materials shortage was the most important performance factor, as it has the first rank among all factors from the perspectives of owners, consultants, and contractors. This agreement between all target groups is traced to the difficult political situation. The most important factors agreed by the owners, consultants, and contractors as the main factors affecting the success of construction projects were: escalation of material prices, availability of resources as planned through project duration, average delay because of closures leading to materials shortage, availability of personnel with a high experience and qualifications, quality of equipment and raw materials in project, and leadership skills for project managers. The authors recommended to develop human resources in the construction industry through proper and continuous training programs about construction projects performance. These programs can update participants' knowledge and can assist them to be more familiar with project management techniques and processes. Owners are encouraged to facilitate payment to contractors in order to overcome delay, disputes, and claims. All managerial levels should participate in sensitive and important decision-making. Continuous coordination and relationship between project participants are required through project life cycle for solving problems and developing project success. Consultants should be more interested in design cost by using multi-criteria analysis and choosing the most economical criteria in order to improve their performance and to increase owners' satisfaction. In addition, consultants are urged to facilitate and expedite orders delivered to contractors to obtain better time performance and to minimize disputes and claims. Contractors should not increase the number of projects that cannot be performed successfully. In addition, contractors should consider

political and business environment risks in their cost estimation for overcoming delay because of closures leading to materials shortages. There should be adequate contingency allowances in order to cover increases in material cost. Proper motivation and safety systems should be established for improving the productivity performance of construction projects. Greater application of health and safety factors are necessary to overcome problems of safety performance. Contractors are counseled to minimize waste rates through project implementation for improving cost. They should be more interested in conformance to project specification to overcome disputes, time, and cost performance

problems. Quality materials should be of a greater interest for contractors in order to improve cost, time, and quality performance. This can be done by applying quality training and meetings that are necessary for performing an improvement. Contractors are urged to be more interested in sequencing of work according to schedule. In addition, contractors should have a cost engineer in their projects to successfully control costs.

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