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Analyzing the Impact of Coordination Factors on Construction Project Success in Pakistan Using Partial Least Squares Structural Equation Modeling

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Conflicts of Interest
There are no conflicts to declare.

ABSTRACT

Coordination is one of the significant components of the construction process. The owners, consultants and contractors struggle to coordinate adequately in massive construction projects whose success could be explain in terms of time, cost, quality and satisfaction. However, coordination factors are crucial in securing the successful accomplishment of all stages of the project. In this study, partial least squares structural equation modeling (PLS-SEM) methodology uses to indicate factors that lack of coordination badly affects the success of infrastructural projects. A conceptual model was developed for the evaluation of project success. The model comprises of two key latent factors. An empirical analysis to test the conceptual model was carried out through the questionnaire survey. The data collected from 246 building experts who were employed in the construction sector in Pakistan. The findings of the analysis showed that the model R^2 value was 0.625 which indicated that the lack of coordination had a main influence on project success. The communication-related factors (beta 0.246) have a greater effect on project success, based on the overall form of the model. The conceptual model GOF was calculated as 0.642 which showed the conceptual model validity and reliability, and the data matches correctly. The current study applies PLS-SEM which is previously missing in the literature; this provides additional insights to the array of knowledge in the construction industry that leads project managers to understand the lack of coordination and its impact on project success.

Keywords: *LACK OF COORDINATION, INFLUENCE ON PROJECT SUCCESS, PLS-SEM, INFRASTRUCTURAL PROJECTS*

1. Introduction

The construction industry, which is backbone of Pakistan's economy, always has economic and social impact in society. The construction industry is an important sector of the Pakistani economy which contributes 2.5 % of total GDP. Unfortunately, this sector is backward as compared to other countries of the region like China, Japan, South Korea, etc. The coordination issues in construction industry are a global phenomenon and Pakistan construction industry has no exception. It is, therefore, important to determine the most influential elements in project that cause coordination issue in the construction area in Pakistan. The main purpose of this study is to ascertain those issues and propose suggestion for their prevention or at least reduce their impact. Construction is the second-largest sector in the economy after agriculture; approximately 30-35% of employment is directly or indirectly linked with the construction sector [1] .The construction industry is developing and there are a number of large and small construction projects are in execution phase especially through China Pakistan Economic Corridor (CPEC). The construction industry is complicated, [2] because it comprises of multiple stakeholders [3, 4], such as consultants, construction managers, contractors, designers, subcontractors and specialists which involved in the project since its inception. Thus, management of project becomes more and more complicated, that firmly need collaboration and coordination till the project completion [5, 6]. Furthermore, the definition of a project success is diverted in this matter. but, it is unanimously agreed that if the project is completed on time then cost and quality is considered a successful [7].

For most of the governments, users and communities, the success of construction projects is a dominant matter. Because the concept of success links to project stakeholders which remain unclear among them, it is difficult to determine the success or failure of the project performance [8]. The ironclad triangle i.e., cost, quality and time were dominantly used a measure of the success in construction projects [9]. For this study success is generally characterized as the degree to which project objectives and expectations are achieved [10]. The challenge for both client and contractor to handover the project successfully is due to expanding complexity in design and involvement of various parties in project till its completion [11]. A project is considered successful if the project is completed on time within budget and required quality and generally most stakeholders are satisfied with everything [10]. Hence, time, cost, quality, and satisfaction were generally used as parameters to measure the success of a construction project [12, 13]. The construction projects unlikely face severe project failure due to low productivity, poor quality, unexpected cost and time [14, 15]. Literature has categorically mentioned various factors for the project success and failure but one of the important factors was lack of coordination that cause project failure [16], but never addressed appropriately in the studies.

Coordination means the convergence, harmonization and alignment of different participating entities in any sector with multiple objectives [17]. Similarly, proper coordination has been found a major contributor in the success of several mega projects such as the multi-billion dollar Atlanta Metro Rail Project and the World Trade Centre, USA [18, 19]. Similarly a high rise building project in china, due to its typical geographical location near a lack led to multiple failures during the project execution resultantly cost overrun was recorded 50% [16]. However, the common goal of construction projects is to complete the project on time, quality and within the estimated budget. If there is better coordination among the parties involved in the construction projects may positively impact project success [20, 21]. Coordination among clients, consultants and contractors who are the main stakeholders in any construction project, have been recognized as one of the most crucial components in achieving a construction project's success [17, 19, 18].

The purpose of the coordination process is adding value to the project delivery and to improve efficiency by addressing interdependence project tasks and parties involved in the project [22, 23]. The uncertainty condition in the project life cycle impedes teamwork that influences the project's performance. The collaboration between all stakeholders to provide the correct information on time is vital [21]. The construction projects are developed and executed in any public and private construction project. The project success or failure on the bases of ironclad triangle is well versed in literature and used to assess the project performance but coordination of parties involved in the project is forgotten that decide the project success and failure. Indeed, project success in the construction industry is an important issue, but without considering the coordination of parties involved in project one cannot determine the desired direction of the projects. It is, therefore, important to understand the factors that reduce coordination among the contracting parties that potentially impact on project success in the construction sector. Therefore, this research aims to examine and provide answers to the following questions:

(i) What are the factors that cause lack of coordination in construction projects?

(ii) Does the lack of coordination directly influence the project success?

(iii) How can PLS-SEM (partial least squares structural equation modeling) methods can be applied to examine the lack of coordination factors that affect the project success in the construction sector.

(iv) How can this study help managers to address the coordination issues proactively in construction projects?

The terms coordination and project success was addressed numerous times in previous studies, but little consideration was paid; how lack of coordination influenced the project success in construction projects, particularly in Pakistan. The authors believed that there is little literature available on this issue and required a comprehensive template showing coordination deficiencies among project participants and its influence on the project success. In this research, the authors' aims to provide an analytical model that not only enable practitioners developing professional capability but also help researchers to ascertain the coordination of stakeholders in construction projects cans its influence on the project success. This study has used PLS-SEM, which includes a number of revolutionary new latest analytical methods, to measure the proposed model and the connection between the latent variables, thus providing opportunity to fill a significant methodological gap in the literature.

2. Objectives of the Study

The main objective of this study is to evaluate the critical opinions of construction professionals regarding coordination factors and their effects on construction project success. Moreover, the research describes the most effective techniques for the risk reduction of coordination factors affecting project success in the construction sector. The main objectives of the study include,

- Identifying coordination factors in construction projects to manage or avoid them in future.
- Examining the perceptions of parties that lack of coordination impact on project success,
- Investigating the lack of coordination factors in the Pakistani construction industry that help to ensure the project success.

3. Literature review

Coordination is one of the key considerations in the management of construction projects and an important contributor to the success of the projects and the accomplishment of objectives. Kubicki el al's. (2006) study says coordination is a crucial function during the construction process. Coordination between the members is a necessary requirement for building efficient and reliable construction processes. They further modeled the building database and the corporative platform for coordination tools in the building process. This model-based approach has helped unofficial and understood coordination allowing participants to access the project's contextual details thus, improve the coordination process in construction. They mentioned that construction project success is based on the relationship between those. Pocock (1996-1997) have about the same view that a fair degree of collaboration between constructors and designers would ensure the optimal results of the project. Hence, coordination is more required for such an environment to build up teamwork and integration working environment, and it is critically important for assuring the success in building projects.

Practitioners usually refer to the state of dependency, relationships or difficult to work together when addressing coordination [27, 28]. A variety of coordinated activities are undertaken as the project is a concept that needs continuous coordination throughout the implementation processes in order to achieve objectives. Most of these activities require support such as frequent meetings among different stakeholders to enhance the progress of a project with better satisfaction [29]. Salah et al. (2016), Saram et al. (2015) studies about coordination in which they find coordination factors that influence construction projects. They divide those factors into different groups and rank coordination factors, for example, all parties participant in plans, quality assurance plan, and joint site visit etc. Similarly Lyer and Jha (2006) enlisted 59 coordination activities that impact on the successful completion of building projects, for the aim of his research, the success of a project was taken into account from the point of view of adherence to quality, cost, time and conflict were arising.

An empirical study conducted by Lyer and Jha (2006), identified that when conforming with the cost estimate it is of utmost importance to the stakeholders, that there should be coordination among the project team members. They highlighted that contribution of coordination is necessary for the achievement of the project cost goal. Tarek Hegazy (2001) is presented a beneficial model for design rationale recording, design changed management and storing design relevant data. The framework offers to enhance design coordination and manage changes, thus helping to improve the efficiency and consistency of the general design process, additionally, each building component in the methodology has predefined communication connection that allows all involved parties to communicate changes to any factor automatically.

Although researchers discuss coordination but they fall short to clearly recognize those activities which the construction project coordinators need to carry out in order to achieve better coordination [33, 34, 35]. Construction factors are found to be the fundamental elements of coordination process which affect the performance of the construction projects; in addition, it is necessary to recognize certain factors in order to improve coordination among construction parties. In fact, contractors are the key participants in the construction site of construction projects [23]. Therefore, under the supervision of the consultant, all stakeholders are expected to organize the tasks before and during the construction process to ensure effective project execution to meet the owner's objectives. Even though, many researchers discuss coordination but they fall short to clearly recognize those activities which the construction project coordinators need to carry out in order to achieve better coordination.

The construction projects are industrialized and implemented in any public and private construction project. The project achievement or failure on the bases of ironclad triangle is well versed in works and used to assess the project presentation but management of parties involved in the project is over and done that choose the project success and failure.

4. Research methodology

4.1. Conceptual model

In this study a conceptual model was designed to evaluate the coordination factors that influence the project success using PLS-SEM. PLS-SEM is a comprehensive multivariate statistical method of analyzing the variance based structural equations [36, 37]. Path model with latent variables includes measurement models that describe the relationship between the observable indicators and the latent variables. The structural equation modeling (SEM) approach is used widely in research and preferred over regression based analysis to analyze and check complex casual relationships [38, 39]. However, structural equation model is a mixture of path analysis regression, factor analysis, regression and multiple correlations which make it a most suitable data analysis tool.

The relationship between coordination and project success can be found in the literature. However, there is a lack of research that develops a comprehensive variable model about how lack of coordination directly affects project success. These relationships assist construction management professionals to evaluate and identify such coordination flaws during project execution that determine the project outcome. In the literature the relationship is not appropriately addressed. A conceptual model is essential evaluating the lack of coordination factors and their direct effect on project success using PLS-SEM. The conceptual model is defined in the relation between latent and observed variables, respectively. The first stage is to determine the latent variables in the structural model and innovation the investigative hypothesis, which is coordination and project success. Because unobserved factors are not calculated directly, a template is needed to develop for measuring those using observed factors.

In this study, the model developed is focused on 20 observed factors that impact coordination. These factors are called exogenous factors that are classified into five major groups: planning related factors, resource handling and documentation related factors, teamwork and leadership related factors, value engineering and facilitating related factors, and communication-related factors. The latent endogenous variable is project success, which is measured using four indicators. The manifest factors are measured directly by means of a five-point Like art scale. The conceptual model explains the relationship between observed endogenous factors and observed exogenous factors that are also known as dependent latent variables shown in figure .1.The endogenous factors indicates unobserved dependent factors that can be impacted by both endogenous and exogenous factors, while exogenous factors are considered as independent latent variables [40].

The issue about what factors impact coordination and affect project success at the project level clearly remains unanswered via SEM in the context of the construction industry. The aim of this research is to address this knowledge gap. Hypothesis's for this study is follows:

Hypothesis 1(H1) lack of coordination directly impact project success.

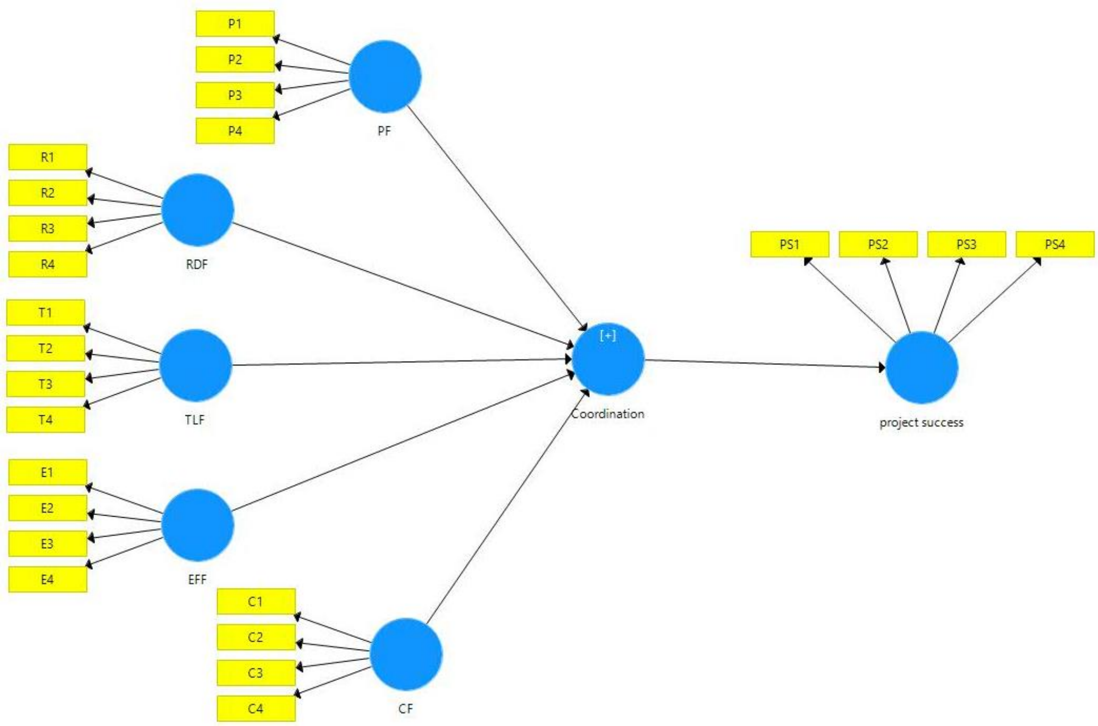

Figure 1 Conceptual model

4.2. Questionnaire design

The questionnaires were used to collect the survey data from construction industry practitioners. The first stage was preparing questionnaire identifying factors from literature. The final questionnaire was distributed among the construction practitioners to get their response from the construction industry of Pakistan. The detailed questionnaire was distributed into two parts. The first parts of the questionnaire contain demographic information of the respondents, such as age, education level, Job title and work experience. The second part of the questionnaire is further divided into two sub-sections as shown in Table .1. The first sub-section of the questionnaire focused on the questions related to factors affecting project coordination and the second sub-section focused on factors influencing project success. The closed-end questions were used in the questionnaire to get the respondents' opinion using 5 point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The respondents' were asked to specify a reasonable significant rating using likert scale for the 24 variables on the questionnaire.

4.3. Data collection and sampling

The identification of 24 factors from the literature provides the basis for the preliminary questionnaire to be produced. The questionnaire was designed with the purpose as comprehensible as feasible. A pilot survey was performed before distribution of the final survey questionnaire to modify and finalize the survey questionnaires. There were four construction professionals involved in examining the questionnaire's design and structure to make the questionnaire easy for comprehension. The main objective of the pilot survey was to verify the accuracy of the questionnaire. It also helped to test whether the significance of all the hypothesized factors were meaningful and significant to the construction industry of Pakistan. Eventually, a final questionnaire was developed with the updated list of factors, which was used to collect the information from the respondents to determine basic relationships and relative importance among the factors, which supported the successive analysis of coordination flaws and project success.

Table 1 List of factors impacting coordination and project success

Factors	**Code**	**References**
	Factors affecting project coordination	
Planning relate factors (PF)		
1. Lack of quality assurance plan	P1	KN. Jah (2007)
2. Better Execution of a project Plan	P2	Salah et al.(2016) ,saram et al.(2015)
3. All Parties participation in plan	P3	K. Crowston (1994)
4. Lack of Identification of appropriate resources	P4	Betts, Martin (1992)
Resource handling and record documentation related factors (RDF)		
1. Lack of Controlling project finances	R1	Saram et al (2015)
2. Record maintenance	R2	Keesoo Kim (2003)
3. Ensuring the timeliness of all work carried	R3	Saram et al (2015)
4. Lack of Drawing documentation	R4	Salah et al [30]
Teamwork and Leadership related factors (TLF)		
1. Lack of Joint site visit	T1	S.A Assaf (2006), KN. Jha (2007)
2. Lack of Meetings	T2	Crowston (1994)
3. Managing contractual issue	T3	Saram et al (2015)

4.	Maintain proper relationships with all parties	T4	K.N. Jha (2006), Saram et al (2015)
	Value engineering and facilitating related factors (EFF)		
1.	Lack of Design and specification clarity	E1	KN. Jha (2007) [41]
2.	Lack of gathering and compiling information	E2	Chitkara (1998)
3.	Identifying potential delays and strategic activities	E3	Saram et al (2015)
4.	Lack of Work integration	E4	KN jha (2007)
	Communication related factors (CF)		
1.	Open a wide and fast communication channels	C1	Harmon, K.J (2003)
2.	Maintaining effective organizational structural and Communication channels	C2	salah et al (2016)
3.	Liaison with the client and consultant	C3	Fayol,H (1949) (1949)
4.	Communicate instances of poor quality, unsafe Or adverse situations to relevant staff	C4	K.N Jha (2006), saram et al (2015)
	Factors affecting Project success (PSF)		
1.	On-time project delivery	PS1	Sadeh et.al. (2000)
2.	Overall, all stakeholders are satisfied with The project outcomes	PS2	Paul Steinfort (2007)
3.	The product quality is accord With the predefined standard	PS3	Sadeh et.al(2000), Paul Steinfort (2007)
4.	Project is operating within The pre-estimated budget	PS4	Sadeh et.al(2000), Paul Steinfort(2007)

The final survey questionnaire was distributed through email, personal visit and other social applications among 600 construction experts. The distributions of questionnaires' were made among the respondents who showed interest or accepted the invitation to participate in the research. The survey questionnaire comprised of cover later outlining the study purpose and ensured maintaining privacy of the respondents. In this research data collection was made from different institutions such as P&D (planning and development department), PWD (Public work department), NESPAK (National Engineering Service Pakistan), NHA (National Highway Authority), DHA (Defense Housing Authority), CBC (Cantonment board Clifton), and some other private construction companies in Pakistan. Designer, contractor, consultant, client, and other parties which involve in construction were the main respondents for research. The majority of respondents were civil engineers. The respondents were CEO (chief executive officer), project manager, site engineers, designer, project coordinator, planning engineer, and quality surveyor in the construction industry, who had adequate expert skills to clarify the relation in this research.

A simple random sampling technique was employed to select the sample from Pakistan's construction industry. The data was selected from the online database, government archives, and organizational records, which were publicly accessible. Help from the parties involved as regular updates in construction and follow up emails and phone calls resulted in efficient response time. The survey was conducted (supervise) from February 15, 2020, to June 6, 2020. Finally, 246 responses were received over four month's duration, representing a response rate of 54.7%. Among 246 responses, the demographic information is shown in table.2. 12.20% of responses have more than ten years of working skill in order to manage the construction industry. In addition, 92% of respondents had an engineering degree and majority of them are Masters and PhD degree in the construction field. In a perception analysis of this kind, therefore, the data collected are deemed adequate to obtain a better judgment from experienced respondents.

Table 2 Demographic details of respondents

Profile	**Frequency**	**percentage (%)**
Education		
Diploma	8	3.25
Bachelors	110	44.71
MS/PHD	128	52.04
Organization position		
Chief executive officer	4	1.63
Project manager	31	12.60
Site engineer	78	31.70
Designer engineer	45	18.29
Quality surveyor	32	13.00
Planning engineer	28	11.38
Project coordinator	28	11.38
Experience (years)		
0>5	148	60.16
5>10	68	27.64
More then 10	30	12.20

5. Data analysis

This portion describes the results of empirical data gathered from the survey. Smart PLS is a modern tool to analyze the statistical data. Therefore, this study has used PLS-SEM for estimating structural equation models. The objective of this study is to examine the factors of coordination that influence the construction project success. In this study, 20 factors impacting coordination and four factors affecting construction project success were obtained through literature review and used to create a model. The conceptual model was developed for simulation to measure the impact of coordination factors (IDV) on construction project success (DV) and implemented PLS-SEM version 3 [52] software to analyze the data. The evaluation of the model used two approaches for data analysis. The first approach is an evaluation of the external measuring model, and the second is an evaluation of the internal structural model. In this study, smart-PLS software has been used to validate and analyze the model.

5.1. Assessment of outer measurement model

The outer measurement model is used to check the reliability and validity of the observed variables. Similarly, the measurement of internal consistency is calculated by means of reliability and individual manifest test, while the validity of the variables is tested on the bases of discriminating and convergent validity [49]. Although most of the previous research has accepted a thumb rule indicates that indicators with loadings range from 0.4 to 0.7, the potential importance of the factors should be considered before refusal and for indicator loading greater than 0.7 is considered to be highly satisfactory [50].

Table 3 Construct reliability and validity

Construct	**items**	**loading**	**Cronbach's alpha**	**CR**	**AVE**
PF	P1	0.790	0.799	0.870	0.626
	P2	0.845			

	P3	0.808			
	P4	0.717			
RDF	R1	0.802	0.836	0.890	0.670
	R2	0.846			
	R3	0.834			
	R4	0.792			
TLF	T1	0.770	0.811	0.876	0.639
	T2	0.840			
	T3	0.751			
	T4	0.835			
EFF	E1	0.812	0.832	0.888	0.665
	E2	0.815			
	E3	0.842			
	E4	0.791			
CF	C1	0.813	0.843	0.895	0.682
	C2	0.898			
	C3	0.840			
	C4	0.743			
PSF	PS1	0.772	0.838	0.892	0.674
	PS2	0.843			
	PS3	0.845			
	PS4	0.821			

The composite reliability (CR), average variance extracted (AVE), and Cronbach's alpha are the three tests that can be used in PLS path modeling to determine the convergent validity of the measured construct [51]. Cronbach's alpha is widely used criterion for internal consistency, which provides an estimate of the reliability based on the indicator correlations. General lower acceptable limit for a successful model indicated by Litwin and Fink is a Cronbach's alpha should be greater than 0.7 [52]. Cronbach's alpha is same as CR, so composite reliability value should be greater than 0.7 [49]. Using the AVE as a convergent validity test, where values of the AVE would surpass 0.5 [53]. A minimum AVE value of 0.5 denotes satisfactory convergent validity as it implies that the construct reflects an average variance of more than 50 per cent of its items [54]. Cross loadings and Fornell-larker criterion are two measures of Discriminant validity in PLS path modeling, which stipulate the extent to which the given construct varies significantly from other constructs [55].

In this research validity and reliability results are shown in the table. 3. According to the table 3, the AVE value of all constructs are greater than the critical value of 0.5, as well as the Cronbach's alpha and CR values of b individual constructs, are higher than 0.7. In addition, the loadings of all factors are within the appropriate range, which exceeds 0.7. These results show adequate validity and reliability of the measuring model. The model has also been checked for discriminant validity based on Fornell-larcker and cross-loading criterion values produced are given respectively in Table 4 and Table 5. The result shows appropriate discriminating validity because all individual manifest factors have higher values than those in the corresponding row. It confirmed the convergent and discriminant validity of the measuring model.

Table 4 Fornell-larcker criterion test

Factors	CF	PF	PSF	TLF	EFF	RDF

CF	0.826				
PF	0.663	0.791			
PSF	0.737	0.586	0.821		
TLF	0.791	0.695	0.761	0.800	
EFF	0.745	0.658	0.730	0.760	0.815
RDF	0.650	0.701	0.620	0.740	0.654

Table 5 Cross- loading values

Code	CF	PF	PSF	TLF	EFF	RDF
C1	0.813	0.608	0.610	0.701	0.594	0.586
C2	0.898	0.601	0.637	0.726	0.666	0.573
C3	0.840	0.504	0.582	0.637	0.623	0.541
C4	0.743	0.464	0.606	0.530	0.577	0.436
E1	0.599	0.593	0.632	0.682	0.812	0.583
E2	0.616	0.578	0.612	0.642	0.815	0.543
E3	0.604	0.490	0.580	0.568	0.842	0.517
E4	0.611	0.476	0.552	0.579	0.791	0.485
P1	0.498	0.790	0.467	0.507	0.488	0.521
P2	0.533	0.845	0.449	0.557	0.522	0.571
P3	0.539	0.808	0.478	0.580	0.536	0.559
P4	0.523	0.717	0.461	0.550	0.533	0.561
PS1	0.609	0.523	0.772	0.646	0.598	0.498
PS2	0.571	0.447	0.843	0.588	0.576	0.484
PS3	0.633	0.511	0.845	0.638	0.648	0.535
PS4	0.600	0.437	0.821	0.623	0.569	0.514
R1	0.518	0.563	0.511	0.583	0.563	0.802
R2	0.533	0.577	0.488	0.599	0.533	0.846
R3	0.566	0.586	0.532	0.648	0.527	0.834
R4	0.511	0.567	0.499	0.591	0.519	0.792
T1	0.636	0.581	0.576	0.770	0.561	0.619
T2	0.634	0.591	0.640	0.840	0.626	0.622
T3	0.599	0.465	0.599	0.751	0.626	0.553
T4	0.659	0.579	0.619	0.835	0.618	0.572

Note: Highlight values are loadings for items, which are higher the recommended value 0.7.

5.2. Evaluation of inner structural model

The following techniques were used for calculating the structural model outcomes. This means analyzing the model's analytical capabilities, and the relation between the constructs. The main criteria used to determine the inner structural model. The important one is the determination coefficient of determination (R^2) of the endogenous latent variables. Adding to that certain functional approaches to calculating the inner structure model contained model's predictive relevance (Q^2), goodness of fit (GoF), and path coefficient and t-statistic value.

5.2.1. R^2 value Evaluation

R^2 Is a function of the variance described in the endogenous variables and thus a function of the model's predictive accuracy? The R^2 values of 0.19, 0.33 and 0.67 are considered to be low, moderate and substantial, respectively according to the PLS path models [56]. The final model R^2 in this research was 0.625, indicating the lack of coordination explains 62.5% of the variation in project success. Hence, project success can be explained as moderate. For the model to have predictive accuracy, R^2 should be greater than

0.10. unless the R^2 value is less than that, the conceptual model is considered unable to represent the endogenous variables[57].

5.2.2. T-statistics and path coefficient

In a PLS model, the path coefficient can be obtained as a standardized beta coefficient (β) [54]. The path coefficient in a predictor construct reflects the predicted change in the endogenous construct for a unit change. In the conceptual model, the β values of each path were compared. The higher the β or path coefficient, its impact on latent endogenous variables is significant. The t-test can determine the importance of path coefficient. A bootstrapping process is used to measuring the significance of the hypothesis [54]. The t-statistics and β are given in table.6. At the 5% level of importance, the t-statistics values must be greater or equal than the cutoff value 1.96 [54].

Table 6 T-statistics and Path coefficient

Hypothesis path	value of β	t-statistics	p-value
CF>Coordination	0.246	21.102	0.000
Coordination >PSF	0.790	19.264	0.000
EFF>Coordination	0.238	21.151	0.000
PF>Coordination	0.200	22.427	0.000
RDF> Coordination	0.221	17.532	0.000
TLF> Coordination	0.238	19.905	0.000

Table 6 reveals the standardized coefficient of coordination and project success is 0.790, and T-statistic value is 19.264. Therefore, the lack of coordination has a significant influence on project success, which proves its direct relationship in construction projects. It can be inferred from the results that the study support the hypothesis i.e., lack of coordination significantly affects project success.

5.2.3. The conceptual model overall quality

The goodness of fit (GOF) model is an index for the outer measurement model and inner measurement model to ensure that empirical results are sufficiently explained by the model. The GOF is determined by Eq.2 in the PLS-SEM [58].

$$GOF = \sqrt{(\text{Average } R^2 \text{ x Average communality})} \quad \text{...Eq.2}$$

The cutoff values for the PLS models global validation range from 0 to 1, resulting in GOF large 0.36, medium 0.25 and small 0.1 [59]. In this study, the conceptual model's GOF is taken as the geometric meaning of the average $R^2$and average communality. The model's GOF is found to be 0.642, which means the model suits very well with the data and has high predictive capacity.

5.2.4. Predictive relevance of the model

The model is expected to forecast by using the Q^2 Stone-Geisser value determined by blindfolding procedures[58]. The criterion of the Stone-Geissor Q^2 indicates that the model must be capable of predicting endogenous latent variable indicators. The value of stone-Geisser below zero indicate a lack of predictive significance of the model and above zero indicate that the model has a predictive relevance for the particular construct[54]. This approach has therefore been adapted to the evaluation of the Q^2 model of this study. The outcomes indicate that the value of Q^2 in the model is 0.414, which is greater than zero, which means that the model has predictive validity. The results of this study provide a better overview of the impact of lack of coordination on project success and could help to develop a compilation of adequate recommendations and practical knowledge for sustainable construction projects.

6. Discussion and implication

This research was conducted using the PLS-SEM method to examine whether the lack of coordination factors affect the project success in the Pakistani construction industry. By employing this technique, factors that influence coordination and its direct impact on project success can be understood. The hypothetical paths set out in the proposed model were significant. The lack of project coordination has been found to be a root cause of project failure, after evaluating analyzing all standard beta coefficients' in the structural equation model. The findings of the structural model revealed that approximately 62.5% of coordination factors influence project success in construction projects. It can be concluded that the planning related factors, resource handling and documentation related factors, teamwork and leadership related factors, value engineering and facilitating related factors, and communication-related factors were the major factors directly impact the coordination, and table 3 shows that these have a major relationship with project success. The communication-related factors (beta 0.246) have the greatest influence on the coordination in terms of relative importance of these five coordinating factors. The communication-related factors contain four sub factors: Establishing and maintaining the effective organizational structure and communication (factor loading 0.898), Liaison with the client and consultant (factor loading 0.840), Open a wide and fast communication channels (factor loading 0.813), Communicate instances of poor quality, dangerous situations to relevant personnel (factor loading 0.743). The parties involved in the project need to analyze these factors to evaluate the degree to which they will impact the construction project's success in order to achieve better coordination in construction projects.

Since the communication-related factors have the highest path coefficient (beta 0.246) impacting coordination, it can be regarded as the most important indicator affecting project success. Unorganized construction could lead to a poorly coordinated project leading to project failure. To overcome this problem, project coordinators will be involved in the planning process of the project. The project professionals have the expertise, qualification, experience, competency and knowledge with respect to construction techniques and methods, and their participation in the project process's pre-construction phase could lead to improved project coordination. It will greatly boost the possibility of project success. The communication-related factors are obviously a crucial element that should be considered by all participants, because of good communication, there will be better teamwork.

Coordination not only influenced by communication-related factors, but also by the other model factors, and this effect has been verified by evaluating relationships. This factor was followed by Planning relate factors (beta 0.200), Resource handling and record documentation related factors (beta 0.221), Teamwork and Leadership related factors (beta 0.238), and Value engineering and facilitating related factors (beta 0.238). These have been shown in Fig 2. All factors have an almost similar path coefficient in the model. One potential explanation of why these were almost similar path coefficient is that all factors are significant to get better coordination for project success.

The model's predictive accuracy was calculated via R^2value. In the PLS path approach analysis, it was found that a lack of coordination had a major effect on project success in the construction industry. R^2value was 0.625, indicating that the lack of coordination factors explained 62.5% of the variation in project success. Lack of coordination is directly related to project success at T=19.264 and P=0.000, suggesting that lack of coordination was a significant predictor of project success. The proposed GOF model ensures that the model -specific empirical data have a predictive capacity of 64.2%.

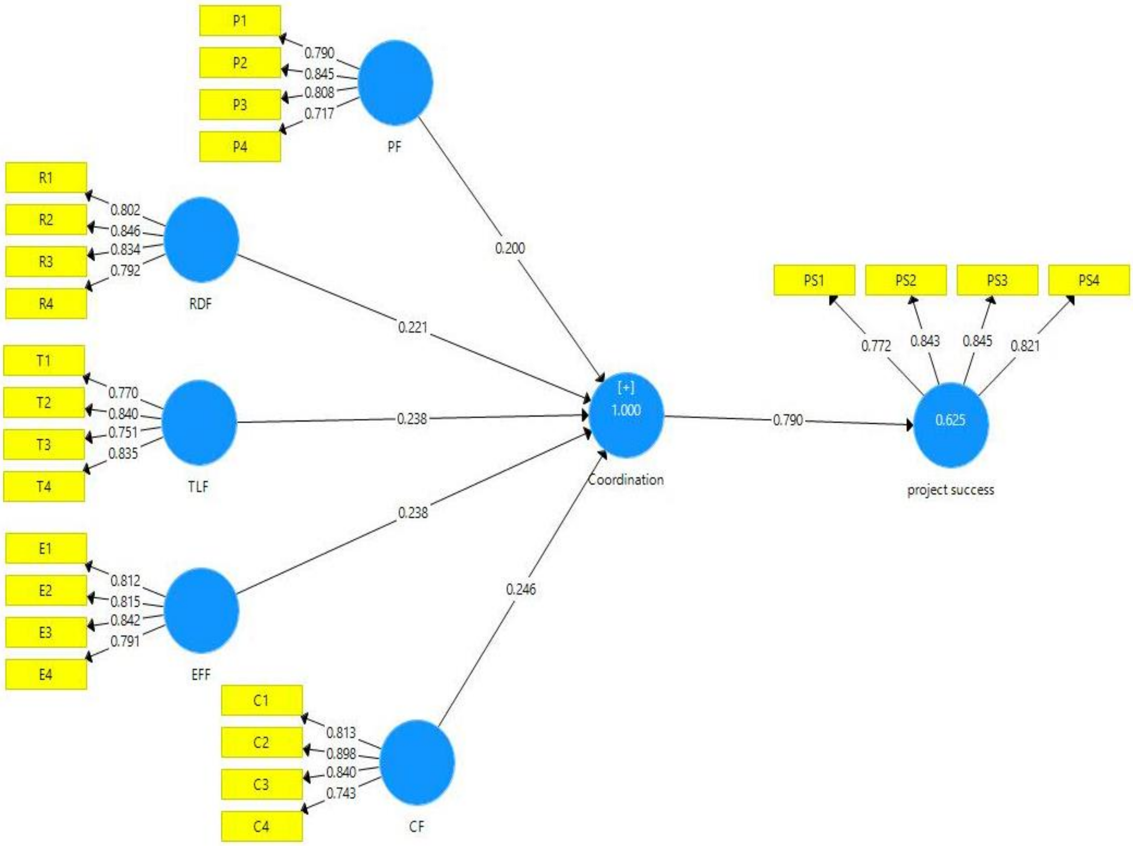

Figure 2 Estimation of the SEM

The model also showed predictive relevance because Q^2 value was significantly exceeded zero (Q^2=0.414). To ensure the validity of this research, the results have been reported for conformation and review to qualified construction experts. Four experts have agreed to join in for expert opinion. The pilot survey was performed by the selected experts, and they were informed of the significance and context of this research provided that this not a testing process but validation of the study. All the professionals agree the results were reliable, and unanimously agreed that the results were important and beneficial to the construction industry. The findings of this study were believed to help construction professionals and researchers to understand each other better. This research examined the hypothesis and confirmed that a lack of coordination in the project directly influenced project success. Consequently, the lack of coordination in construction projects frequently contributes to project failure, thus causing construction projects to fail.

7. Conclusion

The importance of coordination has been acknowledged by the experts and academia in the construction industry as well as in other fields. Many researchers have highlighted a close connection between the coordination and the success of construction projects. The research aimed primarily at examining the effect of the lack of coordination on project success using PLS-SEM. A detailed literature review identified a total of 20 factors influencing coordination and four project success factors. Data was obtained via a questionnaire and then the PLS-SEM method was utilized to analyze the data and to test the hypothesis. An approach was created for evaluating project success, which was informed by five coordination constructs, namely planning, resource handling and documentation, teamwork and leadership, value engineering and facilitating, and communication-related factors, and four project success variables. The results of the study from the calculation of the conceptual model confirmed the hypothesis. The findings of the PLS-SEM study showed that lack of coordination directly impacts project success (beta 0.790 and R^2 0.625) and suggested that the three most important factors were communication, value engineering and facilitating, teamwork and leadership related factors with maximum standardized path coefficient. The conceptual model's GOF index was calculated at 0.642, indicating that the conceptual model has sufficient validity and reliability, which matches the data as supported by the PLS-SEM. Nevertheless, the study also showed that these factors not only influence coordination; a lack of coordination in construction projects also affects project success. The findings of the standardized conceptual model will help project coordinators to identify areas where improved coordination is needed.

This research has significant implications for both realistic and theoretical perspectives, based on theoretical aspects; this research contributes of information or knowledge about lack of coordination and project success, especially from the construction industry perspective, which hasn't been examined in previous studies. This study confirmed that lack of coordination, which includes the five factors, has a major relationship with project success. Therefore, this research covered this awareness gap by presenting empirical evidence that lack of coordination directly affects project success. In addition, this research examined the opinions of construction industry practitioners about these variables through survey-based analysis, and presented empirical evidence of the substantive relation between these factors that could expose a casual effect. With respect to realistic contribution, this research will probably provide solutions to the problems the construction industry faces. In general, it is the hope of the author that this study will benefit the practitioners of construction projects, who can get advantage from the findings by focusing more attention on the significant factors that affect the coordination of project. The result could be used by project coordinators as a basis for the strategic options. In action, it is important to consider the implication of those results. This study suggests that they should have effective leadership, teamwork sprit, communication, and planning and skill engineers for the parties involved in construction. Project success assessment is based on the coordination. The research was carried out in the context of construction sector in Pakistan. Finally more studies are proposed as potential research using the same framework and measure for validating and evaluating results in other countries and creating a validated global model.

Scientific contribution

The main contribution to the amount of knowledge in this research is to fill the gap in available research by empirically analyzing how the lack of coordination affects the success of project in the building industry. The relation between a lack of coordination factors and project success has not been investigated in earlier research work and this is the first study to investigate empirically this relation in the construction sector. This relationship is conceptually interesting, as it connects two significant domains of coordination and project success in construction industry. Therefore, the present research is aimed to add the literature on lack of coordination and effect on project success in a single study, and to provide significant support to systemic strategies and decision making to promote comprehension of the desired results. The current research also introduced an applied advanced statistical model i.e., PLS-SEM, which was previously unavailable in the literature. This research adopts the latest approach to solving the problems by PLS-SEM and thus contributes to the knowledge base. The conceptual model and hypothesis are reasonable and result oriented, undoubtedly add to established knowledge on the subject.

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Data Availability Statement

Some or all data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

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