
Role Of Sustainability And Project Complexity In Achieving Project Success

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ABSTRACT

Keywords:

Sustainability
Project Success
Project Complexity
Triple Constraints

Deficiency of implementing sustainability measures in construction projects is instigating problems in achieving project success. Vast majority of projects are unable to achieve their goals of cost, quality and time duration. The emphasis of this research is to explore the impact of sustainability measures on project success. This research is conducted with positivist stance and quantitative data is collected in a cross-sectional survey. In total 380 questionnaire were distributed among the construction project managers and 189 valid responses are analyzed. The results depicted that sustainability has a positive influence on project success. On the other hand, project complexity showed negative moderation effect between sustainability and project success. It is suggested to organizations working in construction industry to implement sustainability measures in their projects to achieve better results for project success. Also, project managers should improve the efficiency of sustainable practices to reduce the impact of complexity involved.

INTRODUCTION

Based on earlier research, it can be observed that construction projects deeply associated with the environmental, economic and social aspects and have a great impact on society's economy (Banihashemi et al., 2017). There is an increased demand for successful and sustainable construction projects in the world for achieving economic growth especially in the developing countries. Sustainability is poorly addressed in Project Management Body of Knowledge (PMBOK) and rational approach is needed for the degree of fitness in accordance with society and environment at large (Armenia et al., 2019). Consequently, the focus on sustainability has given tough competition to the project managers for delivering project success particularly in the emerging economies (Zhang et al., 2014; Lu et al., 2015;

Banihashemi et al., 2017; Luo et al., 2016).

Achieving sustainability is considered as one of the most important challenge these days. Some researchers have proposed that the criteria of evaluating project success should include sustainability dimension i.e. focuses on social and environmental aspects (Carvalho and Rabechini, 2015). Othman and Ahmed (2013) have explained the challenge groups which a sustainable and successful project has to face during its life cycle. For achieving project success organization face challenges which can be associated with technical, political, managerial, related to human development and Triple Bottom Line (TBL). The implementation of sustainability measures increase the challenges of the project managers however it may provide an opportunity to get more success (Silvius et al., 2019). There is a need to study role of implementing sustainability measures by the organizations and its impact on achieving project success.

Construction related projects plays a vital role in the development and growth of any country and its significance in the developing world is many folds. Pakistan is a developing country and after the agriculture sector construction is the most important industry nowadays. Despite of all efforts a large number of construction projects are still failing in Pakistan. This is causing a great loss in the economy and damage the pace of economic growth. Therefore the focus of this research is on construction projects. Examination of the implementation of sustainability measures and its influence on the construction project success is vital. It is believed that the attributes of a project e.g. project complexity play an important role in determining future success or failure of the project. The hypotheses are formulated in the light of literatures review. Empirical study is conducted to test the role of sustainability having a positive influence on project success. In the second hypothesis role of project complexity is studied as moderator variable. Project complexity is believed to have negative influence on the strength of the relationship between sustainability and project success.

Dao et al., (2016) convey through their research that major hurdles for the attainment of project success are the project difficulties and risks. He explained project difficulty as a project team's expertise to handle the project and if project is not handled by the project team with their full expertise, sustainability of the project may be affected. This in the long run, affects the success of the project. Consequently,

keeping the projects sustainable within the limited constraints is the actual challenge for project managers. Maylor and Turner (2016) have provided a three-step process to manage the complexity problems i.e. understand, reduce and respond. Through this approach project managers can understand the level of impact of a complexity on a project and hence it can be reduced by responding to that complexity with appropriate planning and execution (Maylor and Turner, 2016; Luo et al., 2016).

This research emphasize on defining the relation for sustainability and project success along with several challenges and complexities these projects face for their success. It provides comprehensive literature on sustainability, project success and relationship between sustainability and project success. This research empirically identifies the effect of implementing sustainability measures on success of the projects. Furthermore it also aims to determine moderating effect of project complexity on the relationship of sustainability and project success.

LITERATURE REVIEW

The implementation of tools, techniques, expertise and knowledge to activities for achieving goals and milestones of the project is known as project management. Achieving project constraints (schedule, cost/budget, & performance) is the main goal of Project Management (PM) via dependent activities that start and end at specified time to produce a quality result. Project success is somehow balanced in a life cycle where it is initiated, planned, carried out, and controlled. If the process is done with successful planning by keeping in view all the risk and consequences then the failure chances can be minimized to a significant level.

Sustainability and Project Success

The most important issue nowadays is to achieve sustainability within projects. Sustainability has always been linked to project management. Sanchez, (2015) explained that to recognize the issues of sustainability into project management various details and their relations in projects are required.

Sustainability and project success have been accepted by past researchers as to have a close relationship with each other. A research conducted by (Silvius et al., 2013) contributed in attaining attention of experts to discuss sustainability in view of project management. The economic aspects of sustainability may include the market presence of the project outcome and its direct / indirect economic impact. While, the social aspect of sustainability in project may include labour practices, human rights, product responsibility, community standards and public policy. Environment sustainability may relate to the materials being used in project, biodiversity, energy emissions and wastes and products, services or

transportation being used in project. From beginning till end, a project is kept in balance only by following the economic, social and environmental sustainability regulations (Silvius et al., 2011).

Achieving project success is the final destination for a project manager. PMBoK guide also mentioned sustainability thrice but did not discuss it in detail. Project manager has to keep in mind that sustainability of the project can have a significant impact on its success (Okland, 2015). There is still no clarity in realizing project success but Ika et al., (2012) has explained that project success is dependent upon relevance, efficiency, effectiveness, impact. Martens and Carvalho, (2016) have also suggested

'sustainability' as a latest factor contributing in environmental and social aspects.

Sustainable deliverance in projects comes under five different groups in developing countries which includes human, technical, managerial and triple bottom line. The managerial problems were classified as the most significant out of all these (Othman and Ahmed, 2013). It has been considered that unsustainable management practices were on top among these problems (Martens and Carvalho, 2016a, 2016b). According to (Ika et al., 2012) most important factors that we have to take into consideration are known as Critical Success Factors (CFS's). Success of project depends on achieving its objectives whereas the project management success has to be in accordance with the application of project management practices by a project manager (Martens and De Carvalho, 2014). According to Nieminen and Lehtonen, (2008) accomplishment of project goals needs application of efficient project management practices. Efficiency is the measure of how much the project has deviated from the planned schedule while effectiveness is measured by the terms “project performance” and “customer satisfaction” (Zwikael, 2014). In order to implement sustainability in project management practices the understanding of project details and their relations is a mandatory requirement (Sánchez, 2015). Similarly Brones et al, (2014) suggested that sustainability and project management are related to each other. Hence we can hypothesize that:

H1: Sustainability positively influences project success.

Project Complexity and Project Success

Moving on to the concept of complexity it is considered that the definition of complexity is not recognized easily. Complexity is an inseparable factor from the projects which is known as the main cause for the project failure. Project complexity is commonly separated in two parts that includes project difficulty and project uncertainties. Project complexity arises from issues that affect the project

additionally. In view of Cicmil et al., (2009), complexity is identified as an aspect which helps to plan and control processes of a project. This also affect the triple constraint triangle of time, cost and quality. Provided that complexity of the project is difficult to measure precisely, different researchers carried out numerous results for the identification of its issues and classification (Bosch-Rekvelde et al., 2011). Brockmann and Girmscheid, (2008) made the classification of complexity into five different categories which includes cognition, culture, operation, task and society. Before executing any project, the two key questions must be taken into account:

Q1. What features involve complexity of a project and which issues have created them?

Q2. With respect to the different schools of thought, what are the different factors that contribute to project complexity?

Complexity acts as prime issue for the project managers because it results as a contribution in project failure. Bakhshi et al., (2005) have formed a framework for the awareness of the factors that affect the complexity of the projects. In addition to this Wood et al., (2008) have also conducted a pilot research to find the factors which are associated to the complexity of a project. On the basis of questionnaires and interviews they formed a ranked list of 6 complexity factors in which Organizational complexity scored highest rank. Thus, it is necessary to recognize the importance of complexity in a project at initial steps so that the complexity can be managed right from the start. Based on the previous literature, He et al., (2014) have proposed the classification of project complexity into 6 categories namely: organizational, technological, goal, environmental, cultural and information.

Shenhar and Dvir carried out research implementing the same technique in the early 90s. Their primary research indicated that project attributes depend on two types which include technical risks and structural capacity (Shenhar and Dvir 1996; Shenhar 2001). Both the researchers worked on the need to construct many different dimensions till they produced a new trivial model which is named as Diamond consisting of four aspects which are: originality, difficulty, expertise and phase (Shenhar & Dvir, 2007). Already complexity of the product and user-end difficulty level gained significant amount of familiarity by the innovators in the field of development (Clark & Fujimoto 1991). Likewise Cooke-Davies (2002), Cleland and Ireland (2006), in addition to other researcher's put emphasis on the same aspect; efficiency and performance of any project is affected by the difficulty of the project. Hence we can put forward that:

H2: The relationship between sustainability and project success is moderated by project complexity.

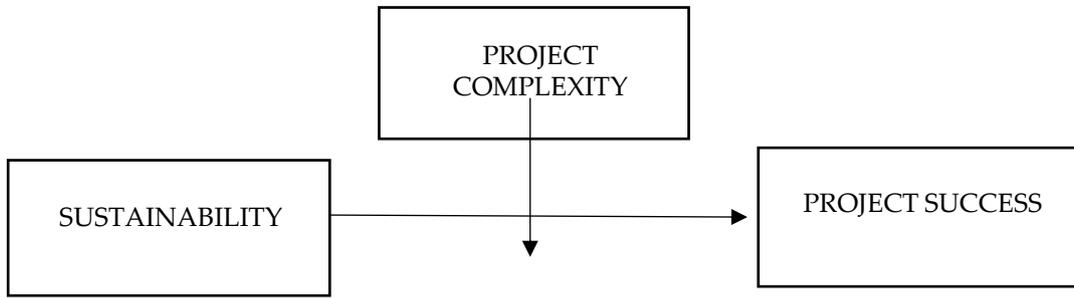


Fig 1: Research Model for Impact of Project Sustainability on project success with Project complexity as a moderator

H1

RESEARCH METHODOLOGY

Data regarding this research is collected using a self-administrated questionnaire. The research instrument is adopted from the study of Silvius and Schipper (2015). Questionnaire used to collect data for this research consists of two sections. Section one of the questionnaires consists of questions regarding demographic information of respondents including gender, age, experience and designation. Section two of the questionnaires consists of questions related to sustainability, project success and task complexity. Eight questions are related to sustainability and five questions each of project success and task complexity. All variables in this study are measured by using 5-point Likert scale which is the most reliable scale of measurement that ranges from “strongly disagree to strongly agree”. The variables of the study and their type along with the number of indicators used for each variable is mention in table 1 below.

Table 1- Variables and indicators

Variables	Type	No of Indicators
Sustainability	Independent	8
Project Success	Dependent	5
Project Complexity	Moderating	5

The population of the study is construction organizations of Rawalpindi and Islamabad. Initially four construction organizations were visited by the researchers. This was to get a better understanding of the working environment and check the suitability of the research instrument. Data is gathered from

professionals who have project management experience related to the construction projects. Convenience sampling technique is used for data collection as it is considered as the most cost-effective technique for collection of data (Etikan et al., 2015). Accordingly, convenience sampling includes people who are available and who are willing to participate (Kitchenham & Pflieger, 2002). Large number of responses were obtained in the presence of the principle researcher to give better understanding about the research instrument and get reliable response. The whole data collection process was completed within 5 months. Target respondents for data collection from these companies includes project directors, project managers, and program managers. In this study, cross-sectional method is applied for the collection of data as the data is collected at a single point in time. This approach is suitable to determine the causal relationship for studying existing scenario or as is analysis.

A total of 380 questionnaires were distributed for the data collection from which 189 were returned and used for the analysis process. The high response rate of 50.2 percent is achieved due to close contact with the respondents in the construction company. The appointments were also taken in advance from the respondents to ensure the reliability and higher response rate. The demographics of respondents show that out of 189 respondents the number of male and female respondents are 174 and 15 respectively. Data is gathered from professionals that include project managers, program managers and directors so that the informational statistics provided is considered to be more and more precise. The detailed demographic information both in numbers and percentage are shown in the table 2.

Table 2- Demographics

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	174	92.06	92.06	92.06
Female	15	7.94	7.94	100.0
Total	189	100.0	100.0	

Data Analyzing Techniques

The study is done with a positivist stance and quantitative data is analysed to determine causal relationship. Normality of the data is checked and correlation and regression analysis are performed. Mean, median, mode and standard deviation are calculated as a part of descriptive analysis. In this study, correlation, linear regression analysis and Hayes process for moderation techniques are used for analysing the association among the independent, moderating and dependent variables.

Data Analysis and Results

Values of mean and standard deviation are depicted by descriptive statistics. Five-point Likert scale is used to assess all variables involved in the study. Table 3 shows mean values of sustainability, project success and project complexity as 4.03, 4.09 and 3.39 respectively. “Project Success” has highest mean value which is (M = 4.09), while “project complexity” has lowest mean value which is (M = 3.39). Standard Deviation for Sustainability is 0.53, Project Success is 0.59 and Task Complexity is 0.91.

Table 3- Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic
Sustainability	189	4.0397	.53926	-1.097	2.478
Project Success	189	4.0910	.59338	-1.344	2.213
Task Complexity	189	3.3979	.91302	-.311	-1.050
Valid N (listwise)	189				

The Table 4 below presents the correlation values among sustainability, project complexity and project success. A highly significant positive correlation is found between sustainability and project success i.e. 0.575. Whereas correlation between project success and project complexity is found significant negative i.e. -0.144. The primary finding from the correlation results suggest that with increase of sustainability measures adopted by the construction firms chances of getting success also increase. On the other hand with increase of project complexity the chances of achieving success decreases.

Table 4- Correlation

Variables	Sustainability	Project Complexity	Project Success
Sustainability	1		
Project Complexity	-0.227**	1	
Project Success	0.575**	-0.144**	1

The coefficient of determination symbolized as r^2 generally pronounced by R square classifies how exactly the data best fits the specific statistical model. The R square value shown in Table 5 is 0.351. The findings of the analysis show 35.1% change in project success is determined by implementing the sustainability measures which is independent variable.

Table 5- Model Summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.593b	.351	.333	.48479	.334	93.801	1	182	.000

The results are obtained for F statistics with the help of regression analysis, which shows the significance of the variables. Table 6 shows that significance value of the model is 0.00 which proves that

independent variables are also significant. The p value below 0.05 is considered as significant. The value of the F-Statistics of the research model is 19.71. This denotes that the model is statistically significant.

Table 6- ANOVA Statistics

Model		Sum of Squares	Df	Mean Square	F	Sig.
2	Regression	23.161	5	4.632	19.710	0.00
	Residual	42.773	182	.235		
	Total	65.934	187			

a. Predictors: (Constant), Sustainability

b. Dependent Variable: Project Success

The value of beta in Table 7 shows that how much change in dependent variable is produced by independent variable provided that the value of coefficient remains significant i.e. $p < 0.05$. The beta coefficient value is 0.575 at the p-value 0.000. By looking at the above table of coefficients, we can clearly see that the Beta value for sustainability is 0.575. This value explains that the change of one unit in sustainability will produce 57% or 0.575 units of change in project success. The coefficient value for sustainability is $p < 0.01$ which is significant. As the value of beta coefficient is positive and significance value is within the acceptable range it proves that sustainability has a positive effect on project success. The results obtained from analysis are backing up the proposed hypothesis H1 which states that sustainability positively influences project success. Therefore, H1 is supported and accepted in this study.

Table 7- Coefficients of Regression

Model	Unstandardized Coefficients		Standardized	t	Sig.
	B	Std. Error	Beta		
Sustainability	.632	.066	.575	9.601	.000

a. Dependent Variable: Project Success

The value of R square changes when the moderation is added to the model. The value of R square by adding the moderator is 0.3668 with F-Value 35.72 at the significance level 0.000. The value shows that how much change in dependent variable will be produced by independent variable provided that the value of coefficient remains significant i.e. $p < 0.05$. The Beta coefficient value for task complexity is 0.1126 at the p-value 0.0098. This shows that task complexity will bring 11 percent change in dependent variable i.e. project success. Keeping independent variable sustainability as constant. The beta

coefficient value for sustainability is 0.6758 at the p-value 0.000 which shows that task complexity will bring 67.5 percent change in dependent variable i.e. project success. Keeping moderating variable task complexity as constant. The beta coefficient value for interaction is - 0.2033 at the p-value 0.0042 which shows that task complexity will bring negative 20 percent change in dependent variable i.e. project success. After adding the interaction R-square changes by 0.287 at the value of $p = 0.0042$.

For moderation test in Table 8, bootstrapping process by Preacher and Hayes (2008) is used (5000 iterations, bias corrected, 95% confidence intervals) In the above table, it can be observed that the interaction term (sustainability x task complexity) has a significant negative beta value towards project success ($B = -.2033$, $p < 0.001$, LLCI: $-.3418$, ULCI: $-.6048$). This infers that H2 is supported which states that task complexity is negatively moderating the relationship between sustainability and project success. This implies that as the project complexity increases, the impact of sustainability on project success becomes weaker. Furthermore, the interaction is checked at three different levels of project complexity.

Table 8- Moderation Analysis

R	R Square	MSE	F-test	P-value		
0.6507	0.3668	0.2266	35.7267	0.0000		
After Interaction (R Square changed due to Interactions)						
	0.287		8.3869	0.0042		
Moderation Analysis						
	Coefficients	SE	T	P	LLCI	ULCI
Constant	4.0684	0.0355	114.6334	0.0000	3.9948	4.1384
Tasks Complexity	0.1125	0.0431	2.6101	0.0098	0.0274	0.1977
Sustainability	0.6758	0.0665	10.1646	0.0000	0.5446	0.8069
Interaction 1	-0.2033	0.0702	-2.8960	0.0042	-0.3418	-0.0648

DISCUSSION

This research is carried out to examine the influence of sustainability and project complexity on project success in the construction industry of Rawalpindi and Islamabad. Two hypotheses were established which were tested by a questionnaire including variables that were further categorized into different measurable items. Research design presented in the study is also verified by data collection from working

professionals and project managers. There exists a positive relationship between sustainability and project success. We retained the statement with the p-value being significant between the independent and dependent variable and the beta value is also within the acceptable and standard range. The practice done in this research is related strongly to project success with a strong correlation. Results can also be related to study of the (Silvius and Schipper, 2015) which concludes that sustainability and project success has a positive direct relationship. Project success and sustainability are acknowledged by past researchers explaining the positive impact of sustainability on project success. The experts have also discussed sustainability in view of project management (Silvius et al., 2013). Project complexity is considered inseparable element from any project which is the basic reason behind failure of projects. Different researchers have carried out various studies to explore causes and impact of project complexity

in the past (Bosch-Rekvelde et al., 2011). It is very important to keep in mind the influence of project complexity on sustainability and project success. It is suggested to align project management practices with sustainability measures to achieve time, cost, and quality goals (Brones et al, 2014,).

CONCLUSION

Concluding from the results obtained by the research, it is recommended that construction organizations should implement sustainability measures in their projects to achieve the better results for project success. Project professionals should improve the efficiency of sustainable practices in their projects to reduce the impact of complexity involved. Project sustainability has the ability to enhance the value of the project in terms of improvement in stakeholder's satisfaction, quality improvement and reducing delays or any budget shortfalls. A strategic and sustainable way of project planning is required to achieve successful implementation of a project. It should also be noted that sustainability being dependent on environmental factors can create greater impact on a projects success if the approach for creating environment friendly projects is applied. Subsequently, it is recommended to design the projects more carefully with environment friendly materials. Thus, by use of more sustainable planning of the project, project managers can organize a project in more sustainable manner to successfully complete it. It is evident from research that project sustainability not only be contingent to environmental sustainability but also social and economic sustainability. It should be kept in mind to consider these aspects while planning a project. It is also recommended that, researchers should also focus on different type of complexities involved in the projects to observe the impact of sustainability on project success.

Limitations

The first limitation of the study is that it is only conducted in the twin cities i.e. Rawalpindi and Islamabad and other cities of Pakistan were not included which in this case is a limitation for this research. A cautious approach is recommended in generalizing the findings of the research particularly in the other countries. Furthermore, the data is collected from the top management that includes project directors and project managers and the opinion of the lower management is not taken into considerations. This might can have some change in the results of this research.

Future research

Scope of the study can be improved in the future by extending the sample size of the study and also by conducting the study in all other major cities of Pakistan. As the lower management staff is not included in the research survey, the study can be enhanced by taking their views and perspectives into account. To study the effect of moderator in more detail and to get more authentic results similar study on other type of projects should be conducted and variations should be analysed.

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