

Research Journal of
**Business
Management**

ISSN 1819-1932



Academic
Journals Inc.

www.academicjournals.com



Research Article

Moderating Influence of Managerial Skills on the Relationship Between Construction Cost Overrun Risks and Completion of Public Private Partnership Projects

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Abstract

Background and Objective: Although most contracts carry mechanism for dealing with disputes, unresolved disputes can impact negatively, thereby hampering completion of public private partnership projects. This study assessed the moderating aspect of managerial skill on the relationship between construction cost overrun related risks and the completion of public private partnership projects.

Materials and Methods: The study employed pragmatic paradigm and correlation with management staff of Sondu-Miriu Hydroelectric Power project made up of 85 personnel being the target population. A sample of 71 participants arrived at using Yamane (1967) were selected for the study proportionately as employer, financier, contractor and the project engineer. Interview schedules and questionnaires were used for data collection. Cronbach alpha was used as a measure of reliability computed from the construction cost overrun related risks scale, managerial skills scale and completion of PPPs scale and an overall instrument reliability of $\alpha = 0.723$ was obtained. Data analysis involved descriptive statistics using measures of central tendency, variability, relationship and association in frequencies and percentages.

Results: Hierarchical multiple regression was used to assess the moderation of managerial skills on the association of variables. Managerial skills moderates' association of construction cost overrun related risks and completion of construction projects.

Conclusion: The study therefore recommends that future PPPs in the construction industry should focus on developing criteria for selection of managers with practices that maximize on productivity.

Key words: Construction cost overrun risks, completion of PPPs, managerial skills, Sondu-Miriu hydroelectric power project, communication breakdown

Citation: Pamela Akinyi Oyieyo, Charles M. Rambo and Anne Ndiritu, 2020. Moderating influence of managerial skills on the relationship between construction cost overrun risks and completion of public private partnership projects. *Res. J. Business Manage.*, 14: 24-30.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Political and economic crises in the public sector in post structural adjustment programmes period, have led to the realization that neither the state nor the private sector alone can initiate and catalyze development and growth in the economy¹. The onset of PPP in management of public service and projects was concisely presented in 1990s as the cornerstone for promoting sustainable development for low income countries². According to reports on private public relationships in the USA, 1988-1993 show a massive transfer of public projects into private ownership of up to 2700 enterprises in over 60 developing countries which yielded US \$ 96 billion in revenue². To this end, governments have adopted reform strategies involving a combination of elements to include productivity, service, market orientation, policy and decentralization as the key elements so as to yield accountability³. These arrangements have emerged from the understanding that significant and almost ultimately responsibility to deliver the projects lies with the governments and the designated public institutions, the public sector faces myriad of challenges including finance, technical and institutional endowment required in delivering such projects thus the unending for collaboration with the private sector to realize success in these projects⁴.

A well thought out and adequately structured, Public-private-partnership arrangement should efficiently and effectively achieve superior results than the traditional public sector infrastructure financing approaches. This is because the public-private-partnership approach incorporates wide range of managerial, commercial and technical capabilities offered by private sector while enjoying goodwill, reduced risks and affordable capital derived from socio-political backing from the public sector. Cost overrun also called escalation refers to the resulting additional monetary expenditure over the preplanned cost⁵. Thus, cost overrun is the ratio between the difference in implementation cost and budget cost and the initial cost and expressed as percentage⁶. Koushki *et al.*⁷ examined cost and delays witnessed in Kuwait's residential development projects in private sector and observed that there were increased delays and costs in higher value projects attributable to design time and inadequate finances.

Frimpongs *et al.*⁸ using a case of Ghanaian water projects focused on 26 factors attributable to cost increases and revealed that difficulty in making monthly payments and management challenges were the main factors of cost variation. The factors causing cost overruns were ranked as management inadequacy of contractors, challenges in

payment, material acquisition, technical inefficiency and rising material costs during implementation. Construction projects are characterised by disputes, which can arise from decisions or actions of the employer or engineer which may be contrary to the contractor's view⁹. Although most contracts carry mechanism for dealing with disputes, unresolved disputes can have negative impact on the projects, thereby hampering its completion. Construction managers need relevant and timely information for the purposes of planning and implementation, controlling and decision making. Information reduces uncertainty in the project management, aids monitoring, and control, it supplements memory and aids simplification of processes¹⁰. Studies by Lyons and Skitmore¹¹ show that communication breakdown, inexperienced managers assigned projects, poor planning and motivation are the major reasons for delays and increased costs in Kenyan projects.

While there may be many factors which impact successful completion of PPP hydroelectric power projects, construction cost overrun related risk may also significantly contribute to completion of these projects. For instance, In Queensland, Australia, a study by Lyons and Skitmore¹¹ looked into Project management and established that in cases where there are more infrastructure projects commissioned simultaneously, the private sector takes responsibility for more risks hence reduced cost of delivery. In the case of the Sondu-Miriu Hydropower project, there were many tasks and phases where bundling could hamper completion and quality of various tasks¹¹. Interactions and interrelations between the organization and its environment make it prone to several external risks. Kartam and Kartam¹² also explains that risk occurring in the construction sector involving PPPs also experience risks which must be transferred and shared between stakeholders to adequately manage the complex scenarios in planning, budget and contract execution.

Risks can cause losses that lead to increase in costs, time delays and lack of quality of projects. Tipili and Ilyasu¹³ noted that one of the challenges facing the construction industry in Nigeria is how to assess the risk of cost overruns and deliver projects within budget. In their study, Tipili and Ilyasu¹³ sought to identify and assess the likelihood of occurrence and degree of impact of the risk factors on construction projects within the Nigerian construction industry. The main objective of the study was to establish a relative significance index score for the most important risk factors affecting the performance of the projects. Based on the composite of risk factors, the cost related risk and time related risk were found to be the most likely to occur and have the most impact on project, whereas environmental risk factor was found to be low weighted risk,

as it had the least likelihood to occur and the least impact score. Tipili and Ilyasu¹³ focused on the likelihood of occurrences of various risks and not the influence of the particular risks on completion of PPP projects.

Risk management has many applications, ranging from the evaluation of alternative activities for budgets and business plans, to the management of cost overruns and delays in projects and programs. Risk management also provides benefits in better accountability and justification of decisions, by providing a consistent and robust process that supports decision-making. Euripides conducted a study whose focus was on troubled projects in construction due to inadequate and insufficient risk management⁸. The main objective of the study was to attempt a composition of already known processes, at such way that it can be applied by the modern enterprises that deal with the undertaking or/and implementation of constructional work. The study sought to reveal the main sources for the failure of a construction project due to the lack of risk management in projects. According to Frimpongs *et al.*⁸, the benefits of risk management are not confined to large or risky projects but are applicable for all scales of project and procurement activity.

Gido and Clement¹⁴ also found that implementation of projects required multidisciplinary approach with experts from different professions like engineers and accountants. Kumaraswamy and Zhang¹⁵ stated that projects fail due to poor arrangements, insufficient legal arrangements and lack of coordination between private and public sectors. Abednego and Ogunlana¹⁶ argue that because parties involved in PPP projects have different perceptions of risks. Good project governance systems are essential for proper risk allocation and ultimately for the projects' success. Inadequate specification of requirements and improper allocation of responsibilities among the contracting parties are the main problems faced by the public sector.

MATERIALS AND METHODS

Study area: The study was conducted at Sondu-Miriu Hydroelectric power Project situated in Nyakach Sub County, Kisumu County-Kenya for a period of 9 months from March, 2017 to December, 2017 during which respondents were met and interviewed. Sondu-Miriu hydroelectric power project was chosen as the case study because it was a composite project, not only aimed at provision of electricity but irrigation for provision of sustainable employment and was implemented as a public private partnership between JICA international and the Kenyan Government.

Research Hypothesis: The null hypothesis was that H_0 : Managerial skills does not significantly moderate the relationship between construction cost overrun related risks and completion of public private partnership project in Kenya.

The study employs pragmatic paradigm to investigate the research problem basing on the case study of Sondu-Miriu Hydroelectric power project¹⁷. Consequently, mixed methods approach was utilized in data collection and analysis which entails the application of both qualitative and quantitative methods simultaneously and progressively in the study^{18,19}. Correlation design was used to establish the relationship between the study variables. The target population for the study was the management staff of Sondu-Miriu Power project made up of 85 personnel. To determine the study sample size, Yamane²⁰ formula was used thus giving a sample of 71. The respondents were selected using proportionate random sampling to include the employer, financier, contractor and the project engineer. This was to ensure representation across all participants.

Since the study adopted mixed methods approach, qualitative and quantitative data was collected thus interview schedules and questionnaires were used respectively. The questionnaires used were semi structured to cover the study objectives in Likert format. In order to ascertain the reliability of the questionnaires, pilot test was done at Oluch-Kimira Irrigation project in Homa Bay County which was an ongoing PPP project. To ensure content validity, experts in the field of project planning and management were involved in determining accuracy and logical aspect of the research variables. Cronbach alpha was used as a measure of reliability computed from the construction cost overrun risk scale, managerial skills scale and completion of PPPs scale. Consequently, an overall instrument reliability of $\alpha = 0.723$ was obtained with completion of PPP projects scale having $\alpha = 0.830$, construction cost overrun $\alpha = 0.630$ and managerial skills scale having alpha coefficient $\alpha = 0.710$. For data collection, the researcher distributed the questionnaires to the selected respondents in person. However, for the respondents who had moved to far geographical areas, questions were sent through Email. The researcher made follow up calls to ensure the questionnaires were filled and returned.

Managerial skills, as a moderating variable was measured using 5 items on a 5-point Likert scale. These items comprised of managerial skills and practices as exhibited by project participants carrying out managerial roles during the execution of the Sondu-Miriu Hydroelectric power project. Based on the designed responses, the items were rated on a scale of 1-5 as 1 = not at all (NA), 2 = rarely (R), 3 = sometimes

(S), 4 = often (O) and 5 = very often (VO). The respondents were expected to indicate their opinion on the scale with regards to how each of the statements was applicable to them.

Statistical analysis: Data analysis involved both qualitative and quantitative approaches where descriptive statistics was used to describe the data using measures of central tendency, variability, relationship and association in frequencies and percentages using Statistical Package for Social Sciences (SPSS. v. 20) as software for data analysis. Hierarchical multiple regression was used to establish the moderating effect of managerial skills on the relationship between the independent variable and dependent variable modeled according to the equation:

$$Y = B_0 + B_1X + B_2M + B_3XM + \epsilon$$

where, Y is the completion of PPP project, B_1 is coefficient of construction cost overrun, B_2 is coefficient of the moderating variable (managerial skills), B_3 is coefficient of the interaction term, X is construction cost overrun related risks, M the moderating variable (managerial skills) and XM is the interaction term.

RESULTS

Managerial skills as a moderating variable on the relationship between construction cost overrun related risks and completion of ppp projects: Data collected was analyzed to show frequency and percentage of each response as well as the overall item mean and standard deviation as presented in Table 1.

It was evident from the findings of the study that participants generally follow up with team members whenever they feel that their behavior has a negative impact

on clients (Mean = 4.21 ± 0.73). This was higher than the composite mean (Mean = 3.627 ± 1.146) showing that this was a prevalent leadership practice during the construction of Sondu-Miriu Hydroelectric power project. Specifically, 17 (43.6%) of the respondents indicated that they often follow up, 15 (38.5%) indicated that they very often follow up while the remaining 7 (17.9%) indicated that they just sometimes follow up with team members whenever they feel that their behavior has a negative impact on clients.

Another dominant characteristic of the project participants was that when putting together a team, they consider the skills they need and then seek people who best fit their criteria (Mean = 4.00 ± 0.61). This shows that the respondents generally agree with this attribute as the item mean is significantly higher than the composite mean (Mean = 3.627 ± 1.146). Specifically, 32 (82%) of the respondents cumulatively indicated that when putting together a team, they often consider the skills they need and then seek people who best fit my criteria. In this case, 25 (64.1%) indicated that they do this often while 7 (17.9%) indicated that they do it very often. Further, only 7 (17.9%) indicated that they only did this sometimes thus a proof that this is probably true or not true.

In terms of motivating team members, the study found that this was to a low extent (Mean = 3.69 ± 0.73) as majority of the respondents 18 (46.2%) indicated that they try to motivate their team members by tailoring their approach to match individual needs only sometimes. However, a significant proportion of the respondents 15 (38.5%) indicated that they often while another 6 (15.4%) that they try to motivate their team members by tailoring their approach to match individual needs very often. Thus, cumulatively, 21 (53.9%) of the study participants believe that they often try to motivate their team members by tailoring their approach to match individual needs.

Table 1: Managerial skills as a moderating variable on the relationship between construction cost overrun related risks and completion of ppp projects

Statement	NA	R	S	O	VO	Mean ± SD
I follow up with team members whenever I feel their behavior has a negative impact on clients.	0 0.0%	0 0.0%	07 17.9%	17 43.6%	15 38.5%	4.21 ± 0.73
When putting together a team, i consider the skills i need and then i seek people who best fit my criteria.	0 0.0%	0 0.0%	07 17.9%	25 64.1%	07 17.9%	4.00 ± 0.61
I try to motivate my team members by tailoring my approach to match individual needs.	0 0.0%	0 0.0%	18 46.2%	15 38.5%	06 15.4%	3.69 ± 0.73
I talk to team members about their individual goals as well as organization and link these to the goals of the entire organization.	3 7.7%	2 5.1%	07 17.9%	15 38.5%	12 30.8%	3.79 ± 1.17
I talk to individual team members to ensure they're happy and productive.	0 0.0%	0 0.0%	04 10.3%	24 61.5%	11 28.2%	4.18 ± 0.60
Composite mean ± Standard deviation						3.627 ± 1.146

Based on the designed responses, NA: Not at all, R: Rarely, S: Sometimes, O: Often, VO: Very often

Similarly, the study found that the participants talk to their team members about their individual goals as well as organization goals to an averagely high extent (Mean = 3.79 ± 1.17). With the item mean being higher than the composite mean (Mean = 3.627 ± 1.146), this shows that this was a regular practice during the construction of Sondu-Miriu project. This emerged as majority of the respondents 15 (38.5%) indicated that they often talk to their team members about their individual goals as well as organization goals while another 12 (30.8%) indicated that they did this very often. Further, 7 (17.9%) of the respondents indicated that they sometimes talk to their team members about their individual goals as well as organization goals with only 3 (7.7%) saying they do not talk to their team members about their individual goals as well as organization goals while another 2 (5.1%) opined that they rarely do that.

Similarly, the study found that the study participants always talk to individual team members to ensure they're happy and productive (Mean = 4.18 ± 0.60). This view was presented by majority of the respondents 24 (61.5%) who indicated that they often do this while another 11 (28.2%) indicated that they talk to individual team members very often as another 4 (10.3%) indicated that they only sometimes talk to individual team members to ensure they're happy and productive. Overall, the item mean was higher than the composite mean (Mean = 3.627 ± 1.146).

Moderating influence of managerial skills on the relationship between construction cost overrun related risks and completion of ppp projects:

In order to establish whether managerial skills moderated the influence of construction cost overrun related risks on completion of PPP Hydroelectric power projects, a hierarchical linear regression analysis was conducted. This was done in two steps. In the first step, completion of PPP project was coded as the dependent variable while construction cost overrun related risks and managerial skills were the predictors. In the second step, completion of PPP project was retained as the dependent variable while construction cost overrun related risks, managerial skills and an additional variable formed as an interaction term between managerial skills and construction cost overrun related risks were used as the predictors. In determining the interaction term between construction cost overrun related risks and managerial skills, the values of each of the variables were mean centered and products computed to control for instances of multi-collinearity. The regression output for the moderation effect of managerial skills on the influence of construction cost overrun related risks on completion of construction PPP projects is presented in Table 2.

The regression output shows two models for each output with model 1 showing output without the interaction terms while model 2 shows the output with the interaction terms thus indicating whether there is moderation or not. From the

Table 2: Regression output for the moderating influence of managerial skills on the relationship between construction cost overrun related risks and completion of ppp projects

Mode	R	R ²	Adjusted R ²	Std. Error of estimate	Change statistics				
					R ² change	F change	df1	df2	Significant F change
Model summary									
1	0.817 ^a	0.668	0.650	1.476	0.668	36.25	02	36	0.000
2	0.821 ^b	0.675	0.647	1.482	0.007	0.714	01	35	0.004
Model	Sum of squares			df	Mean square		F		Significant
ANOVA^a									
Regression	157.9			02	78.96		36.25		0.000 ^b
Residual	78.43			36	2.179				
Total	236.4			38					
Regression	159.5			03	53.17		24.21		0.000 ^c
Residual	76.86			35	2.196				
Total	236.4			38					
Model	Unstandardized coefficients		Standardized coefficient			Collinearity statistics			
	Beta	Std. Error	Beta	t-test	Significant	Tolerance	VIF		
Coefficients^a									
Constant	15.25	4.793		3.182	0.003				
Construction cost overrun	-0.679	0.098	-0.667	-6.943	0.000	0.999	1.00		
Managerial skills	0.443	0.094	0.451	4.695	0.000	0.999	1.00		
Constant	14.22	4.964		2.865	0.007				
Construction cost overrun	-0.678	0.098	-0.666	-6.907	0.000	0.999	1.00		
Managerial skills	0.466	0.099	0.475	4.726	0.000	0.920	1.09		
Interaction term cost overrun and managerial skills	0.025	0.030	0.085	0.845	0.004	0.921	1.09		

a: Dependent variable: Completion of construction project, b: Predictors: (Constant), managerial skills, construction cost overrun, c: Predictors: (Constant), managerial skills, construction cost overrun, interaction term

model summary, model 1 had a statistically significant F change ($p < 0.001$, $p < 0.05$) with $F(2,36) = 36.25$ ($p < 0.001$). Similarly, model 2 with the interaction term was also statistically significant ($p < 0.001$, $p < 0.05$). Further, there was a significant change in $R^2 = 0.007$ (0.7%) [$F(1,35) = 24.21$, $p < 0.001$] due to addition of the interaction term thus indicating that there was a statistically significant moderation effect of managerial skills on the relationship between construction cost overrun and completion of construction projects through PPPs ($p = 0.004$, $p < 0.05$).

From the coefficients table, the interaction term between construction cost overrun related risks and managerial skills was statistically significant ($p = 0.004$). The regression model equation for the moderation effect of managerial skills on the influence of construction cost overrun related risks on completion of PPP project was presented as Eq. 1:

$$Y = B_0 + B_1X + B_2M + B_3XM + \varepsilon \quad (1)$$

Where, Y is the completion of PPP project, B_1 is coefficient of construction cost overrun related risks, B_2 is coefficient of the moderating variable, B_3 is coefficient of the interaction term, X_2 is construction cost overrun related risks, M is the moderating variable and X_2M_x is the interaction term. Rewriting the equation we obtain Eq. 2:

$$Y = 14.22 - 0.678X + 0.466M + 0.025XM \quad (2)$$

DISCUSSION

The study found that managers generally follow up with team members whenever they feel that their behavior has a negative impact on clients (Mean = 4.21 ± 0.73). This shows that it is a prevalent managerial practice to follow up on team members showing behaviors with negative impact on clients during the construction of Sondu-Miriu hydroelectric power project. On the contrary, Lyons and Skitmore¹¹ showed that communication breakdown, inexperienced managers, poor planning and motivation are the major reasons for delays and increased costs in Kenyan projects.

Further, when putting together a team, they consider the skills they need and then seek people who best fit their criteria (Mean = 4.00 ± 0.61). Similarly on motivating team members, the study found that this was to a low extent (Mean = 3.69 ± 0.73). The finding shows that although managers who participated in the construction of Sondu-Miriu Hydroelectric power project tended to motivate their team

members, this was to a low extent. Similarly, Abednego and Ogunlana¹⁶ showed that contractors and owners suffer from lack of innovative methods to prevent and mitigate risks.

The study also established that managers talk to their team members about their individual goals as well as organization goals to an averagely high extent (Mean = 3.79 ± 1.17). This shows that the study participants were conscious of the need to talk to their team members about their individual and organizational goals. Further, managers always talk to individual team members to ensure they're happy and productive (Mean = 4.18 ± 0.60). This ensures that challenges facing individual team members are identified and resolved to help improve productivity. On the contrary, Kumaraswamy and Zhang¹⁵ noted that projects fail due to poor arrangements, insufficient legal arrangements and lack of coordination between private and public sectors.

The study established that there was a statistically significant moderation effect of managerial skills on the relationship between construction cost overrun related risks and completion of construction projects through PPPs ($p = 0.004$, $p < 0.05$). Thus, managerial skills had a moderation effect on the influence of construction cost overrun related risks on completion of PPP projects. Similarly, Frimpongs *et al.*⁸ ranked the factors causing cost overruns as management inadequacy of contractors, challenges in payment, material acquisition, technical inefficiency and rising material costs during implementation.

CONCLUSION

The study concludes that managerial skills moderate the influence of construction cost overrun related risks on completion of PPP projects. The study therefore recommends that future PPPs in the construction industry should focus on developing criteria for selection of managers with practices that maximize on productivity.

SIGNIFICANCE STATEMENT

This study discovered that managerial skills moderate the influence of construction cost overrun related risks on completion of PPPs. Specifically, managerial skills minimize the cost overrun risks when they are positively enhanced. This is an aspect of knowledge that has been overlooked by many researchers thus the findings introduce a new perspective in project management.

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