

# Factors Influencing Adoption of Resource Planning by Contractors in the Construction Industry of Kenya

Shadrack Mutungi Simon

**Abstract:** *The construction industry in Kenya has grown in leaps and bounds over the years. Bon and Crosthwaite (2000) state that the industry makes a significant contribution to the economy of any country since it not only creates employment for many people but also supports other sectors of the economy. It is because of this significance that special consideration should be paid to the execution of construction projects since they are the backbone of the industry. Better execution of projects will lead to improved growth of the industry. In order for projects to be delivered effectively, resources ought to be managed in an optimum manner. According to Simon, Gwaya and Diang'a (2017) the two most critical aspects of resource management could be said to be resource planning and leveling. While it was established by the same authors that resource planning and leveling are highly practiced in the Kenyan construction industry though in an unstructured manner, the authors failed to outline the factors which influence such practices. It is because of such gap that the researcher sought to undertake this study. The purpose of this study was to establish the factors influencing the adoption of resource planning in the Kenyan construction industry. A survey research design was adopted and a response rate of 76% was attained. There seemed to be consensus among the respondents regarding the following factors influencing Resource Planning: Financial status of the contractor (RII=0.8390); adequacy of labour (RII=0.8308); adequacy of plant and equipment (RII=0.8304); presence of qualified personnel (RII=0.8152); prompt honouring of payments certificates (RII=0.7901); level of project documentation (RII=0.7410); compliance with safety procedures (RII=0.7154); type of procurement system (RII=0.6949); weather (RII=0.6127) and contractor's ICT Compliance (RII=0.5897). The most significant factor was financial status while the least important was contractor's ICT Compliance. Multiple regression analysis revealed that higher levels of Resource Planning are associated with higher levels of adequacy of labour and equipment, ICT compliance, high level of project documentation, high financial status, prompt payments, type of procurement, identifying the number of people required, establishing quantities of equipment, quantification of amount of materials. The analysis also revealed that higher levels of Resource Planning are associated with lower levels of Compliance with safety and bad weather.*

**Index Terms:** Resource Planning, Construction

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## I. INTRODUCTION

The construction industry in Kenya has grown in leaps and bounds over the years. Simon (2018) states that the industry makes a significant contribution to the economy of any country since it not only creates employment for many people but also supports other sectors of the economy. It is because of this significance that special consideration should be paid to the execution of construction projects since they are the backbone of the industry. Better execution of projects will lead to improved growth of the industry. In order for projects to be delivered effectively, resources ought to be managed in an optimum manner. According to Simon, Gwaya and Diang'a (2017) the two most critical aspects of resource management could be said to be resource planning and leveling. Planning is arguably the most important role that a project manager plays within a construction project. This involves strategizing on the best means and methods of executing the project. A project has widely been defined as an activity which has a start and an end, consisting of activities which occur sequentially and most important of all, which requires resources (Project Management Institute, 2013). Once all these sequential activities have been delivered on time, within budget and to the desired quality, then the contractor has succeeded in executing the project. While it was established in Simon, Gwaya and Diang'a (2017) that resource planning and leveling are highly practiced in the Kenyan construction industry though in an unstructured manner, the authors failed to outline the factors which influence such practices. It is because of such gap that the researcher sought to undertake this study.

## II. LITERATURE REVIEW

### 2.1. Factors Influencing Contractor's Resource Planning

According to Trigunarsyah (2005), planning is a process of developing options and determining actions to enhance opportunities and minimize threats posed to project objectives. Planning also defines and assigns responsibilities for particular activities to different individuals. Simon (2017) cites that unavailability of resources at the right times causes delays which affects the construction period. Resource planning must be appropriate to the particular project, cost effective in addressing the challenges, timely to enhance success, realistic within the project context, and owned by all parties (Trigunarsyah, 2005).

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Several authors have pointed out a number of factors which influence resource planning by contractors. These include: adequacy of plants and equipment (Mendoza, 1995); adequacy of labour (Nosbisch, Co, Winter, & League, 2005); compliance with safety procedures (Mattila & Abraham, 1998); contractor's ICT Compliance (Mendoza, 1995); contractor's organizational structure (Joshi & Patil, 2015);

contractor's project management capability (Dubey, 2015); financial status of the contractor (Garmsiri & Abassi, 2012); weather (Schweiz, 2014); prompt honoring of payments certificates (Singh, 2013); technical competence (Tawalare & Lalwani, 2012); and type of procurement system (Winter, 2006).

## 2.2. Contractor's Resource Planning Success Indicators

According to Mbugua, et al., (1999), and as cited by Takim and Akintoye (2002), performance or success indicators specify the measurable evidence required to prove that a planned effort has achieved the desired result. These indicators should be established before the activity is undertaken. This enables the planners to easily establish the level of success achieved by the action taken.

Some of the indicators for resource planning include: ability of plan in facilitating project resource optimization (Takim & Akintoye, 2002); adequacy of plan in determining suppliers' delivery dates (Mendoza, 1995); ability of plan to adhere to cost estimate (Saqib, Farooqui, & Lodi, 2008); ability of plan to adhere to project technical requirements (Zanen & Hartmann, 2010); ability of plan to adhere to quality (Takim & Akintoye, 2002); ability of plan to adhere to time (Gates, 2010); ability to adequately accommodate contractors work (Sheldon Shaeffer, 2006); clarity in communication (Salleh et al., 2009); ability to integrate sub-contractors work (Mendoza, 1995); plan's flexibility (Singh, 2013); plan's provision of basis for preparing labour and material schedules (Takim & Akintoye, 2002) and plan's provision for facilitating project monitoring and control (Mendoza, 1995).

## III. METHODOLOGY

The study adopted a survey research design in the attempt to establish the factors influencing the adoption of research planning by contractors in the construction industry of Kenya. Questionnaires were distributed to contractors and a response rate of 76% was attained.

The following formula as cited from Iyer & Jha (2005) was used to calculate the Relative Importance Index (RII);

*Equation 3.5: Relative Importance Index Calculation*

$$RII = \frac{\sum W}{A \times N}$$

Where,

*W* is the weighting given to each statement by the respondents and ranges from 1 to 5;

*A* is Highest response (integer 5); and

*N* is the total number of respondents.

The main aim of carrying out Relative Importance Index (RII) was to calculate the significance of the findings by determining the weights of each of the attributes.

Multiple regression was used to establish the presence of any relationship between the influencing factors and the extent of resource planning. Multiple regression is the

process of deriving a regression model with two or more independent variables usually known as predictors (Ankrah, 2007). It enables a researcher to study the effects and their magnitude of these independent variables on a dependent variable. The coefficients in the model signify the various weights of the independent variables to the overall prediction (Hair, et al, 1998).

According to Field (2000), there are three main methods used to determine which independent variables to be included in the regression model. These are; hierarchical, forced entry, and stepwise methods. Hierarchical regression relies on past research in determining predictors which are then entered into the model depending on their importance. New predictors can only be entered after these known variables are already in the model (Field, 2009). This method could not be relied upon in this research due to lack of strong empirical evidence ranking such predictors. In the second method, all perceived predictors are forced into the model. The stepwise method relies on a mathematical criterion. Predictors are entered into the model based on whether they their significance in an F-test is  $\leq 0.05$  (Field, 2009). This research used both forceful entry and stepwise methods.

## IV. DATA ANALYSIS

### 4.1. Respondents' Response Rates

Out of a total of 106 questionnaires distributed to respondents, 81 were returned. This was equivalent to a response rate of 76%.

### 4.2 Factors Influencing Resource Planning

A number of factors influencing Resource Planning were presented to the respondents to express views on their significance based on a likert scale (5-Very High; 4- High; 3-Moderate; 2-Low; 1-None). The results were presented in the tables below.

**Table 4.1: Factors Influencing Resource Planning (Comparison of Means)**

S/No		Mean	Std. Deviation	N	Rank
1	Adequacy of labour	4.15	0.940	75	2
2	Adequacy of plants and equipment	4.15	0.833	75	2
3	Compliance with safety procedures	3.60	0.959	75	7
4	Contractor's ICT Compliance	2.96	1.108	75	10
5	Presence of qualified personnel	4.07	0.890	75	4
6	Level of project documentation	3.69	1.065	75	6
7	Financial status of the contractor	4.19	0.896	75	1
8	Weather	3.09	1.221	75	9
9	Prompt honoring of payments certificates	3.97	0.972	75	5
10	Type of procurement system	3.52	1.143	75	8

*Source: (Author, 2016)*



As per Table 4.1, and based on means, “Financial status of the contractor” was the most significant with a mean of 4.19 while “Adequacy of labour” and “Adequacy of plant and equipment” were the second most significant with a mean of 4.15. The fourth and fifth factors were “Presence of qualified personnel” and “Prompt honoring of payments certificates” with means of 4.07 and 3.97 respectively. “Level of project documentation” and “Compliance with safety procedures” were the sixth and seventh most important factors with means of 3.69 and 3.60 respectively. The eighth factor was the “Type of procurement system” with a mean of 3.52. The last two factors were “Weather” and “Contractor’s ICT Compliance” with means of 3.09 and 2.96 respectively.

There was a huge difference of 1.23 (as seen in table 4.27) in the means of the highest and lowest ranked factors. This meant that while some factors were considered to be key in influencing Resource Planning, others were not very convincing among the respondents. It is important to note that the first nine factors were all ranked highly by majority of the respondents. However, the last factor seemed to be less influential due to its low mean. Generally, all the factors presented to the respondents can be said to be critical in influencing Resource Planning since they have an overall mean of 3.739 as seen in the table 4.28 below.

**Table 4.2: Factors Influencing Resource Planning (Summary of Means)**

	Mean	Min	Max	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.739	2.960	4.187	1.227	1.414	.199	10

Source: (Author, 2016)

**Table 4.3: Factors Influencing Resource Planning (Relative Importance Index)**

S/No		N	RII	Rank
1	Adequacy of labour	78	0.8308	2
2	Adequacy of plants and equipment	79	0.8304	3
3	Compliance with safety procedures	78	0.7154	7
4	Contractor’s ICT Compliance	78	0.5897	10
5	Presence of qualified personnel	79	0.8152	4
6	Level of project documentation	78	0.7410	6
7	Financial status of the contractor	77	0.8390	1
8	Weather	79	0.6127	9
9	Prompt honoring of payments certificates	81	0.7901	5
10	Type of procurement system	78	0.6949	8

Source: (Author, 2016)

The researcher further carried out an analysis of the same factors using the Relative Importance Index. The results, as per table 4.3 indicated that the most significant factor considered when carrying out Resource Planning was “Financial status of the contractor” with a RII of 0.8390. Other factors in descending order were: “Adequacy of labour” (RII=0.8308); “Adequacy of plant and equipment” (RII=0.8304); “Presence of qualified personnel”

(RII=0.8152); “Prompt honoring of payments certificates” (RII=0.7901); “Level of project documentation” (RII=0.7410); “Compliance with safety procedures” (RII=0.7154); “Type of procurement system” (RII=0.6949); “Weather” (RII=0.6127) and lastly “Contractor’s ICT Compliance” (RII=0.5897)

Both methods of analysis ranked financial status of the contractor and contractor’s ICT Compliance as the most and least important factors influencing Resource Planning respectively. The ranking for all factors was similar in both methods of analysis.

A difference was also noted in the N values between the calculation of mean values and the Relative Importance Index calculations. This is because while the calculations for the RII included all data provided by the respondents, the SPSS software only considered questionnaires which had complete data sets for all the factors provided for consideration by the respondents.

Since the questionnaire gave the option of respondents suggesting other factors which they considered to be influential in Resource Planning, only one more factor was proposed and that was top management support.

**4.3 Regression Analysis between Resource Planning and Influencing Factors**

In order to measure the factors extent to which various factors affected the extent of Resource Planning practice, a regression procedure was carried out with Extent of Resource Planning as the dependent variable and “ICT challenges”, “Adequacy of Labour”, “Project Delays”, “Weather”, “Tedious Exercise”, “Lack of commitment”, “Type of procurement”, “Site storage constraints”, “Equipment breakdown”, “Amount of materials”, “Absenteeism of workers”, “Financial status”, “Project risks”, “Contract disputes”, “Technical Incompetence”, “Materials Shortage”, “Items of equipment required”, “Qualified personnel”, “Poor documentation”, “Prompt payments”, “Number of people required”, “Level of documentation”, “ICT compliance”, “Compliance with safety”, “Quantities of equipment”, and “Adequacy of equipment” as the independent variables. The above independent variables were drawn from three categories of variables; aims of undertaking resource planning, influencing factors of resource planning and challenges associated with Resource Planning.

**Table 4.4: Regression analysis results for RP and Influencing Factors (Model Summary)**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.821 <sup>a</sup>	0.674	0.426	0.815

a. Predictors: (Constant), Adequacy of labour, Adequacy of plants and equipment, Compliance with safety procedures, Contractor’s ICT Compliance, Presence of qualified personnel, Level of project documentation, Financial status of the contractor, Weather, Prompt honoring of payments certificates and Type of procurement system

Source: (Author, 2016)





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The value of  $R^2$  for the model generated is 0.674; this implies that 67.4% of the variation in Resource Planning

Is explained by the independent variables included in the model.

**Table 4.5: Regression Analysis Results for RP and Influencing Factors (ANOVA)**

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	46.839	26	1.801	2.710	0.003 <sup>b</sup>
	Residual	22.604	34	.665		
	Total	69.443	60			

a. Dependent Variable: Extent of Resource Planning

b. Predictors: (Constant), Adequacy of labour, Adequacy of plants and equipment, Compliance with safety procedures, Contractor's ICT Compliance, Presence of qualified personnel, Level of project documentation, Financial status of the contractor, Weather, Prompt honoring of payments certificates, Type of procurement system

Source: (Author, 2016)

The essence of ANOVA is to establish whether the model is significant. The results in this case indicated that  $F=2.710$  and  $p=0.003$ . This means that the proposed model significantly improves the prediction of Resource Planning. A significance figure higher than 0.05 would have rendered the model useless in predicting the dependent variable.

**Table 4.6: Regression Analysis Results for RP and Influencing Factors (Coefficients)**

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.957	1.589		-.602	.551
	Adequacy of Labour	.137	.330	-.089	-.416	.680
	Adequacy of plant & equipment	.591	.372	.374	1.592	.007
	Compliance with safety	-.517	.235	-.436	-2.199	.035
	ICT compliance	.287	.190	.286	1.507	.141
	Qualified personnel	-.318	.218	-.239	-1.462	.153
	Level of documentation	.245	.185	.230	1.326	.194
	Financial status	.158	.206	.126	.767	.049
	Weather	-.028	.124	-.032	-.227	.822
	Prompt payments	.222	.206	-.182	-1.075	.290
	Type of procurement	.098	.178	.097	.551	.586

a. Dependent Variable: Extent of Resource Planning

Source: (Author, 2016)

Table 4.6 above reveals that some of the independent variables are statistically significant while others are not. Those predictors found to be statistically significant were: Adequacy of plant & equipment ( $p=0.007$ ); Compliance with safety ( $p=0.035$ ); and Financial status ( $p=0.049$ ). All the other variables were found to be statistically insignificant. The equation below was obtained from the above multiple regression.

$$RP = -0.957 + 0.137AL + 0.591AE - 0.517CS + 0.287ICT - 0.318QP + 0.245LD + 0.158FS - 0.028W - 0.222PP + 0.098TP$$

Where: RP=Extent of Resource Planning; AL=Adequacy of Labour; AE=Adequacy of equipment; CS=Compliance with safety; ICT=ICT compliance; QP=Qualified personnel; LD=Level of documentation; FS=Financial status; W=Weather; PP=Prompt payments; and TP=Type of procurement.

The multiple regression analysis revealed that higher levels of Resource Planning are associated with higher levels of adequacy of labour and equipment, ICT compliance, high level of project documentation, high financial status, prompt payments, type of procurement, identifying the number of people required, establishing quantities of equipment, quantification of amount of materials. The analysis also revealed that higher levels of Resource Planning are associated with lower levels of Compliance with safety and bad weather.

## V. RECOMMENDATIONS

It is important that contractors have access to readily available skilled labour and equipment on the onset of any project as this will ensure when project plans are made, execution can be carried out without many challenges. Contractors should also ensure that they are in a good financial position before they take up any jobs.

## REFERENCES

- Ankrah, A. (2007). An investigation into the impact of culture on construction project performance. University of Wolverhampton.
- Bon, R., & Crosthwaite, D. (2000). The Future of International Construction. London: Thomas Telford Publishing.
- Dubey, A. (2015). Resource Levelling for a Construction Project, 12(4), 5–11. <http://doi.org/10.9790/1684-12440511>
- Field, A. (2000). Discovering statistics using SPSS for Windows: advanced techniques for the beginner. London: Sage Publications.
- Field, A. (2009). Discovering Statistics using SPSS. London: Sage Publications.
- Garmsiri, M., & Abassi, M. R. (2012). Resource leveling scheduling by an ant colony-based model, 8(1), 1. <http://doi.org/10.1186/2251-712X-8-7>
- Gates, L. P. (2010). Strategic Planning with Critical Success Factors and Future Scenarios: An Integrated Strategic Planning Framework. Software Engineering Institute, (November), 67.
- Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). Multivariate data analysis. Upper Saddle River, N.J.: Prentice Hall.
- Iyer, K., & Jha, K. (2005). Factors affecting cost performance: Evidence from Indian construction projects. International Journal of Project Management, 23, 283–295.
- Joshi, R., & Patil, P. V. Z. (2015). Resource Scheduling of Construction Project : Case Study, 4(5), 563–568.
- Mattila, K. G., & Abraham, D. M. (1998). Resource Leveling of Linear Schedules Using Integer Linear Programming. Journal of Construction Engineering and Management, 124(3), 232–244.



12. Mbugua, L. M., Harris, P., Holt, G. D., & Olomolaiye, P. . (1999). A framework for determining critical success factors influencing construction business performance. In 15Th Annual ARCOM Conference (pp. 255–264).
13. Mendoza, C. (1995). Resource Planning and Resource Allocation in the Construction Industry. University of Florida.
14. Nosbisch, M., Co, K. P., Winter, R., & League, L. (2005). Managing Resource Leveling CPM Schedule Logic.
15. Salleh, Rohaniyati, Kajewski, Stephen, Yang, J. (2009). Critical Success Factors of Project Management for Brunei Construction Projects: Improving Project Performance, 334.
16. Saqib, M., Farooqui, R. U., & Lodi, S. H. (2008). Assessment of Critical Success Factors for Construction Projects in Pakistan. First International Conference on Construction In Developing Countries (ICCIDC-I) “Advancing and Integrating Construction Education, Research & Practice,” 392–404.
17. Schweiz, I. N. D. E. R. (2014). An Approach for Solving Resource Leveling Algorithm Simulation Abstraction, 103(1).
18. Sheldon Shaeffer. (2006). International Institute for Educational Planning. Newsletter, XXIV(March), 14–15. <http://doi.org/10.1177/0013161X84020001013>
19. Simon, S. M. (2017). Effect of Top Management Support on Resource Planning and Leveling (RP & L) Among Contractors in the Kenyan Construction Industry. International Journal of Engineering and Advanced Technology (IJEAT), 6(5), 183–187.
20. Simon, S. M. (2018). Evaluation of the Resource Leveling Techniques Employed by Contractors in the Kenyan Construction Industry. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 7(4), 8–12.
21. Simon, S. M., Gwaya, A., & Diang’a, S. (2017). Exploring the Practice of Resource Planning and Leveling ( RP&L ) Among Contractors in the Kenyan Construction Industry. International Journal of Soft Computing and Engineering (IJSCE), 7(1), 44–52.
22. Singh, A. (2013). Benefits of Implementing a Resource Planning Software in your Organization. Retrieved July 25, 2016, from <http://project-management.com/benefits-of-implementing-a-resource-planning-software-in-your-organization/>
23. Takim, R., & Akintoye, A. (2002). Performance Indicators for Successful Construction Project Performance. Association of Researchers in Construction Management, 2(September), 2–4.
24. Tawalare, A., & Lalwani, R. (2012). Resource Leveling in Construction Projects using Re- Modified Minimum Moment Approach, 6(2), 733–735.
25. Trigunaryyah, B. (2005). Factors that Influence Contractor ’ s Risk Response Planning in Controlling Cost of Road Construction Project in Indonesia 2 . Risk Response Planning as a Tool for Project Cost Control, 125–133.
26. Winter, R. (2006). Proper Implementation of Resource Leveling By Ron Winter Consulting.
27. Zanen, P., & Hartmann, T. (2010). An Overview of Tools for Managing and Controlling Construction Projects (No. 3).

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