Exploring the Practice of Resource Planning and Leveling (RP&L) Among Contractors in the Kenyan Construction Industry

Shadrack Mutungi Simon, Abednego Gwaya, Stephen Diang'a

Abstract: ***The performance of construction projects depends to a great extent on how best resources are managed. Resource planning and leveling are critical aspects of resource management which need to be fully incorporated and practised in any site. Failure to manage the resources available through planning and leveling is likely to result in increased project costs, time overruns and poor quality. This assertion is supported by Tarek, (2010) who argues that proper resource planning and leveling helps resolve resource conflicts, which cause numerous challenges to the organization, such as: delay in completion of certain tasks, challenges in assigning a different resource to a certain task, inability to alter task dependencies, addition or removal of certain tasks and overall time and cost overruns of projects. He further argues that the aim of resource leveling is to increase efficiency when undertaking projects by maximizing on the resources available at hand. While it would be true to say that quite a number of authors have addressed the issue of resource management, the author feels that the subject of resource planning and leveling in the Kenyan construction industry is not well covered. This is due to a number of reasons which create a gap to be researched on. Authors such as Abeyasinghe et al., (2001); Ballard, (2000); Bandelloni et al., (1994) among others have covered different aspects of resource planning and leveling. It is however important to note that all these authors address the topic in developed countries. Some of the literature found on the topic is based on the manufacturing industry. This therefore creates the need to study the Kenyan construction industry and establish the underlying factors behind the practice of resource planning and leveling among construction industry players. The purpose of this research was to explore the practice of resource planning and leveling (RP&L) adopted by contractors within the Kenyan construction industry and the factors influencing the adoption of such techniques. This research mainly adopted a case study design where questionnaires were used to collect data from respondents. The research site was Nairobi and the target population was NCA 1-3 contractors. Random sampling was used to identify the 106 respondents. A response rate of 76% was achieved. Data obtained was analyzed using descriptive statistics, relative importance index analysis and spearman's correlation analysis. The study concluded that: though there is a high level of usage of RP&L in the Kenyan construction industry much of which is non-structured, construction projects' progress continue to be affected by delayed materials, lack of labour and lack of equipment at the points of need; RP&L is practised more in older contracting firms and where there is support from top management; and finally a high degree of RP is associated with reduced negative impact of construction project progress***

Keywords: Resource Planning, Resource Leveling, Construction Project Performance.

I. INTRODUCTION

Construction industry has been defined as the total industry involving the utilization of human, natural and economic resources in the conception, design and construction, maintenance and demolition of building and civil engineering works (Chitkara, 1998). According to K'Akumu (2007), construction is a strategic industry in developing economies like Kenya. This is due to its contribution to the macro economy of any country, Gross Domestic Product (GDP), gross fixed capital formation, inter-sector linkages and employment opportunities for the members of the public (United Nations Centre for Human Settlements, 1984).

It is however important to note that the construction industry can only grow and thrive when construction projects are executed in an efficient manner. Efficiency is often a result of proper planning. According to Reddy & Nagaraju (2015), resources play a vital role in construction projects. Resource requirement within a project include but not limited to unskilled labour, skilled labour, management, tools, equipment, construction materials and finances. The performance of construction industry depends chiefly on how best these resources are managed (Abeyasinghe, Greenwood, & Johansen, 2001).

Construction project planners prepare a project schedule assuming that all the resources required for each activity will be available to the contractor at all times during the construction process (Aslani, et al 2009). The process of distributing available resources to various project activities' objectives is called 'Resource Planning'. This is done in a way so that the project completion schedule is least affected (Dubey, 2015).

The resource leveling problem arises when there are sufficient or even excess resources available and it is necessary to reduce the fluctuations in the pattern of resource usage. These fluctuations are very undesirable since they usually present financial, utilization, and labour difficulties contractors (Schultz, Slevin, & Pinto, 1987). The scheduling objective is to make the resource requirements fairly uniform, and in other cases to make them meet desirable non-uniform resource levels in resource leveling.

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Resource Leveling is a method for developing a schedule that attempts to reduce fluctuations in resource requirements. This technique levels the resources in such a way that we can apply them as uniformly as possible. Poor resource management results into cost and time overruns. Mendoza, (1995) agrees with this assertion by arguing that majority of projects suffer from avoidable delays resulting from inadequate resource planning and control. Poor resource management is also likely to contribute to poor quality work. The two-most important aspects of resource management are; resource planning and resource leveling.

II. LITERATURE REVIEW

2.1 Project planning

Project planning has been argued by many to be the cornerstone of any project implementation. Project management requires a proper strategy which is usually formulated at the planning stage. It gives a road map of how the project will be implemented and the resources which shall be employed in the process of executing the project. Planning involves defining project goals, specifying tasks and formulating how the objectives shall be met (Badawiyeh, 2010).

2.1.1 Project Constraints in Project Planning

(a) Labour Constraints

Human resources are typically classified by the skills they bring to the project: carpenter, steel fixer, welder, painter, operator, inspector and engineer among others (Cunningham, 2013). Sometimes, the available labour lacks the skill and expertise to effectively execute their mandates in the project. It is for this reason that once the project team or contractor get effective workforce, they find it very difficult to release them. They feel that they may get jobs elsewhere and lose them. They will then tend to hold on to them even when there is no work for them at the moment.

(b) Materials Constraints

Most of the material resources required for construction activities are in non-renewable and not easily replenished. Some are not available locally and have to be imported from overseas. Periodic shortages are also bound to occur. Poor performance of projects has been blamed on material unavailability and shortages within the construction industry (Lau & Kong, 2006).

(c) Equipment Constraints

Equipment is usually presented by type, size, and quantity and is often overlooked as a constraint. The most common mistake is the assumption that the resource pool is satisfactory for the entire project. High crashing or delay costs can be avoided by recognizing all equipment constraints before the start of the project (Lau & Kong, 2006).

2.2 Resource Planning & Leveling in Construction Projects

The four main essential resources required in any construction project include; materials, equipment, people and time. For the project to accomplish the project plan and schedule, it is important to make sure that the necessary materials, personnel, equipment and time are availed in desired quantities at the time they are scheduled for in the project plan and schedule.

Despite resource planning phase being very important in construction projects, many projects suffer avoidable delays from inadequate resource planning and control (Mendoza, 1995). Resource planning aims to identify resource quantities for different activities and schedule these resources over the project duration.

The aim of undertaking resource planning is to identify the: types of labor required for the project; roles and key responsibilities for each labor type; number of people required to undertake each role; quantities and types of equipment required; items of equipment needed and their purposes and total amount of materials required (Kass, 2012; Kumari & Vikranth, 2012; Stukhart, 1995; Badawiyeh, 2010).

Resource Planning and Leveling can either be carried out in the head office or site office depending on where the person executing the exercise is based. It can either be carried out in a formally written or informal unwritten format. A range of personnel working under the contractor can be utilized to carry out the exercise.

2.2.1 Labour Resource Planning & Leveling

The most important resource to a project is its people; the project team. According to Mendoza (1995), human resources for construction projects can be grouped in to three categories; office personnel, construction personnel (field supervision and labor) and construction sub-contractors.

The task of personnel recruitment for construction projects lies with the project manager who may delegate the responsibility to the construction manager or other project team members. It is thus the responsibility of the recruiting officer to acquire the personnel according to the needs of the project. It is also their responsibility to release the personnel from the project if they are no longer needed by the project.

2.2.2 Material Resource Planning & Leveling

The materials plan is used to guide the project manager in planning for material resources. Depending on site constraints, different approaches could be used to plan for the materials schedule. Concepts like Just-In-Time (JIT) have been used for confined sites. Though this concept is widely considered as the best for procuring materials, it can only be used for materials whose future availability is certain. While different sites adopt different strategies for materials planning and scheduling, they should all ensure that materials are present on site at the time the project schedule dictates and they should not be seen to delay the project (Ala-Risku & Kärkkäinen, 2006).

2.2.3 Equipment Resource Planning & Leveling

This involves identification of all the equipment that will be required to accomplish the project, e.g.: office equipment (PCs, photocopiers, mobile phones etc.), telecommunications equipment (cabling, switches etc.)

and machinery (heavy and light machinery) (Charoenngam, 2003). Sequencing of construction activities should be in such a way that equipment from one activity can be shifted to the other on its completion. This aims to reduce the total requirement of equipment at any given time. It also seeks to achieve effective utilization of equipment on the project.

III. RESEARCH METHODOLOGY

Based on the argument raised by Bryman, (2004), Bryman & Bell, (2007), Creswell, (2009), and Spector, (1981), this study can be classified as a survey research design, because quantitative data was collected on several variables during the same time. Survey research comprises a cross-sectional design in relation to which data are collected predominantly by questionnaire or by structured interview and at a single point in time with the aim of collecting a body of quantitative or quantifiable data in connection with the variables, which are then examined to detect patterns of relationship or association (Bryman, 2008). Broadhurst, Holt, & Doherty, (2012) indicate that methods used to collect data in a survey research include questionnaire, interview (structured or loosely structured), observation, analysis of documents and unobtrusive methods. The researcher used questionnaires to seek the opinions and actual information from the target population.

The research site for the proposed study was Nairobi County. This formed the basis for establishing the target population. The research was confined to building contractors registered under categories NCA1 to NCA3 in this geographical scope.

The target population comprised of 145 contractors drawn from NCA 1 to NCA 3 categories. A suitable sample size was determined using the following formula extracted from Ankrah (2007) and originally postulated by Czaja & Blair (1996). The same formula has also been adopted by Mugenda & Mugenda, (1999).

N=(z^2 x p(1-p))/c^2 Where: N = sample size; z = standardized variable (1.96 which corresponds to 95% confidence level); p = percentage picking a choice, expressed as a decimal (50% or 0.5 was used.); 1- p = proportion of the target population not having the particular characteristics; c = confidence interval, expressed as a decimal (degree of accuracy required, usually set at 0.05).

Random sampling was used to select the 145 respondents in this study. Data obtained was analyzed using the Statistical Package for Social Scientists (SPSS v.21).

IV. DATA ANALYSIS AND DISCUSSIONS

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 Demographic Profiles of Respondents and their Firms

4.2.1 Role of the Respondent in the Firm

Table 4.1 below indicates that the highest percentage (24.7%) of respondents were Site Agents while the lowest were Architects with a representation of 1.2%. These results depict the norm in the Kenyan construction industry; that the contractor is mainly in the office (hence a frequency of 23.5%) and mostly represented by a Site Agent (hence a frequency of 24.7%) in most construction sites. While almost all construction sites have foremen in charge of different trades or even a general foreman in charge of all other foremen, a low frequency was due to the desire to mostly engage academically competent persons to respond to the questionnaire. The role of an Architect had the lowest frequency possibly due to the fact that majority of contractors in Kenya rarely engage in design work since the most prevalent procurement system in the country is the traditional design-bid-build where the contractor is engaged when all the design work has been accomplished.

Table 4.1: Role of Respondent

Role of Respondent in the firm	N	Percent
Contractor	19	23.8%
Quantity Surveyor	9	11.3%
Civil & Structural Engineer	3	3.8%
Site Agent	20	25%
Construction Manager	13	16.3%
Architect	1	1.3%
Site Engineer	8	10%
Foreman	5	6.3%
Others	2	2.5%
Total	80	100.0%

Source: (Author, 2016)

4.2.2 Age the Firm

Table 4.2: Age of the Firm

Age of the Firm	N	Percent
Up to 5 years	32	40.0%
6 - 10 years	22	27.5%
11 - 15 years	9	11.3%
16 - 20 years	4	5.0%
More than 20 years	13	16.3%
Total	80	100.0%

Source: (Author, 2016)

The table above shows that majority (60.1%) of the firms engaged in this survey have been operating in the Kenyan construction industry for a period of more than 6 years. When compared between the "local" and "foreign" contractors, a big proportion of those who were in the industry for less than 6 years were classified as "foreign".

4.2.3 Category of Firm

Table 4.3: Category of Firm

Category of Firm	N	Percent
Foreign	8	10%
African	6	7.5%
Local	66	82.5%

Total	80	100.0%

Source: (Author, 2016)

Results indicated that Local contractors had the highest frequency of 81.5% followed by Foreign contractors with a frequency of 9.9% and the African contractors with a frequency of 7.4%. The construction industry is mainly composed of local firms. An exceptionally high frequency for Local contractors meant that the results of this study would comfortably reflect the views and position of local firms regarding resource planning and leveling.

4.3 The practice of RP&L among contractors

A number of questions were included in the questionnaire to explore the practice of resource planning and leveling among contractors. These included: the extent to which they carry out resource planning and leveling; the kind of resource planning and leveling carried out by the contractors; extent of support by top management in executing resource planning and leveling; the person bestowed with the responsibility of carrying out resource planning, educational background of such person and their academic qualification; aims of undertaking resource planning and leveling; effect of delayed materials, lack of labour and equipment on project progress.

4.3.1 Extent of Equipment Planning

When respondents were asked to rate the extent to which they carry out Equipment Resource Planning, their responses produced a mean of 3.67 as indicated in table 4.4. It is clear from this that majority of contractors in the country practice Resource Planning in the Equipment category. The cost of equipment in most building projects ranges between 20-30% of the total project cost. Kumari & Vikranth, (2012) point out that the equipment cost has to be controlled properly by allocating various items of equipment efficiently in different phases of the project. Kass (2012) asserts that equipment planning is necessitated by the need to establish the size and various types of equipment needed either on rent or outright purchase.

4.3.2 Extent of Labour Planning

Contractors were asked to give the extent to which they carried out Labour Resource Planning, the results produced a mean of 3.94 as indicated in table 4.4. It is clear from this that majority of contractors in the country also practice Labour Resource Planning. Labour planning helps the organization maintain the right number of employees at the right time with the capability to execute tasks which are aimed at ensuring success of the project (Thomas *et al*, 2004).

4.3.3 Extent of Material Planning

Respondents were asked to rate the extent to which they carry out Material Resource Planning. These responses produced a mean of 4.23 as indicated in table 4.4. It is clear from this that majority of contractors in the country practice Material Resource Planning. The cost of materials in most building projects ranges between 60-70% of the total project cost. A study by Stukhart (1995) argues that the cost of installed materials is more than 50% of the total project cost. According to Kumari & Vikranth, (2012), material planning is necessary to fulfil the requirements of the project at different phases of the project while reducing wastage at the same time.

4.3.4 Comparison between Equipment, Labour and Material Planning

As seen in Table 4.4, the means for the extents of resource planning by contractors in the categories of Equipment/Plant, Labour and Materials were 3.67, 3.94 and 4.23 respectively. This means that highest level of resource planning by contractors is in the category of material resources. However, means of 3.67, 3.94 and 4.23 indicate that contractors in the Kenyan construction industry carry out extensive resource planning in all major categories of resources.

Table 4.4: Extent of Resource Planning by Contractors.

	Mean	**Std Dev**	**Rank**
Extent of Equipment Planning	3.67	1.077	3
Extent of Labor Planning	3.94	0.827	2
Extent of Materials Planning	4.23	0.867	1

Source: (Author, 2016)

The reason why more emphasis is paid to Material Resource Planning compared to Labour Resource Planning and Equipment Resource Planning could be attributed to the fact that materials form 60-70% of the project cost. It is for this reason that contractors believe that most of their profits comes from materials and hence the need to properly plan to avoid wastages. As cited in Kass (2012), proper material management is critical since materials account for a substantial portion of the project's time and cost. According to Naief (2002), materials not only account for 50-60% of the total project cost, but also control 80% of its schedule.

4.3.5 Nature of Resource Planning

The researcher sought to establish the nature of resource planning carried out by contractors. The table below frequencies regarding the nature of resource planning carried out by contractors.

Table 4.5: Nature of Resource Planning

Nature of Resource Planning	**N**	**Percent**
Defined, written, standard	19	23.8%
Unwritten	13	16.3%
Both of above	48	60.0%
Total	80	100%

Source: (Author, 2016)

While it may seem that more contractors carry out defined/formal/standard resource planning compared to the informal resource planning, this may be misleading since according to the researcher's judgement, majority of those who said they practise both unwritten/informal and defined/formal resource planning do more of the unwritten/informal than the defined/formal resource planning.

This because majority of the respondents failed to provide evidence of any material (soft or hard) that they used to carry out the defined/formal resource planning. Therefore, it would be correct to conclude that majority of the contractors in the Kenyan construction industry practise an informal/unwritten method of resource planning.

4.3.6 Responsibility of Resource Planning

Table 4.6 below shows results regarding those bestowed upon the responsibility of carrying out resource planning in their respective firms.

Table 4.6: Responsibility of Resource Planning

Responsibility of Resource Planning	N	Percent
Directors/Central administration	17	21.3%
Project Manager	35	43.8%
Project Coordinator	11	13.8%
Construction Manager	13	16.3%
Site Agent	4	5.0%
Total	80	100%

Source: (Author, 2016)

As seen from the table above (4.6), Project Managers were the most popular preferred choices for carrying out Resource planning with a frequency of 43.8% (N=35). These results are reflective of what Mendoza, (1995) asserts by saying that it is the responsibility of the project manager to identify and schedule project needs in a manner that efficient utilization can be made of resources available. Since majority of Project Managers, Project Coordinators and Central administration are based in offices, it would be correct to assert that much of the Resource Planning carried out by contractors is office based. These results are supported by Clough & Sears, (1991) who argue that the main objective of carrying out resource planning and resource allocation is to support the field operations so that the project can meet its time and cost objectives.

4.3.7 Educational background

Table 4.7 below shows frequencies for the academic backgrounds of those carrying out resource planning in their respective firms.

Table 4.7: Academic Background of the Person Carrying out Resource Planning

Academic Background	N	Percent
Construction Management	17	21.3%
Quantity Survey	18	22.5%
Civil/Structural Engineer	17	21.3%
Construction Project Management	14	17.5%
Architect	2	2.5%
Others	8	10%
I don't Know	4	5%
Total	80	100%

Source: (Author, 2016)

As seen from table 4.7 above, majority of those carrying out Resource Planning had academic backgrounds of Quantity Survey (22.5%, N=18). Other results were; Civil/Structural Engineer (21.3%, N=17), Construction Management (21.3%, N=17), Construction Project Management (17.5%, N=14), Architect (2.5%, N=2); Others (10%, N=8); and I don't know (5%, N=4). It is interesting to note that 100% of those termed to be in the "Others" category had an educational background in Building Construction/Technology.

4.3.8 Aims of undertaking Resource Planning

Resource Planning and Leveling can be carried out for various reasons. A number of aims as cited from Siboe, (2016) were presented to the respondents to express views on their significance based on a likert scale. The results were tabulated in the tables below.

Table 4.8: Aims of undertaking Resource Planning (Relative Importance Index)

S/No.	Aims of undertaking Resource Planning	N	RII	Rank
1	Responsibilities of each labour	80	0.8625	4
2	Number of people required	81	0.8765	2
3	Items of equipment required	81	0.8716	5
4	Quantities of equipment	81	0.8765	2
5	Amount of materials	81	0.8988	1

Source: (Author, 2016)

The results, as per table 4.8 indicated that the most significant factor considered when carrying out Resource Planning and Leveling was "Identify the total amount of materials needed" with a RII of 0.8988. Other factors in descending order were: "Identify the types and quantities of equipment needed" (RII=0.8765); "Identify the number of people required to fill each role" (RII=0.8765); "Identify the roles and key responsibilities for each labor type" (RII=0.8625) and lastly "Identify the Items of equipment to be used and their purposes" (RII=0.8716)

Since the questionnaire gave the option of respondents suggesting other aims which they considered to be relevant, a number of factors were obtained from the study. These were: identify time needed to complete a specific task; determine rate of labour and equipment in terms of time; to identify which trade of labourers would be to be laid off as the amount of work decreased; identify and prioritize procurement of resources time wise; to assist in planning accordingly; to ensure the project has the right skills and materials at the right time; identifying the cost of the project; identifying the time needed and timely planning.

4.3.9 Effects of resource unavailability on project progress

Respondents were asked to indicate (on a likert scale) how often the progress in their projects was affected by delayed supply of materials, lack of labour on sites and lack of equipment on sites.

Although this research has already established that contractors pay more attention to material resource planning compared to labour resource planning and equipment resource planning, the table 4.9 below indicates that projects carried out by respondents' firms were more likely (3.11) to be affected by delayed material compared to lack of labour (2.68) and lack of equipment (2.68). This means that more needs to be done with regard to material resource planning if building projects are to proceed more smoothly. However it could also be argued that material resources are an extensive area which involves many external project participants in the name of suppliers. This means that even though proper plans may be put in place to ensure materials are on site every time they're needed, it is hard to control parties (suppliers) who are not on site and whose activities are also affected by other parties (manufacturers).

Table 4.9: Effects of Resource Unavailability on Project Progress.

Effects of resource unavailability on project progress	N	Mean	Std. Deviation
Delayed materials	81	3.11	1.095
Lack of labour	80	2.68	1.261
Lack of equipment	81	2.68	1.105

Source: (Author, 2016)

Projects were less affected by lack of labour and lack of equipment as depicted by lower means compared to that of materials. This could be attributed to the fact that labour and equipment contribute to only 30-40% of the project cost. It could also be attributed to the fact that since this study was based on NCA 1- NCA 3 contractors, majority of such contractors owned much of the equipment required to execute building projects hence it was easy to avail such equipment whenever needed on site. However according to Kass (2012), unavailability of materials when required on sites is the most frequent cause of delay in construction projects.

4.3.10 Extent of Equipment Leveling

From the table 4.10 below, when respondents were asked to rate the extent to which they carry out Equipment Resource Leveling, a mean of 3.80 was produced as indicated in table 4.18. It is clear from this that majority of contractors in the country practice Resource Leveling in the Equipment category. There is a small difference (0.13) between the mean for the extent of Equipment Resource Leveling (3.80) and the mean obtained in table 4.4 for the extent of Equipment Resource Planning (3.67).

4.3.11 Extent of Labour Leveling

Table 4.10 below indicates a mean of 3.99, when respondents were asked to rate the extent to which they carry out Labour Resource Leveling. It is clear from this that majority of contractors in the country practice Labour Resource Leveling. There is also a small difference (0.05) between the mean for the extent of Labour Resource Leveling (3.99) and the mean obtained in table 4.4 for the extent of Labour Resource Planning (3.94).

4.3.12 Extent of Material Leveling

Respondents were asked to rate the extent to which they carry out Material Resource Leveling. These responses produced a mean of 4.06 as indicated in table 4.10. It is clear from this that majority of contractors in the country practice Material Resource Leveling. The above mean for the extent of Material Resource Leveling (4.06) is lower than the mean obtained in table 4.4 for the extent of Material Resource Planning (4.23). This means that even though 4.06 is still high, not all contractors who practice resource planning in materials resources category go further to carry out leveling of such resources.

4.3.13 Comparison between MRL, LRL and ERL

The table 4.10 below shows a comparison between the means for the extents to which contractors carry out resource leveling in the three main categories of resources namely; materials, labour and equipment.

Table 4.10: Comparison Between MRL, LRL and ERL

	N	Mean	Std. Deviation	Rank
Extent of Equipment Leveling	80	3.80	0.892	3
Extent of Labour Leveling	80	3.99	0.879	2
Extent of Material Leveling	80	4.06	1.060	1
Average		**3.95**		

Source: (Author, 2016)

As seen in the table 4.10 above, the means for the extents of resource leveling by contractors in the categories of Equipment/Plant, Labour and Materials were 3.80, 3.99 and 4.06 respectively. This means that highest level of resource leveling by contractors is in the category of material resources. However, means of 3.80, 3.99 and 4.06 indicate that contractors in the Kenyan construction industry carry out extensive resource leveling in all major categories of resources. A comparison between the means obtained above for resource leveling and those seen in Table 4.4 for resource planning produces similar ranking with materials being in first position followed by labour and equipment in that order.

4.3.14 Nature of Resource Leveling

The researcher sought to establish the nature of resource leveling carried out by contractors. The table below shows the frequencies regarding the nature of resource leveling carried out by contractors.

Table 4.11: Nature of Resource Leveling

Nature of Resource Leveling	N	Percent
Defined, written, standard	28	35.0%
Unwritten	16	20.0%
Both of above	36	45.0%
Total	80	100%

Source: (Author, 2016)

The table above (4.11) clearly shows that while 20.0% and 35.0% of the contractors surveyed carry out unwritten and defined/standard resource leveling respectively, a big proportion 45% of the contracting firms practise both unwritten/informal and defined/formal resource leveling. A flashback to the results obtained in figure 4.5 regarding the nature of resource planning carried out by contractors, there is a significant increase (23.8%-35%) in the percentage of contractors carrying out defined/standard resource leveling compared to those practising defined/standard resource planning. This could be attributed to the fact that resource leveling being a more complex exercise compared to resource planning requires formal approach rather than an informal strategy. These results are validated by Reddy & Nagaraju, (2015) when they claim that many organisations have a structured hierarchy of resource levelling.

4.3.15 Relationship between Age of Firm, Extent of ERP, LRP and MRP

A Spearman's correlation was run to determine the relationship between the age of the firm, extent of carrying out Equipment Resource Planning (ERP), extent of carrying out Labour Resource Planning (LRP) and extent of carrying out Material Resource Planning (MRP).

Table 4.12: Correlation between Age of Firm, Extent of ERP, LRP and MRP

			Age of firm	ERP	LRP	MRP
Spearman's rho	Age of firm	Correlation Coefficient	1.000	.225*	.108	.172
		Sig. (2-tailed)	.	.048	.348	.132
		N	80	78	78	78
	ERP	Correlation Coefficient	.225*	1.000	.543**	.485**
		Sig. (2-tailed)	.048	.	.000	.000
		N	78	78	78	78
	LRP	Correlation Coefficient	.108	.543**	1.000	.564**
		Sig. (2-tailed)	.348	.000	.	.000
		N	78	78	78	78
	MRP	Correlation Coefficient	.172	.485**	.564**	1.000
		Sig. (2-tailed)	.132	.000	.000	.
		N	78	78	78	78

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Source: (Author, 2016)

The above table 4.13 indicates a weak positive monotonic correlation (0.225) between the age of firms and extent of carrying out ERP. This relationship was significant since sig=0.048. The above table also indicates a very weak positive relationship (0.108) between the age of firms and extent of carrying out LRP which was not statistically significant (sig=0.348). Further, the above table (4.13) indicates very weak positive relationship (0.172) between the age of firms and extent of carrying out MRP. This correlation is statistically insignificant (sig=0.132)

An analysis on the relationships between the individual extents of resource planning reveals a moderate positive monotonic (p=0.543) relationship between extent of Equipment Resource Planning (ERP) and the extent of extent of Labour Resource Planning (LRP) which was highly significant (sig=0.000). The table also presents a highly significant (sig=0.000) moderate positive monotonic relationship between the extent of Equipment Resource Planning (ERP) and the extent of extent of Material Resource Planning (MRP) at p=0.485. When the test was also used to analyse the correlation between the extent of Labour Resource Planning (LRP) and the extent of extent of Material Resource Planning (MRP) produced a spearman's correlation coefficient of 0.564. This indicates a highly significant (sig=0.000) moderate positive monotonic relationship between the variables.

4.3.16 Relationship between Age of Firm, Extent of ERL, LRL and MRL

The table 4.13 below shows a correlation between the age of the firm, extent of carrying out Equipment Resource Leveling (ERL), extent of carrying out Labour Resource Leveling (LRL) and extent of carrying out Material Resource Leveling (MRL).

Table 4.13: Correlation between Age of Firm, Extent of ERL, LRL and MRL

			Age	ERL	LRL	MRL
Spearman's rho	Age of firm	Correlation Coefficient	1.000	.075	.109	.050

			Age	ERL	LRL	MRL
		Sig. (2-tailed)	.	.514	.338	.661
		N	80	79	79	79
	Extent of Equipment Leveling	Correlation Coefficient	.075	1.000	.492**	.470**
		Sig. (2-tailed)	.514	.	.000	.000
		N	79	80	80	80
	Extent of Labour Leveling	Correlation Coefficient	.109	.492**	1.000	.663**
		Sig. (2-tailed)	.338	.000	.	.000
		N	79	80	80	80
	Extent of Material Leveling	Correlation Coefficient	.050	.470**	.663**	1.000
		Sig. (2-tailed)	.661	.000	.000	.
		N	79	80	80	80
**. Correlation is significant at the 0.01 level (2-tailed).						

Source: (Author, 2016)

When the spearman's rank-order correlation was run to determine the relationship between the age of firms and extent of carrying out Equipment Resource Leveling (ERL), a spearman's correlation coefficient of 0.075 was obtained as seen in table 4.13. This symbolised a very weak positive relationship between the variables and which was not statistically significant since p = 0.514.

A spearman's rank-order correlation between age of firms and extent of carrying out Labour Resource Leveling (LRL) produced a spearman's correlation coefficient of 0.109 as seen in table 4.13 This depicted a very weak positive relationship between the variables and which was not statistically significant since p = 0.338.

Further, the above table (4.13) indicates a spearman's correlation coefficient of 0.050 between the age of firms and extent of carrying out Material Resource Leveling (MRL). This result indicates a very weak positive relationship between the variables which was not statistically significant since p = 0.661.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

The following conclusions were made from this study:

(a) There is a high level of usage of Resource Planning and Leveling in the Kenyan construction industry. However much of this is carried out in a non-structured manner.

(b) Since the emergence of project management profession, project managers continue to be relied upon by contractors to handle resource management in construction projects.

(c) The reasons established for carrying out Resource Planning and Leveling from contractors were all anchored to the three main categories of resources namely; material, labour and equipment.

(d) Despite contractors carrying out Resource Planning, construction projects' progress continue to be affected by delayed materials, lack of labour and lack of equipment at the points of need.

(e) Older contractors perform better in Resource Planning and Leveling compared to younger firms.

(f) Resource Planning and Leveling is practised more in contracting firms where there is support from top management.

5.2 Recommendations

The following recommendations were made

(a) Personnel engaged in Resource Planning and Leveling in contracting firms should not just be academically qualified but should also possess adequate experience in the area of resource management.

(b) All levels of employees should be integrated in the resource planning and leveling exercise. Labourers employed in construction sites should also be properly trained on the benefits of resource planning and leveling. This will help improve their morale.

(c) Contractors should preferably employ professionals who have a background in the construction industry in their sites.

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