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FACTORS INFLUENCING PERFORMANCE OF SOLID WASTE MANAGEMENT PROJECTS AT KENYA PORTS AUTHORITY

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ABSTRACT

The study investigated factors influencing performance of solid waste management projects at KPA. The study adopted a descriptive research design to collect quantitative data. The target population was drawn from KPA's environment section, Pollution Control section, KPA security section and KPA solid waste external contractors. The population of the study consisted of project coordinators, project managers, project team members and project solid waste contractors. The target population for the study was 410 of which a sample size of 202 respondents was picked for the study through random sampling. Data was collected by use of questionnaires. To reinforce data reliability, validity and accuracy, a pilot study was conducted on 10 respondents who were not involved in the final sample to ascertain and detect any ambiguities; correct any poorly constructed questions and those that were irrelevant. After raw data was collected, it was edited to ensure that it was clean and accurate. It was then coded. Statistical Package for Social Sciences (SPSS 24.0) was used to analyze data. Data analysis and interpretations was presented using descriptive statistics as well as inferential statistics, factor analysis and analysis of variance were used. Multilinear regression model was also used. The study findings established that there was a significant influence of stakeholders' involvement, technological complexity, project manager's skills and legal framework on performance of solid waste management at KPA. The study recommended that KPA should establish better disposal of ship solid waste and extend the port waste management plan to all stake holders, they should train their stakeholders on new technologies of managing solid waste. KPA also needs to ensure that all stakeholders at the port abide by environmental legal laws governing solid waste management and lastly KPA should have a clear communication plan that will help distribute accurate information on solid waste management to various stakeholders.

Key Words: *Stakeholders Involvement, Technological Complexity, Manager's Competence, Policy, Solid Waste Management*

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INTRODUCTION

Throughout history, the advancement of human beings has been inherently connected to the management of solid waste because of its impact on public and environmental health. Solid waste management (SWM) has a very long and convoluted history (Nathanson, 2015). Solid Waste Management system roots can be traced well back to the ancient times. The Greeks had challenges of aligning waste removal system and the growing population. There were land and sanitation challenges as well. It was not until urban population outrage on solid waste that that it was seen as a menace to both human and environmental health. Many cities grew rapidly, accommodating the growing population which led to worsening of the cramped cities (Mezier, 2013).

Today, the issue of Solid Waste Management (SWM) has become critical as solid waste generation is continuously increasing with population and industrialization. This is significantly more so in urban areas because of fast urbanization which implies that the urban infrastructure available is not capable of dealing with the amount of solid waste produced (Solberg, 2012). Kenya being a regional commercial hub in Africa with many economic activities especially in Nairobi and Mombasa, generates a lot of solid waste with little solid waste management practices Solberg, 2012).

Kenya has a planning document named Vision 2030 which is divided into three major pillars that is economic, social and political. The social pillar's aim is to realize a just and cohesive society that enjoys equitable and social development in a very clean and social environment. This is underpinned in the social strategy paragraph 5.4 which envisions Kenya to become a nation which has clean, secure and sustainable environment by 2030. In order to realize the strategy, the document specific strategies will be to improve pollution and solid waste through the design and application of economic incentives as well as commissioning o the private- public partnership for water and solid sanitation delivery. He flagship projects earmarked for this strategy to succeed include the development of tight regulations for plastic bags and limiting further production and usage of unfriendly environmental detrimental plastic bags and enactment of solid waste management strategy (Jouhara, 2017).

Kenya Vision 2030 therefore recognizes the importance for efficient and sustainable solid waste management systems to be established as it develop into a more industrialized country by 2030.. For this reason the visison2030 identified five major cities and towns namely Mombasa, Kisumu, Eldoret, Nakuru and Thika as the flag ship for solid waste management projects. National Environmental Management Authority is expected to deliver this flagship Vision 2030

It is estimated that Mombasa County generate almost 700-800 of solid waste daily Mombasa county report (2017) the amount of solid waste generated by Mombasa County. Presently collection of generated solid waste is approximated to be 68% of all the waste produced. This implies the other 32% normally ends up being burnt, thrown out in streets or at the sea shores. This is a worrying concern because of the towns rising population and seeing the gate way of Kenyan's tourism suffocate under mountains of garbage and trash is not very much economically sound. Mismanagement of project solid waste such as burning of plastic that produces toxic fumes is also very detrimental to environmental health and the inhabitants.

The Port of Mombasa is the principal gateway to the Eastern Africa region, serving a wide hinterland consisting of Kenya, Uganda, Rwanda, Burundi, South Sudan, Northern Tanzania, Eastern Democratic Republic of Congo and Somalia. It serves a hinterland of about 150 to 250 million people in different markets in East and Central Africa. The efficiency of the Port therefore has a major impact on the economies of the countries it serves and can unlock the region's growth potential if operated efficiently and developed in step with growing trade demand, is mandated to maintain,

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operate, improve and regulate all schedule seaports along the Kenyan coastline. The Authority is responsible for the management of the Port of Mombasa and other small seaports including the old port in Tudor creek, Funzi, Kilifi, Kiunga, Lamu, Malindi, Mtwapa, Shimoni and Vanga.

The KPA also manages inland container depots in cities and towns like Nairobi, Eldoret and Kisumu and has liaison offices in other countries such as Kampala, Kigali and Bujumbura that cater for transit countries. The Lake Port of Kisumu has also been added to KPA's mandate. International maritime trade is served through the Port of Mombasa, which is the critical nerve centre of business serving Uganda, Rwanda, Democratic Republic of Congo, Tanzania, Burundi and South Sudan. The Mombasa Port is well connected in the region, with over 33 shipping lines calling and providing direct connectivity to over 80 ports. The Mombasa Ports Authority's main objective is to continually improve service delivery and meet customers' expectations through provision of quality port services by managing ports' solid waste which is in line with ISO 9001:2008 and other generally accepted national and international standards. KPA envisions playing a critical role towards supporting the national development agenda and the execution of the Vision 2030.

Statement of the Problem

Ships on voyage consume a lot of resources that always end up in generation of solid waste that range from residues of running the ship engines and hoteling activities that takes place on board the ships. Port operations and other activities that do take part on board the ship generate solid and liquid waste Port operations and other related activities generate both solid and liquid waste. The Port does not have a solid waste management plan for both ships and port wastes. Past efforts by KPA and other stakeholders to set up a modern solid waste reception facility have so far been unsuccessful. This makes the Port of Mombasa to be non-complaint with the international standards as stipulated in the Marpol 73/78 convention. Sewage solid waste from the Port sanitary facilities is served by septic tanks that do not have soak pits and thus drain raw sewage directly into the Ports harbor. Likewise storm water drains effluent directly into the harbor water (Port of Mombasa Final draft report plan, 2017)

The current KPA solid waste management system is outsourced to the third party service providers but still fail to meet the standards (Port of Mombasa Final draft report plan,2017). It is expected that all these are likely to have negative effects on the productivity and efficiency, labor performance through adverse effects on health and safety which leads to increased operational costs to increased, reduced berth utilization and increased ship turnaround time.

From the relevant empirical review studies conducted on solid waste management, it is evident that research has been carried out in municipalities and Counties. There focus has mainly been on how to manage household and Municipality solid waste. Mutungwa (2012) conducted a study on an Assessment on public- private partnership for solid waste management in Wote town, Makueni County, the study aimed at at providing an alternative solution to the existing Solid waste management (SWM) system in Makueni. County, the study aimed at providing an alternative solution to the existing Solid Waste Management (SWM) systems in Makueni. Nyayiemi (2012) conducted a study on determinants of effective solid waste management in Kakamega Municipality, Kenya. The purpose of the study was to establish the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya and explore opportunities for waste reduction and recycling.

Malii and Mugambi (2015) conducted a study on Determinants of Risk in Solid Waste Management Projects, in Kenya (a case of Solid Waste Management projects in Mombasa County). The purpose of the research was to study the determinants of risk in solid wastes projects, in Kenya, where Mombasa County solid wastes projects were taken as a case study. Little had been

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done on factors influencing solid waste management project in Kenya Ports Authority or KPA as a Port. This was considered as a research gap, and justified the topic of choice and grounded the relevance of the research topic as a rich area of research where more information and knowledge addition was needed to inform and add value to the Academia, and project management professionals and the Government.

Objectives of the Study

The general objective of the study was to investigate the factors influencing performance of solid waste management projects at Kenya Ports Authority. The specific objectives were:-

- To examine the influence of project stakeholder's involvement on performance of solid waste management projects at Kenya Ports Authority.
- To establish the influence of project manager's competence on performance of solid waste management projects at Kenya Ports Authority
- To determine the influence of project technological complexity on performance of solid waste management projects at Kenya Ports Authority.
- To determine the influence of project organization's policy on performance of solid waste management projects at Kenya Ports Authority

The research hypotheses were;

- **Ho_1**: project stakeholder's involvement has no significant influence on performance of solid waste management projects at Kenya Ports Authority
- **Ho_2**: Project manager's competence has no significant influence on performance of solid Waste Management project at Kenya Ports Authority
- **Ho_3**: Project technological complexity has no significant influence on solid waste management projects at Kenya Ports Authority
- **Ho_4** : Project organization policy has no significance influence on performance of solid waste management projects at Kenya Ports Authority

LITERATURE REVIEW

Stakeholder Theory

This theory describes issues regarding stake holders in an organizations and there interest and involvement in organizations projects. The stakeholder theory is a theory of management that attempts to describe the morals and values used in managing an organization (Bondy *et al*, 2011). The stakeholder theory is mirror image of performance of projects. The theory states that involvement of stakeholders in a project leads to project performance (Scheid, 2011)). This theory therefore attempts to explain the relationship of the organization to its external environment and its behavior within the environment**.**

Complexity Theory

Complexity is the inability of an organization to predict the behavior or nature of a system due to very large numbers of different parts within the same system and the dense relationship among them (Sheard, 2012). Globally, many large projects are getting so complex that it is becoming very difficult to operate them. Thus reflecting the adaptive interdependent networks and systems that are normally seen in agile organism such as bee colonies and self-evolving viruses.

Skills Theory

The skills theory grew from the obvious flaw in the trait approach. Skills theorists sought to discover the skills and abilities that made effective leaders. In the case of this study it is the competent project manager. This theory is similar to trait theory. The theory focuses on what types of skills are needed for an effective leader. Katz's three-skill approach and Mumford's skills model developed from skills theory leadership. According to this theory technical, human and conceptual skills are very n important for an effective leader. Technical skills are specific task skills like the ability to use modern solid waste management tools. Human skills are the

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ability to work with project team and conceptual skills refers to the ability to work with broad concept and ideas thus being knowledgeable. These skills are important for leaders although their level of importance vary from organization to organization. Effective leadership is dependent on how leader competencies are affected by the leader's attributes, experiences, and the environment.

The Structural-Functional Theory

The proponent of this theory Radcliff-Brown is considered the father of modern anthropology. This theory emphasizes that behaviour is shaped by the values of a given organization or firm. According to this theory organization cannot have a culture that is totally different from the community in which it operates. Radcliffe-Brown (1881-1955), who is one of the foremost proponents of this theory, states that the values of the society in which a particular organization functions, deeply permeate it and influences its goals , objectives and activities. The emergence of different values and system is caused by factors like the history of an organization, past leadership, procedures, policies and legal frame works.

Project Management Theory

This theory is theory is given by transformation view in operation. The theory of project is provided by the transformation view, according to transformation view, a project is viewed as transformation of inputs to out puts. This theory is based on three theories that is management as planning, the dispatching model and the thermostat model. The idea behind management-as planning is, that management at the operation level is seen to consist of the creation, revision and the implementation of plans (Williamson, 2013). This approach to management views strong causal connections between the actions of management and the outcomes of the organization. In this study the inputs of the independent variables in solid waste management gives the out puts in dependent variable which is the performance of solid waste management at KPA. The dispatching model assumes that the planned activities can be implemented by a notifications of the start of the activity to the executing it.

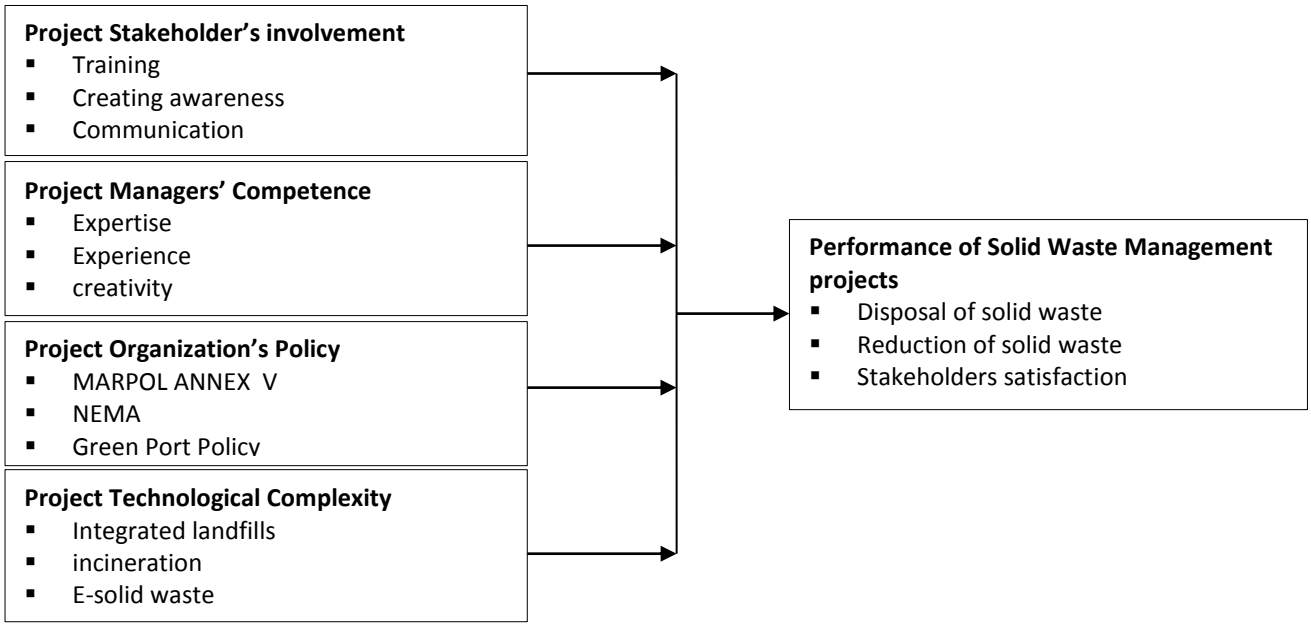

Figure 1: Conceptual Framework

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Empirical Review

Several studies have been conducted in Kenya concerning Solid waste management. Nyayiemj (2012) conducted a study on determinants of effective solid waste management in Kakamega municipality, Kenya. The purpose of the study was to establish the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya and explore opportunities for waste reduction and recycling. The study had the following objectives: to examine how economic factors influence effective solid waste management , to establish the extent to which technical factors influence effective solid waste management, to determine how institutional factors influence effective solid waste management and to establish how social factors influence effective Solid Waste Management in Kakamega Municipality.

The study employed descriptive survey research design whose main purpose was to determine Municipality Solid Waste (SWM) management challenges of Kakamega Municipality in Kenya. The target population consisted of all four respondents from NEMA. 62 employees from Kakamega Municipality. 40 employees from Ministry of Public Health and Sanitation and 16 employees from the Ministry of Housing (MOH). The respondents were selected through on SWM. The municipal council's lack of a policy on waste reduction at the source and on involving community groups and lack of clear authorities and sanitation rules negatively and significantly. Cluster sampling and purposive sampling techniques. The study found out that economic factors had low levels, and this led to inefficient effective Solid Waste Management in Kakamega Municipality. Technical factors had marginal associations on the effectiveness of effective Solid Waste Management. Institutional factors like municipality's lack of public awareness

Malii & Mugambi (2015) conducted a study on Determinants of Risk in Solid Waste Management Projects, in Kenya (A Case of Solid Waste Management Projects in Mombasa County) the purpose of the research was to study the determinants of risk in solid wastes projects, in Kenya, where Mombasa County solid wastes projects were taken as a case study. The general objective of studying the determinants of risk in solid waste projects, in many parts of the world and then related it, with the Kenyan case specifically in Mombasa. Based on this, the research project objectives and questions were therefore framed, specifically in line with, the role of legal framework, technology, personnel skills and policy, the study had, a target population of eighty eight (88) solid waste projects workers was proportionally selected, out of which a sample size of seventy two (72) solid waste projects workers, was determined, through proportionate stratified random sampling technique.

Mutungwa (2012) Assessment of public-private partnership for solid waste management in Wote town, Makueni county Kenya The study aimed at providing an alternative solution to the existing Solid Waste Management (SWM) systems. The study set out to investigate how Public-Private Partnership (PPP) approach in SWM system could be applied in Wote town by: evaluating the operations, efficiency and effectiveness of the existing SWM systems in the Town, (establishing the roles and level of participation of all current stakeholders involved in SWM systems, assessing PPP application towards improved SWM in Wote Town.. Data collected was coded and entered into the computer for analysis using the Microsoft Excel and presented inform of charts, tables and graphs. Descriptive and inferential statistical methods were used to draw conclusions for the study. Results revealed that a mean of 87.5 of the respondents were female while 12.5 were male, 50% of residents produced above 2Kgs of solid waste per day. and burning. The study revealed that stakeholders involved are few and limited. The alliances between them are completely weak and this has led to the poor SWM systems in the town. Their roles and responsibilities are not clearly defined

METHODOLOGY

This study used a descriptive research design. Descriptive research measures the characteristics of a particular population, whether at a fixed point in time or over time**.** The study population included KPA environmental section, pollution control section, KPA security section and KPA solid waste contractors and it targeted the project coordinators, project managers, project team members and project contractors. The reason for targeting them was that they had first-hand information and they were involved in making policies and strategies on solid waste management for the entire organization. This study adopted random sampling technique, where sampling population members were divided into homogeneous subgroups called strata before sampling. The primary data was collected using a questionnaire. The questionnaire had closed predetermined and standardized set of questions. Secondary data was obtained from literature sources through review of published literature such as journals, articles, published theses and text books. The researcher made use of secondary data from the education sector. Descriptive and inferential statistics were done using SPSS version 24. Data was presented in tables. Multiple regression analysis was used to show the influence of the independent variables on the dependent variables. The multiple regression equation was as follows:

$$\mathbf{Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$$

Y = Represents the dependent variable, performance of Solid Waste Management projects

β_0 = Intercept of regression line

β_1 - β_4 = Partial regression coefficient of the Independent Variables

X_1 = project stakeholder's involvement

X_2= project manager's competence

$\mathbf{X_3}$= project organization's policy

$\mathbf{X_4}$ **=** project technological Complexity

ε = error term or stochastic term.

RESULTS

Project Stakeholder's Involvement

The respondents were asked to indicate to what extent to which project stakeholders were involved in project solid waste management at KPA. Descriptive measures of the project stakeholders' involvement components were obtained and the results were given by Table 1.

Table 1: Descriptive Statistics of project Stakeholder's Involvement

Statement	Mean	Std. Deviation
KPA communicate the importance of environmental stewardship to all levels of employees and stakeholders	4.16	0.825
KPA conducts awareness campaign to highlight issues on solid waste management	4.68	0.011
KPA holds workshops on policy implication for all stakeholders	4.54	0.015
All contractors appointed for waste removal have equipment's for lifting large bins	3.66	0.964
KPA ensures that all contractors appointed for waste removal deal with all waste types	3.95	0.135
Overall	**4.20**	**0.772**

Table 1 showed that on average the respondents agree that all the components of the project stakeholders' involvement had some influence on the project solid waste management. The means of the components ranged from 3.66 to 4.68 with an overall mean of 4.20.

Project Technological Complexity

On a Likert scale of 1 to 5, respondents were asked their opinion on the influence of various components of the project technological complexity on project solid waste management. The results obtained were given in Table 2.

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Table 2: Descriptive Statistics Project Technological Complexity

Statement	Mean	Std. Deviation
KPA has harmonized waste management system	4.34	0.981
Online waste management information system exists or used by various stakeholders	3.95	0.880
All stakeholders trained in new technologies of managing solid wastes example incarnation recycling and landfill	3.73	0.974
Waste monitoring systems on effluent being discharged	3.91	0.679
Overall	**3.98**	**0.753**

Table 2 showed that on average the respondents agree that all the components of the project technological complexity had some influence on the project solid waste management. The means of the components ranged from 3.73 to 4.34 with an overall mean of 3.98.

Project Managers Competence

Respondents were asked on a Likert scale of 1 to 5 of the perception on the influence of project managers' competence on project solid waste management. The descriptive statistics were given by Table 3.

Table 3: Descriptive Statistics of Project Managers Competency

Statement	Mean	Std. Deviation
Project managers are adequately trained in collection, sorting, storage and transportation of solid waste management	4.33	0.904
Prior Experience in solid waste management is important for a project manager	3.82	0.989
Academic and technical project managers skills project manager and teams soft skills plays an important role in management of solid waste	3.60	0.891
Project managers need to embrace new technologies in managing solid waste at the port	3.71	0.886
Overall	**3.87**	**0.844**

Table 3 showed that on average the respondents agree that all the components of the project Managers' competence had some influence on the project solid waste management. The means of the components range from 3.60 to 4.33 with an overall mean of 3.87.

Project Organization's Policy

A descriptive statistical analysis was carried on the project organization's policy to help bring out a deeper understanding on its influence on project solid waste management. The results obtained were presented on Table 4.

Table 4: Descriptive Statistics of Project Organization's Policy

Statement	Mean	Std. Deviation
There are specified waste handlers for Marpol based	3.89	.990
KPA's environment department has overall authority to control waste flow at the port	4.02	0.772
There is one leading agency for port waste sources and types	3.94	0.876
Numerous environmental laws are in place relating to waste management practices and are consistently implemented and adhered to	4.01	0.439
KPA extends ports waste management plan to ship captains	4.01	0.633
Overall	**3.97**	**0.796**

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Table 4 showed that on average the respondents agree that all the components of the project organization's policy had some influence on the project solid waste management. The means of the components range from 3.89 to 4.4.02 with an overall mean of 3.97.

Project Solid Waste Management

Further analysis was done on the components of solid waste management to determine their descriptive statistics measures. The results obtained were given by Table 5.

Table 5: Descriptive Statistics on project Solid Waste Management

Statement	Mean	Std. Deviation
The organization has established better disposal methods of solid waste	4.29	0.154
The organization has enhanced better disposal methods of solid waste that has led to its reduction	3.65	0.933
The organization has incorporated best disposal methods of solid waste that has led to stakeholders satisfaction	4.34	0.756
The organization has extended ports waste management plan to ship captains	4.30	0.823
Online waste management information system exists or used by various stakeholders	3.87	0.920
Overall	**4.09**	**0.894**

The components had means ranging from 3.65 to 4.30 with an average of 4.09

Inferential Statistics

Regression Results

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801[a]	.641	.632	.54257

a. Predictors: (Constant), framework, Stakeholder, Complexity, Competency

Table 7: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	85.612	4	21.403	78.0561	.000[b]
	Residual	47.984	175	.2742		
	Total	133.595	179			

a. Dependent Variable: Waste Management

b. Predictors: (Constant), Policy, Stakeholder, Complexity, Competency

Table 8: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.025	.162		.153	.878
	Stakeholder	.183	.080	.160	2.295	.023
	Complexity	.293	.090	.251	3.252	.001
	Competency	.202	.091	.185	2.216	.028
	framework	.350	.107	.300	3.281	.001

a. Dependent Variable: Waste Management

Results showed that all the independent variables had significant influence on the dependent. This is because the p value of the test statistics are less than 0.05. The resultant regression model is given by equation 1

According to the analysis, the equation ($\hat{Y} = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4$), the resultant regression model is given by equation 1 as;

$$Y_i = 0.183 X_1 + 0.293 X_2 + 0.202 X_3 + 0.35 X_4 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where $x_1, x_2, x_3 \; and \; x_4$ are project stakeholder's involvement, project technological complexities, project managers' competence and project organization's policy respectively and Y_i is the project solid waste management.

The model showed that keeping other factors constant, for every one unit change in project stakeholders involvement, project solid waste management increases by 18.3%; for every one unit change in project technological complexity, project solid waste management increased by 29.3%; for every one unit change in project managers competence, project solid waste management increases by 20.2% and for every one unit change in project organization's policy, project solid waste management increases by 35%.

Hypothesis Testing Results

Table 9: Summary of Research Hypotheses

Null Hypothesis	Comments
Project stakeholder involvement does not significantly influence project solid waste management at KPA.	Rejected
Project technological complexities does not significantly influence project solid waste management at KPA.	Rejected
Project managers' competence does not significantly influence project solid waste management at KPA	Rejected
Project organization's policy does not significantly influences project solid waste management at KPA	Rejected

CONCLUSIONS

The study's objectives were to examine the influence of project stakeholder's involvement, to establish the influence of project manager's competence, to determine the influence of project technological complexity and to determine the influence of project organization's policy on performance of solid waste management projects at Kenya Ports Authority. Study findings were used to conclude that there is a strong relationship between the study independent and dependant variables. Therefore, it was concluded that project stakeholders' involvement has a strong influence on the project solid waste management at KPA. Secondly from the study, it was concluded that project technological complexity influences the project solid waste management at KPA. Further results concluded that project managers' competence influences the project solid waste management at KPA. It was finally concluded that project organization's policy influences the project solid waste management at KPA.

RECOMMENDATIONS

- Kenya Ports Authority should establish better disposal of ship solid waste and extend the ports waste management plan to all the stakeholders including ship captains and crews, for effective solid waste management.
- Kenya Ports Authority should encourage recruitment and retention of project managers with necessary skills, knowledge and experience in various aspects of solid waste so as to enhance proper solid waste management in the organization.
- Due to technological complexity, Kenya Ports Authority should train their stake holders on new technologies of solid waste management system, waste monitoring system and equip

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them with new technology of online waste management system in order to manage solid waste effectively at the Port.

- Kenya Ports Authority to ensure that all stakeholders involved in solid waste management at the port abide by the environmental legal laws governing solid waste management for efficient disposal of solid waste resulting from the ships.
- Kenya Ports Authority should have a clear communication plan to help distribute accurate information on solid waste to various stakeholders and which will help enhance performance of solid waste management in the organization.

Suggestion for Further Studies

Being the only port in Kenya further studies can be carried out in East African sea port especially Port of Dare-salam and the results compared so as to ascertain the similarities and consistency on project solid waste management at the ports.

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