



**THE EFFECT OF WASTE MANAGEMNT PRACTICES ON OPERATIONAL PERFORMANCE: THE CASE OF PAPER BOARD PACKAGING SECTOR OF BISHOFTU TOWN ADMINISTRATION, ETHIOPIA.**

--Manuscript Draft--

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### Abstracts

*The general objective of this research is to determine the effect of waste management on the operational performance of paperboard (carton) packaging Sector in Bishoftu Town Administration (BTA). Explanatory research design was used to answer research hypothesis regarding the effect of waste management practices on operational performance. Quantitative research approach was applied. The number of target population of the research was 227 from which the sample size of 151 was selected using stratified random sampling technique. The primary data was collected using questionnaires. To assure data quality content validity and reliability tests were made. Inferential analysis methods (correlation and regression) were used to analyze the data. Both correlation and regression analyses indicated that waste management practices had large, positive and significant effect on operational performance of the sector under study. Both methods revealed that waste reduction management practice tend to have highest level of effect than others. Despite this significant effect of waste management practices on operational performances, the paperboard packaging factories do not widely apply these practices to better improve the operational performances of the sector. Therefore, factories within the sector better include these waste management practices within their strategic management plans and adapt the state art technology to effectively manage these practices and reap benefits thereof.*

**Key Terms:** *paperboard (carton), waste, waste management practices (waste reduction, waste reuse/remanufacturing, waste recycling, waste recovery, waste disposal) and operational performance.*

## I. INTRODUCTION

### 1.1. Backgrounds of the Study

The waste management practice has long histories for its application and hence the waste management issue is not new historical background. Sroufe's (2003) studied regarding the effects of environmental management systems on environmental management practices and operations and suggested that the waste management practices have positive and significant effect on financial performances of the organization. John and Seetharaman (2013) studied the role of waste and performance management in the construction industry focused on identifying the most effective waste management methods that can help the companies to reduce their cost and thus increase their corporate profits. The study by Roslan, Habidin, Zainudin, Norazlan and Hadji (2014) in Malaysian Healthcare Industries and their research finding indicated that waste management practice is closely linked to organizational performance. David Mutua Kimeu (2015) study on the operational performance of hotels in Mombasa, Kenya indicates that the waste management practices have insignificant positive effect on operational performance. The other recent research was solid waste management practices for the hotel industry in Vietnam (Hoang, Phu and Fujiwara, 2017) simply report on prevailing trends of SWM practices of hotel industry.

Yet studies show that the paperboard sector offers little profit margins and requires large initial investments (Koskinen, 2009). The sector performance can be measured with regard to financial and non-financial. The paperboard packaging sector is under constant pressure to reduce harmful wastes to environment particularly to water and land, supply of quality products, meeting effectiveness and efficiency of production process and the customer needs to determine its operational performances (Koskinen, et al., 2009).

Thus, the purposes of this thesis were to identify the pre-consumed waste management practices and operational performance measures, analyze the effect of pre-consumed waste management practices on operational performances, develop research model of waste management practices and organizational performance measures relationship for paperboard packaging sector of BTA. In this research, there are five categories of waste management practices: waste reduction, waste reuse/remanufacturing, waste recycling, waste recovery, waste disposal and ten measures of operational performances: reduce cycle times of operations, workflow improvement, flexibility of operations, quality of the products and services, delivery speed of products, new product development and innovations, promote the increment of sales growth, promote the increment of market share, improves customer satisfaction and customer retention, job satisfaction and employee productivity.

### **1.2. Statement of the Problem**

Because of increasing demand to increase the organizational performances in general packing factories tend to consider their waste management strategies. To consider the association between waste management practices and operational performances of the organizations, several researchers were attracted to study the effect of waste management practices on organizational performances. However, the previous researches mainly focus on the effect of post-consumed wastes than pre-consumed wastes as well as financial performance than operational performances. Sroufe's (2003) study suggested that these waste management practices have positive and significant effect on financial performances of the organizational. The research result of John and Seetharaman (2013) focused on identifying the most effective waste management methods that can help the companies to reduce their cost and thus increase their corporate profits. The research findings of Roslan, Habidin, Zainudin, Norazlan and Hadji (2014) used correlation to determine the relationship but not regression. Other researcher, Kimeu (2015) research findings of this research indicate some variations against previous researches in that the waste management practices have insignificant effect on operational performance and although there is positive relation, it is very low.

But the previous studies did not duly consider the effect of waste management practices on operational performance of the organization. That is there is issue gap in the previous researches. Most of the researches emphasized on the effect of waste management practices on financial performance, particularly cost reduction and profit increment while marginalizing operational performance (McAllister, Jessica, 2015; Maloba, 2012; Baharum, 2016). The other problem related to previous studies is regarding the explanatory variables used to explain the explained variable. The other research gap considered related to research method triangulation. The other

important gap is the type of the wastes the previous researches focused on. The related previous researches focused on waste management practices of post-consumed waste packages that were recollected from different sources instead of the pre-consumed wastes. Still other major gap considered was the areas of the study units. The previous studies dealt with wastes generated in hotels, health centers, and electronic manufactures.

Therefore, this research was needed to address some of these gaps; particularly the research focused on the effect of pre-consumed WMPs on operational performance of paperboard packaging sector of BTA using inferential analysis of correlation and regression in addition to descriptive analysis. The research also included more explanatory variables of WMPs to explain more the operational performance and used the mixed research method (research method triangulation) and data triangulation to ensure more reliability. The research was also aimed to identify the existing WMPs, operational performance measures of the sector and challenges to manage wastes efficiently and effectively in the sector under study.

### **1.3. Research Hypothesis**

To answer the formulated research problem, the following research hypotheses have been developed:

1. There is no waste management practice that has effect on the operational performances of the paperboard packaging sector of Bishoftu Town Administration?
2. There is no determinate waste management practice that predicts the operational performance of the paperboard packaging sector of Bishoftu Town Administration?

### **1.4. Scope of the study**

In terms of areas of the study this study covered the paperboard packaging sector. That is the research did not cover other packaging factories such as plastic, fibers and bottling packaging because they involve different inputs, technology and accordingly produce different types of wastes. Regarding to geographical coverage, this study covered paperboard packaging sector operating within Bishoftu Town Administration. Regarding to the waste type, this study considers the waste management practices of pre-consumed wastes and do not cover the after-consumed wastes.

### **1.5. Significance of the Study**

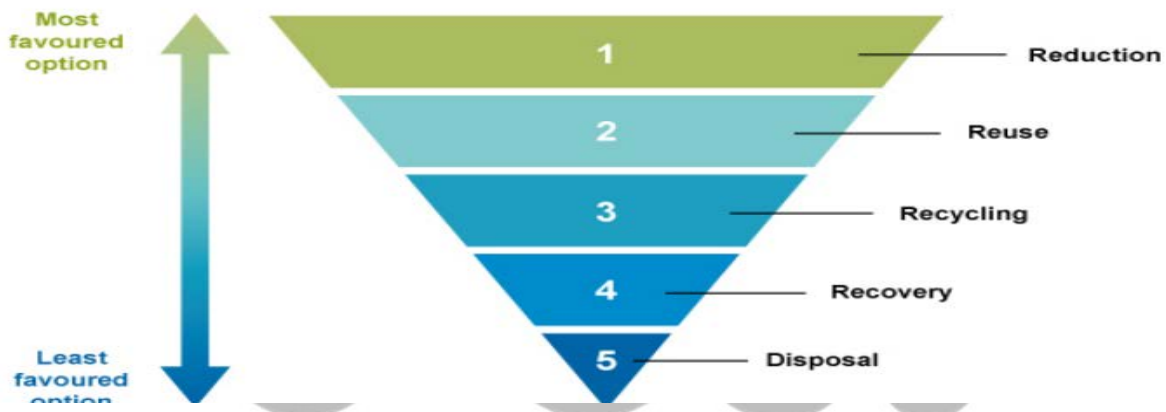
This study was intended to increase the insights of managers and experts for better understanding of waste management practices, to help the factories to understand the major improvement areas to implement waste management practices as part of their strategic goals and policy makers as well as to add extra knowledge to exiting body of knowledge of the theoretical and conceptual model of the effect of waste management practices on operational performances. Furthermore, it was expected to lay a ground for future researchers on related areas.

## 2. LITERATURES REVIEW

### 2.1 Theoretical Literature Review

Manufacturing firms may have different attitudes to the concept of wastes based on the organizational culture, attitudes they have on the importance of the waste, their economic level, and the government policies to the treatment of waste. Benny Getahun (2007) defined waste as “...any material disposed of as no longer useful in common usage.” According to the FDRE Solid Waste Management Proclamation No.513/2007 solid waste is “anything that is neither liquid nor gas and is discarded as unwanted.” Under this law the plastic packaging materials are duly considered rather than other packaging materials (Article 12). EU 2010 defines waste management practices hierarchy as a waste management behavior which relates to recycling, reusing and reduction (Srinivas, 2015).

Figure 1: Waste Management Hierarchy



(Sources: Australia Paperboard Corporation (APCO) working group, 2018)

Waste management hierarchy is the internationally accepted guidelines for waste management practice, given emphases to reduce waste at source.

### 2.2. Empirical Literature Review

Roslan, Habidin, Zainudin, Norazlan, Hadji (et al., 2014) in their research regarding waste management practices and organization performance they fading indicated that waste management practice is closely linked to organizational performance. Other more related researches were conducted in later periods. The research conducted on the effect of waste management practices on the operational performance of hotels in Mombasa, Kenya (Kimeu, et al., 2015) was more comprehensive than the previous ones in terms of addressing the independent variables as well as using specific measurements or indicators of operational performance. There is also other research conducted in Vietnam that analyzed solid waste management practices for the hotel industry in Vietnam (Hoang, Phu, and Fujiwara, 2017). The study results simply provided information or report on prevailing trends of SWM practices of hotel industry. Several researchers Roslan, Habidin, Zainudin, Norazlan, Hadji, et al., 2014) indicated that the waste management practice will have positive consequence on organizations' performances in terms of financial performance,

customer satisfactions, product flexibility, productivity, internal business process performance, innovation and learning growth performance.

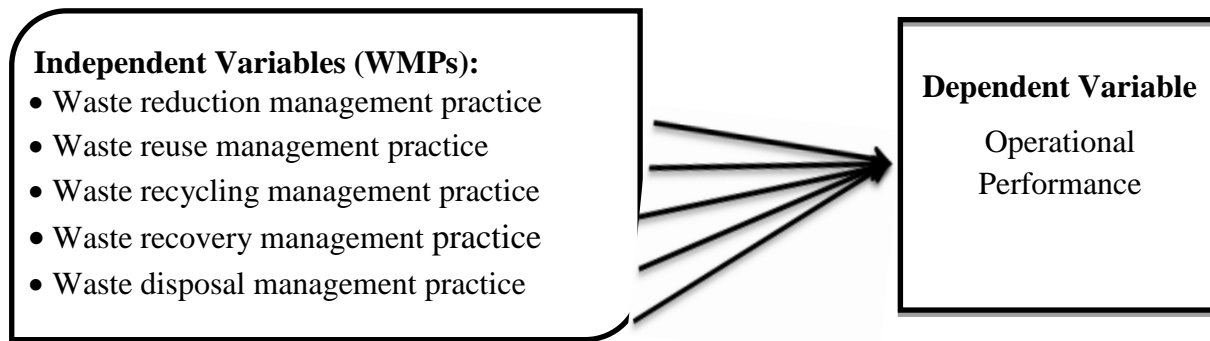
### **2.3. The Research Gap**

In general, this research was conducted to supplement some of the gaps in researches reviewed hereinabove particularly issue gaps, content gaps, methodology gaps, gaps in the fields or units of the study. Regarding to the issue of the study, the previous researches focused on post-consumer waste management practices whereas this research focused on pre-consumed wastes. It excluded the post-consumer wastes collected, sorted and reprocessed from households, commercial and industrial wastes. Moreover, the research issue covered by the previous researches was the relation between waste management practices with organizational performance while focusing on the financial performance rather than operational performance which is the focus of this research. Regarding the content gaps, the previous researches taken individually considered two or three waste management practices as determinate factors of organizational performance. On the other hand, this research focused on operational performances by taking into account more waste management practices as well as additional indicators of operational performances. Regarding the methodology gaps, most of the previous researches considered the descriptive analysis to consider the relation between the waste management practices and organizational performance while this research used mixed research methods including correlation and regression analyses. Regarding the field of the study, the previous researches considered health industry, hotel industry and manufacturing industry. But this research studied the packaging industry. As regards to geographical gaps, to researcher's knowledge none of such researches were conducted in Ethiopia, particularly in Bishoftu Town Administration (BTA).

### **2.5. The Conceptual Model/Framework of the Research**

One of the objectives of this research is to formulate a model that would be used to determine the operational performance of paperboard packaging firms in Bishoftu Town. The model proposed in this study, however, was not an exhaustive one; it can be further extended by adding other variables the researcher did not made reference to. The independent variables comprised of waste management practices (waste reduction, reuse, recycle, recovery and disposal) of the packaging factories.

Figure 2: The conceptual model/framework



Source: Literature Review, Sroufe's (2003); Kimeu (2015))

### 3. THE RESEARCH METHODOLOGY

#### 3.1. Research Design

The explanatory research approach was used to analyze the research hypothesis regarding the effect of waste management practices on operational performance as well as to assess the relative prediction of each independent variable (IV) of the dependent variable (DV).

#### 3.2. Research Approaches

In this research, quantitative research method was used to conduct the correlation and regression analysis between waste management practices and operational performance between waste management practices and operational performances.

#### 3.3. Research Unit Analysis

In Bishoft Town Administration there are 3 packaging factories for producing paperboard packaging within the packaging industry with primary objectives of creating a growing packaging requirement of the country (Bishoftu Town Investment Office Investors Profile, 2019). These were Unlimited Packing Private Limited Company (ULP PLC), East Africa Tiger Brand Private Limited Company (EATB PLC) and Seven Hills packaging Private Limited Company (SHP PLC) where the ULP PLC takes the lead in terms of quantity of production, and number of employees. These factories are producing similar types of package materials with somewhat different technologies and capacity. They have manufactured different types of paperboards for packaging for different purposes of agricultural and horticultural products, industrial goods, processed foods and beverages, construction materials, medicine and medical supplies and more for both domestic and export distributions ((Bishoftu Town Investment Office Investors Profile, et al, 2019). This production process involves the generation of packaging wastes which amounts to 5-7 tons per day and 1, 800 —2, 520 tons per year (Bishoftu Town Investment Office Investors Profile, et al, 2019). This waste is huge amount that may have tremendous effect on the operational performance of the industry if managed effectively and efficiently managed by the firms.

### 3.4. Target Population and Sampling Techniques

The area of the study demands permanent staffs those who have substantial knowledge and skills about the waste management practices. The number of respondents (target population) in Unlimited Packing Private Limited Company (UP PLC) was 89, in East Africa Tiger Brand Private Limited Company (EATB PLC) was 76 and in Seven Hills Packaging Private Limited Company (SHP PLC) was 62. That is the total number of target population included in this research was 227. The number of respondents or informants in each study unit (area) was determined using a proportionate stratified sampling technique to ensure random selection of respondents from all factories based on the proportion of the target population in each factory. For the purpose of this study the sample size was determined based on Taro Yamane (1967), sample selection method with a probability of 5% free error with 95% confidence level. A total of 230 samples will be drawn from the total target population.

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = is the required sample size

N= is the population size and

e= is the level of precision.

The formula was developed by Taro Yamane (1967). BY applying the above formula

$$n = 227 / [(1+227)(0.05)^2]$$

$$n = 151$$

The sample size is 151. This sample size gives true reflection of the research findings and fair representative of the respondent views.

Table 1. Number of Subject Respondents (Samples) from Each Study Unit

	Name of Factory/Firm	No of Target Population	Proportion of each factory	Sample Size in each factory
1	Unlimited Packing Plc.	89	0.4	59
2	East Africa Tiger Brand Plc.	76	0.3	51
3	Seven Hills Packing Plc.	62	0.3	41
	<b>Total</b>	227	1.00	151

(Source: Researcher's own calculation)

Many researchers commonly add 10% of samples size to calculated sample size to compensate for respondents that the researcher is unable to contact and possibility of non-returns (Taherdoost, 2017). Therefore, for the purpose of this research the actual sample size addressed was 166 [(151 \* 0.1) + 151 ≈ 166] to ensure the collection of primary data from 151 ideal size.

### 3.5. The Types and Sources of Research Data

The data collected to carry on this research is mainly primary data gathered from the employees and management of the paperboard packaging sector. The primary data was collected from



respondents to questionnaires and interviewees. In addition to primary data, secondary data regarding the sector was collected from the factories to supplement the primary data.

### 3.6. Data Collection Instruments (Methods)

The primary data was collected using structured questionnaire survey. Additionally, secondary sources on waste management methods were used for literature review

### 3.7. Data Analysis Tools

In this research both correlation and regression analyses were used to analyze the quantitative data. The research was analyzed using Pearson product-moment correlation coefficient ( $r$ ) to identify the association between the independent and dependent variables in the study. Assuming that the dependent variables (operational performance of packaging factories) is denoted by  $Y$  and the independent variables (waste reduction, reuse, recycle, recovery and disposal) denoted by  $x_1$  to  $x_5$  respectively, then a simple linear multiple regression equation will be given by:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \mu$$

*Model Description:*

- $y$  = Operational performance
- $\beta$  = Constant term
- $x_1$  = waste reduction management practice
- $x_2$  = waste remanufacturing management practice
- $x_3$  = waste recycle management practice
- $x_4$  = waste recovery management practice
- $x_5$  = waste disposal management practice
- $\mu$  = error term

Multiple linear regressions make a number of assumptions but all these assumptions will not be critical in all conditions (Gujarati, 2009). The assumption tests were carried on and interpreted in results and discussion part.

### 3.8. Reliability and Validity

Data measurement involves assigning scores to individuals so that they represent some characteristic of the individuals (Dornyei, 2007, Lincoln and Guba (et al., 1985). In this research data quality was assured via the following techniques.

#### 3.8.1. The Internal Content Validity Test

First, the items included in the questionnaire were judged by experts in each paperboard packaging factory. Appropriate questionnaire was developed based on established theory and findings of previous studies as well as the facts in the sector. Thirdly, to produce valid generalizable results, the target population was clearly defined; adequate sample size was determined based stratified random sampling method. Fourthly, the logical framework of the research was conducted by following the ideal structure of the general research framework (Marion & Jolaine, 2001). This logical flow of the study assured the internal validity of the research.

### 3.8.2. Data Reliability

Reliability is the degree to which the items that make up the scale are all measuring the same underlying attribute (i.e. the extent to which the items ‘hang together’ or interdependent) (Lincoln and Guba, et al., 1985).

Table 2. Reliability Test of Items of Independent Variables

Variable	No of items	Cronbach’s Alpha
WRMP	14	0.773
WRUMP	14	0.765
WRCMP	9	0.755
WRVMP	10	0.762
WDMP	11	0.729
<b>Total Items</b>	<b>58</b>	<b>0.860</b>

(Source: SPSS Output of Reliability Statistics, 2019)

Legend: WRMP=waste reduction management practices; WRUMP=waste reuse management practices; WRCMP= waste recycle management practices; WRVMP = waste recovery management practices; WDMP = waste disposal management practices.

The values range from 0 to 1, with higher values indicating greater reliability. Nunnally (1978) recommends a minimum level of 0.7. Each item within each independent variable and all 58 items taken together indicated that there is a good and acceptable reliability of inter-item consistency.

### 3.9. Ethical Consideration

For any social science research ethical issues can really arise in all phases of the research process: data gathering, data analysis and interpretation, conclusions and recommendations. (Merriam, 1998). To ensure the research was ethical, the researcher avoided plagiarism practices. A researcher was responsible for both informing and for protecting respondents. As an ethical researcher, the researcher of this study was morally bounded to conduct the research in a manner that avoids potential damages to those involved participants in the study. Besides this, the researcher performed the following safeguards to ensure protection and rights of participants when the data are going to be collected. Firstly, the respondents were announced that any of the response should be kept confidential. The researcher introduced himself and informed them that the purpose of the study was only for academic purpose. The researcher also considered the proper conduct of the data analysis, interpretations, conclusions and recommendations tasks based on the basis of data collected.

## DATA ANALYSIS, INTERPRETATION AND PRESENTATION

### 4.1. Introduction

In this section, the gathered data was analyzed, presented and interpreted using appropriate statistical tools to answer the research hypothesis. To avoid the probability of no responses 10 % of the sample size (i.e., 15) was added. Hence, the researcher distributed 166 structured questionnaires respondents within the sector. For five (5) respondents failed to complete and return

the questionnaires on time only 161 questionnaires were collected. This shows that the study had a better response rate of 97%.

## 4.2. Inferential Analysis

In this research inferential analysis was conducted using correlation analysis and regression analysis.

### 4.2.1. Correlation Analysis

The correlation analysis was conducted to consider the strength, direction and significance of effects between waste management practices taken as whole with operational performances. Table 3 shows Pearson's multiple correlation coefficient matrixes between waste management practices and operational performance of the paperboard packaging sector.

Table 3 Multiple Correlation Coefficients between WMPs and OP

		WRMP	RUMP	WRCMP	WRVMP	WDMP	OP
WRMP	Pearson Correlation	1	.378**	.429**	.184*	.199*	.612**
	Sig. (2-tailed)		.000	.000	.024	.014	.000
WRUMP	Pearson Correlation		1	.267**	.251**	.060	.519**
	Sig. (2-tailed)			.001	.002	.467	.000
WRCMP	Pearson Correlation			1	.094	.043	.511**
	Sig. (2-tailed)				.249	.600	.000
WRVMP	Pearson Correlation				1	-.006	.299**
	Sig. (2-tailed)					.942	.000
WDMP	Pearson Correlation					1	.230*
	Sig. (2-tailed)						.005
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

(Source: SPSS Output of the Research Data Analysis, 2019)

Legend: WRMP=waste reduction management practices; WRUMP=waste reuse management practices; WRCMP=waste recycle management practices; WRVMP = waste recovery management practices; WDMP = waste disposal management practices.

The result shows that the Pearson correlation coefficients  $r$  of all waste management practices with operational performance are positive; that is with the increase of any waste management practice, the operational performance of the packaging sector also increases. This implies that all independent variables (waste management practices) have a positive relationship/effect with the operational performance of the sector under study. But each independent variable has different strength of relationship with operational performance. This research result is in line with some previous researches. Roslan, Habidin, Zainudin, Norazlan and Hadji (2014) studied waste management practices and organization performance in Malaysian Healthcare Industries and their research finding indicated that waste management practice is closely linked to organizational performance. That is their research finding indicated that positively waste management practice is positively related to organizational performance. However, according to Kimeu (et. al., 2015)

waste management practices have insignificant positive effect on operational performance of hotel sector.

#### 4.2.1. Regression Analysis

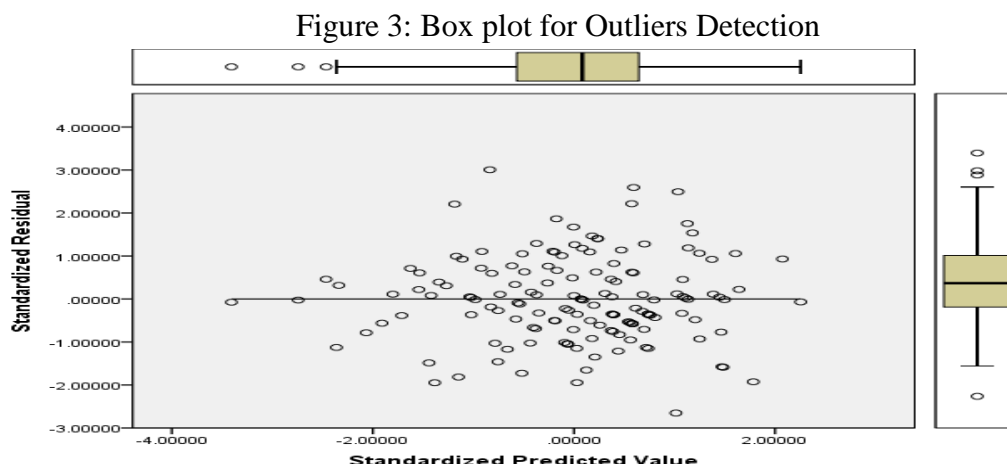
Regression analysis deals with estimating the value of dependent variable on the basis of one or more independent variables. To do so, an equation is developed between dependent and independent variables by means of least square method. Therefore, the regression model should fulfill the required assumptions of least squared methods.

##### 4.2.1.1. Sample Size

According to Tabachnick & Fidel et al (2007) suggestion regression technique is to be used if it satisfies  $N > 50 + 8m$ , where N is number of participants (respondents), m is the number of independent (predictor) variables. For this research there were 5 predictor variables on which 151 respondents were participated. This is number is greater than 90 ( $50 + (8*5) = 90$ ) which was the minimum requirement for the regression model of this research. Therefore, the sample size selected was adequate enough to explain the DV using the five (5) IVs by using the regression model.

##### 4.2.1.2. There should not be Significant Outliers

As seen in figure 3, there were some data outside the box although the midline is approximately laid in the mid-point of the data. The outlier cases with 'o' indicate the presence of insignificant deviation whereas any extreme case would have been identified with an asterisk (\*) (Colin Gray & Kinnear, 2012). From this it can be concluded that there are no extreme cases or scores that are significantly deviate from other observations in the sample data.

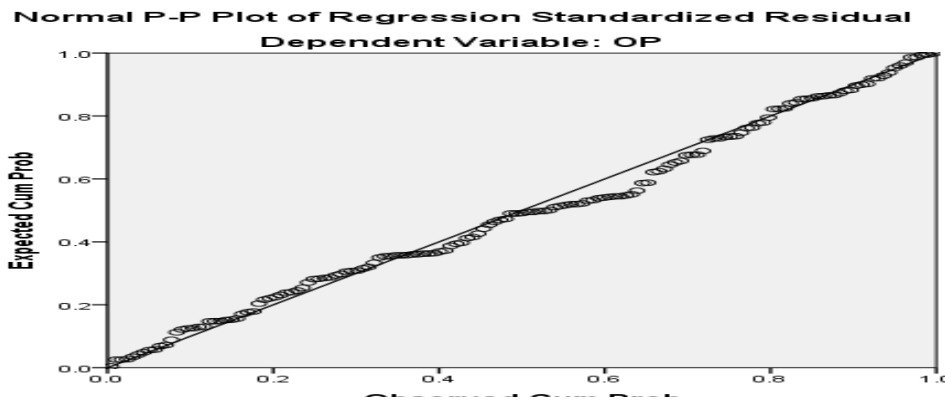


(Source: SPSS Output of the Research Data Analysis, 2019)

##### 4.2.1.3. Linearity Assumption of Parameters

The points roll around the straight line from the origin to the right diagonally. This proved that the parameters of the predictors have linear relation to the value of the predicted value. Therefore, the researcher conducted statistical test to consider whether there is non-linearity relationship.

Figure 4: The Normal P-P plot of Standardized Regression Residual



(Source: SPSS Output of the Research Data Analysis, 2019)

#### 4.2.1.4. The Non-Multicollinearity Assumption

The non-multicollinearity assumption can be tested using tolerance and VIF values. As seen from Table 4, the values of tolerance for all explanatory variables are more than 0.2 with Therefore, in this research the independency of predictor variables is not violated in terms of tolerance test.

Table 4: Collinearity Statistics of Independent Variables

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.488	.251		1.947	.053		
	WRMP	.271	.052	.336	5.163	.000	.706	1.417
	WRUMP	.244	.054	.276	4.535	.000	.810	1.235
	WRCMP	.230	.051	.277	4.538	.000	.801	1.248
	WRVMP	.105	.042	.141	2.480	.014	.926	1.080
	WDMP	.105	.043	.138	2.469	.015	.956	1.046

a. Dependent Variable: OP

(Source: SPSS Output of the Research Data Analysis, 2019)

The VIF for all variables are below 10 for all IVs. Therefore, in this research the absence of multicollinearity of predictor variables is not violated in terms of VIF test.

#### 4.2.1.5. The Mean of the Residuals Should Be Zero

The model is said to be unbiased if the mean or average value of the error (residual) variable is zero (Frost, 2018). The values yield zero value when summed to each other.

Table 5: The Mean Value of Residual Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.8188	4.4171	3.7806	.28235	151
Residual	-.66685	.75567	.00000	.24716	151
Std. Predicted Value	-3.406	2.254	.000	1.000	151

Std. Residual	-2.653	3.006	.000	.983	151
a. Dependent Variable: OP					

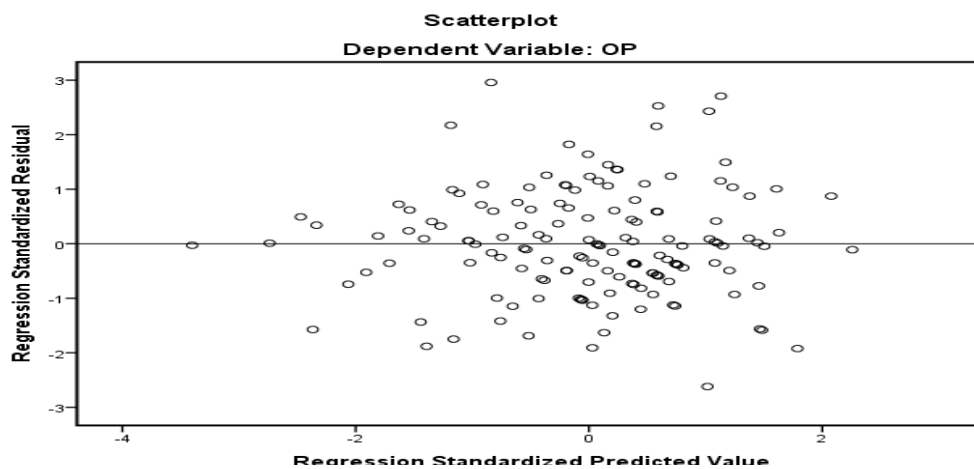
(Source: SPSS Output of Data Analysis, 2019)

The test result shows (Table 5) that the mean value of residual and the standard residual is zero (0). Therefore, the assumption that the mean value of the residuals should be zero is not violated in this study.

#### 4.2.2.6. Homoscedasticity Assumption

Homoscedasticity describes a situation in which the error term or the residuals in the relationship between the independent variables and the dependent variable is the same across all values of the independent variables (Gujarati et al., 2007).

Figure 5: Homoscedasticity Test



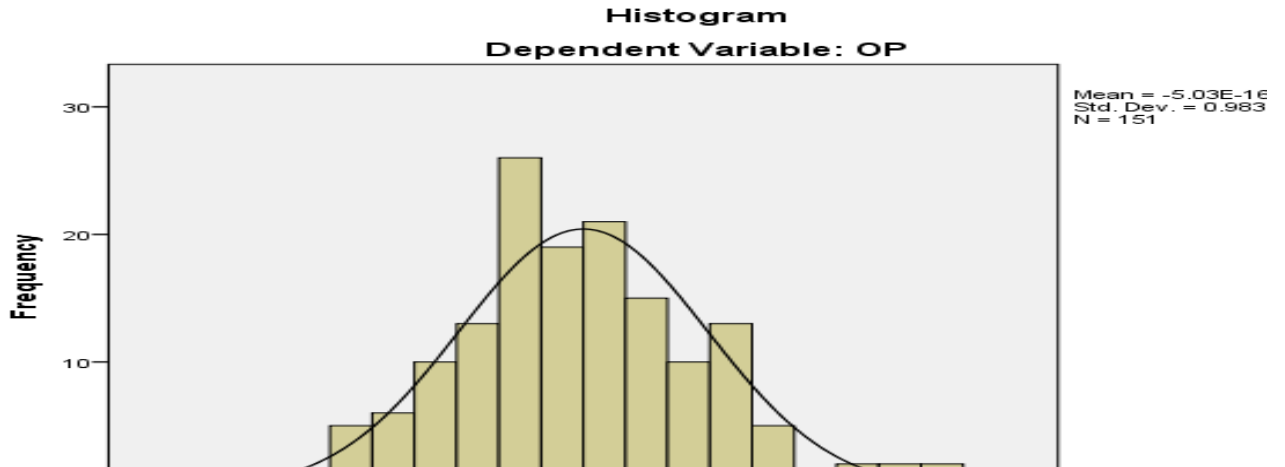
(Source: SPSS Output of the Research Data Analysis, 2019)

As seen in figure 6, the ballpoints on the residual plot appear to be randomly scattered around zero along the fitted (predicted) values along x-axis. The vertical width of the scatter also doesn't appear to increase or decrease across the fitted values (between -3 and 3 with zero (0) at the midpoint). Thus, the residuals do not systematically fall above or below the line across zero. Therefore, this residual plot indicates that the assumption of homoscedasticity was not violated.

#### 4.2.1.7. Normality Assumption

Normality is used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores in the middle, with smaller frequencies towards the extremes (Gravetter & Wallnau, et al., 2000). In this research, normality was tested using the frequency distribution histogram. The frequency distribution of the residuals on the histogram (see Fig 6) is approximately asymmetrical. The data lies between equal distance of -3 and 3. From this it can be concluded that the data distribution was approximately normal for 151 observations.

Figure 6: Histogram (Frequency) for Normality Test



(Source: SPSS Output the Research Data Analysis, 2019)

#### 4.2. Testing the Significance of Regression Model using Variation Measure

The most commonly used variation of measures to determine the multiple linear regression models are the coefficient of multiple determination (R-Squared,  $R^2$  or Adjusted  $R^2$ ) (Frost et al., 2018).  $R^2$  evaluates the scatter of the data points around the fitted regression line.

Table 6: Model Summary for Efficiency Estimation

Model Summary <sup>b</sup>									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig.F change
1	.750	.563	.548	.25660	.563	37.362	5	145	.000
a. Predictors: (Constant), WPDMP, WPRCMP, WPRUMP, WPRVMP, WPRMP									
b. Dependent Variable: OP									

(Source: SPSS Output of Research Data Analysis, 2019)

The  $R^2$  explained about 56.3% of the variation in the operational performance of the sector under study out of the total variation and the rest 43.7% of the operational performance is explained by the others not addressed by this model. The adjusted  $R^2$  compensates for the addition of variables. In the present research  $R^2$  value is 56.3 % and adjusted  $R^2$  value is 54.8%. Here it can be concluded that overall regression model, taken the independent variables together have strong relationship with an effect on the response variable (operational performance).

#### 4.3. Testing the Significance of the Regression Model Using the F-test

For a multiple regression model with intercept, we want to test the following null hypothesis and alternative hypothesis (Zikmund, 2000):

- $H_0: \beta_1 = \beta_2 = \beta_3 = 0$  (No linear relationship between the X and Y; i.e., changes in Y are not related to changes in X).
- $H_a$ : At least one coefficient is not 0 (at least one X variable linearly affects Y i.e., changes in Y are related to changes in X).

The F-test statistic ( $F = 37.362$ ;  $P = 0.001$ ) indicated that the regression model of the study is good at explaining patterns in data because the model was statistically significant with the probability of error at p-value of 1% ( $p = 0.001$ ).

Table 7: ANOVA

ANOVA <sup>a</sup>						
Model		Sum of Squares	Df	Mean Square	F Statistics	Sig.
1	Regression (model)	12.300	5	2.460	37.362	.000
	Residual	9.548	145	.066		
	Total	21.848	150			
a. Predictors:(Constant), WRMP, WRUMP, WRCMP, WRVMP, WDMP						
b. Dependent Variable: Operational performance						

(Source: SPSS Output of Data Analysis, 2019)

Therefore, it can be concluded that the F-test proved that all independent variables jointly have linear effect on the response variable (operational performance). That is the waste magnet practices jointly have large linear effect on the operational performances of the packaging sector under study.

#### 4.4. Testing the Significance of the Regression Model using the t-test

T-test assesses the significance of the relationship (effect) of individual independent variable on the mean value of predicted variable (Zikmund et al., 2000). Therefore, irrespective of their relative importance in predicting the response variable, each independent variable has significance value in predicting the response values. That is each predictor variable (regressor) has linear relationship with the dependent variable.

Table 8: Regression Coefficients

Regression Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t=B/SE	Sig.
		B	Std. Error	Beta		
1	(Constant)	.442	.256		1.727	.086
	WRMP	.276	.054	.337	5.164	.000
	WRUMP	.247	.055	.274	4.493	.000
	WRCMP	.232	.052	.274	4.469	.000
	WRVMP	.109	.043	.143	2.512	.013
	WDMP	.105	.044	.135	2.412	.017

a. Dependent Variable: Operational Performance

(Source: SPSS Output of Data Analysis).

Therefore, it can be concluded that the t-test proved that individual independent variable has linear effect on the response variable (operational performance). Therefore, each WMP taken



individually significantly predicts the operational performance of the packaging sector. That is no predicting variable is rejected from the regression model.

#### 4.5. The Relative Importance of the Predictor Variables

As indicated in regression coefficients Table 8, the waste reduction management practice (WRMP) with *Beta* value of 0.337 is the most important predictor of operational performance followed by waste reuse and recycle management practice ( $B=.274$ ) and waste recovery ( $Beta = .143$ ). Waste disposal management practice (WDMP) with *B* value of 0.137 is the least important predictor.

#### 4.6. The Multiple Linear Regression Equation

The major goal of analyzing regression model is to develop the multiple linear regression model (MLR) which allows us to predict mean values of the predicted dependent variable given values of the independent variables (Fabozzi e tal., 2014, Frost et al., 2018). Accordingly, the following regression model was created based on the unstandardized coefficient (*B*) values (Table 8) to the WMPs of the paperboard (carton) packaging sector of BTA.

$$Y = .442 + .276x_1 + .247x_2 + .232x_3 + .109x_4 + .105x_5,$$
$$R^2 = 56.3\% \text{ (efficiency estimation)}$$

Compared to the previous research results, both present result and previous results indicates that waste management practices have positive relation with operational performance in general. However, the research conducted by Kimeu (et al., 2015) was that the waste management practices have insignificant effect on operational performance of hotels. The present research finding, although in different sector, indicates that waste management practices have significant effects on operational performance of the sector under the study. Therefore, the managements of sector should give due attention to these waste management techniques so as to improve the performance of the sector.

### SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1. Summary of Findings and Conclusions

The Pearson's multiple correlation *r* analysis (zero-order analysis) indicated that waste reduction management practices under the study have moderate positive and significant effect on operational performance but waste recovery management practice and waste disposal management practice have weak positive and significant relation with operational performance. The waste management practices jointly determine the operational performance of the sector under study by 56.3% of coefficient of determination at standard error estimation of 0.2566. The F-test indicates that this efficiency of estimation is significant ( $F = 37.362$ ;  $P = 0.001$ ). The t-test indicates that individual independent variable individually has significant effect on response variable (operational performance). Based on the standardized regression coefficients of the model, the waste reduction management practice (WRMP) with *Beta* value of 0.337 is the most predictor of operational performance followed by waste reuse management practice (274), waste recycle management practice (0.274), and waste recovery management practice (0.143). Waste disposal management practice (WDMP) with *Beta* value of 0.135 is the least predictor of the operational performance in the model.

## 5.2. Recommendations

For a paperboard packaging sector to remain competitive, in addition to manufacturing at a low production cost, they must be able to manufacture quality products and deliver quality services to satisfy the customers, increase sales growth and market share, increase customer satisfaction to retain existing customers and attract new customer, consider environmental sustainability. In this line, the following recommendations were drawn from the foresaid findings and conclusions:

- To reap more benefits, the packaging factories in the sector should clearly segregate the wastes based on the types and purposes of the wastes.
- The factories within the sector should include WMPs to their formal plans to manage their wastes to increase the operational performance of the organization. The packaging factories should also plan to include many of dimensions of the operational performance as the parts of their objectives.
- The factories within the sector have to create training programs to educate the employees and managers regarding the relation between waste management practices and operational performance because about the quarters of the company members have no clear idea regarding this relation.
- The factories have been suggested to give due regards for all management practices under the study although highest attention need to be given to waste reduction management practice.

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