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ELECTRIC POWER OUTAGE DYNAMICS AND FINANCIAL PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

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Abstract

Past literature portrays most manufacturing firms in both developed and developing economies as reliant on electric power supply for their operations. Therefore, occurrences of electric power outage create operational threats to the firms. This study aimed at establishing the influence of electric power outage dynamics on financial performance of manufacturing firms in Kenya. The study utilized positivism philosophical point of view and descriptive survey research design. The null hypothesis which stated that the relationship between electric power outage dynamics and financial performance of manufacturing firms in Kenya is not significant was tested at 95% confidence level whereby multiple regression models were incorporated for data analysis. A population of 447 manufacturing firms in Kenya with membership of Kenya Association of Manufacturers (KAM), was considered for the study out of which a sample size of 138 firms was drawn using stratified random sampling. Structured questionnaires were utilized to collect data which involved drop and pick approach. The research results indicate that electric power outage dynamics had statistically significant influence on financial performance. T-test results indicated that for every unit alteration in power outage frequency, financial performance varied by .332 units which was negative and statistically significant with ($p<05$). Whereas, a unit adjustment of power outage duration translated to .061 unit direct alteration of financial performance of firms in Kenya undertaking manufacturing activities, which was not statistically significant with ($p>.05$). For power outage notification, a unit variation resulted to .032 unit alteration of financial performance of Kenyan based manufacturing firms which was positive and not statistically significant with ($p=.805$). This study outcome enlarges existing knowledge on electric power outage dynamics and financial performance for it is evident that electric power outage dynamics have statistically significant influence on financial performance. Therefore, top management of manufacturing firms should focus on optimal mechanisms for management of power outage frequencies in order to mitigate their negative effect on financial performance. The study also

provides an input to the academic literature arising from assimilation of transformation theory and the cost-of-production theory of value. KAM will find these research findings useful in advocating the Government for better efficiencies in electric power supply systems. Additionally, KAM member firms are guided to adopt strategies to mitigate against negative effects of power outages such as production stoppages that result in damages and increased production costs that ultimately results in negative impact on firms' financial performance.

Keywords: *Electric Power Outage Dynamics, Financial Performance, Manufacturing Firms*

Introduction

Electricity is a fundamental input factor for many production processes and is also the dominant source of energy for manufacturing firms (Karen, Erin & Qiong, 2015). The pivotal role of energy in most production processes renders any deficiencies negative to the firm production efficiencies and further results into a decline in output (Abotsi, 2015). Low supply of electricity is depicted by power reliability problems characterized by power outages and/or power quality fluctuations (Eto, Koomey, Lehman, Martin, Mills, Webber &Worrell, 2001). An electric power outage is a short or long-term loss (supply interruption) of electric power (Eto *et al.* 2001, Fouzul, Dhananjay, Neelotpal & Deepak, 2012). Growitsch, Malischek, Nick and Wetzel (2013) defined power outage as the stoppage of electricity power supply resulting to zero power supply. This anomaly may arise due to either planned or unplanned reasons. A planned power outage is an electricity shortage scheduled by the electricity suppliers and may be as a result of scheduled maintenance or due to a need to address an emergency (Moyo, 2012). A planned outage may also be necessitated by lack of sufficient power generation to meet the full demand of the end users (Scott, Darko, Lemma & Juan-Pablo, 2014).

Electric power outages are characterized by dynamics which may include aspects such as time of occurrence of the outage, length/duration of outage, frequency of outage, source of outage, perceived reliability level of power supply and notification of outage, or lack of it among others (Nooij, Koopmans & Bijvoet, 2007; Alam, 2014 and Singh & Mangat, 2012). Power outages are a major challenge for industrial firms and have negative effect on productivity and performance of firms (Cissokho & Seck, 2013; Allcott, Allan & Stephen, 2014). These effects manifest in various ways within the firm including; effect on firm efficiency, additional costs to the firm's production processes through investment in alternative sources of energy or costs incurred in replacement or repairs of affected equipment due to power outages and, impact on quality of goods or services as a result of power outage (Cissokho & Seck, 2013). Therefore, electric power outage dynamics adversely impact firm performance in a variety of ways (Steinbuks & Foster, 2010).

Planned power outages occur at designated time spans and are usually scheduled in advance and are sometimes accompanied by notifications to power consumers from the power providers. On the other hand, unplanned outage is shortage of electric power that is not scheduled by the providers. The causes of such scenarios could be uncontrollable activities such as cable theft, bad weather, illegal power connections that affect the system, aged power infrastructure that may malfunction and other human activities such as excavation or physical developments in affected areas (Simonoff, Zimmerman, Restrepo, Dooskin, Hartwell, Miller, Remington, Lave & Schuler, 2005). Unplanned power outages are not anticipated and randomly affect electricity end users resulting in numerous damages of equipment, hence resulting in further consequential losses such as loss of business opportunities, lost production time and loss of expensive raw materials (Bawuah & Anaman, 2018). Negative effects of power outages are

experienced by both domestic and commercial customers (Singh & Mangat, 2012).

Power outages may be defined based on fluctuations of electricity supply in a certain locality (Schoeman & Saunders, 2018 and Moyo, 2012). Power outage frequency is how often service is interrupted. This may be defined based on the number of occurrences over a specific time period, either per day, week or on monthly basis. Any frequency of power outage is undesirable; however, higher frequency of the outages increases the unreliability of power and may result in significant effect on business operations.

Outage duration measures the amount of time that curtailed supply of electricity is experienced by individual or commercial customers (Fisher-Vanden, Mansur & Wang, 2015). Power outage duration is the amount of time spent without electric power. The duration of the power outage is known to determine the costs of the interruption to firms (Nooij, Koopmans & Bijvoet, 2007). Power outage frequencies and the duration are characteristics that are known to trigger considerable strains for some industries, mainly those that rely on electricity as a major input resource (Frederick & Selase, 2014).

Power outage notification is an advance communication to end users of electric power within a reasonable duration before the power outage. A notification before an interruption lowers the consequences of that interruption (Nooij, Koopmans & Bijvoet, 2007). Outage notification alleviates negative effect of power outage by businesses as they are provided the opportunity to shift to alternative power sources such as generators, or safely discontinue operations, thus reducing or eliminating damage to semi-finished goods and reducing wasted manufacturing time. On the other hand, unmitigated loss due to lack of notification may cause various damages that may affect product quality and cause significant increase in costs of operations (Lai, Yik & Jones, 2008).

The time that an electric power outage occurs is also a component of electric power outage dynamics. This perspective refers to the timing of blackout occurrence whether planned or unplanned (Frederick & Selase, 2014). The timing of the occurrence can be either during the day, evening or night. Further, it can occur during the working days from Monday to Friday or it can occur over the weekend, that is on Saturday or Sunday. The time power blackouts occur has diverse implications such as the number of users affected and the costs thereof. For instance, it is expected that if power outage occurs during the day, commercial enterprises will be more adversely influenced as compared to domestic users of electric power due to heightened operations at that time of the day. In the study of Schoeman & Saunders, (2018) for example, it was revealed that in Ireland, firms engaged in industrial activities lost more of their value load in the middle of the week between eight am and six pm in the evening as compared to domestic users of electric power.

The interface between electric power outage dynamics and performance is underpinned by both cost-of-production theory of value by Adam Smith (1937) and transformation theory of Shepherd, 1970's. Under cost of

production theory of value, Smith (1937) advocated that price of any good or service is the summation of the total cost of all the resources that went into making that particular product. Such that, the individual components of the total cost could be any of the factors of production such as labor, capital or land and taxation. Therefore, the long run price of a commodity is equivalent to the sum of the cost of inputs whether intended or unintended such as power outage related costs. This implies that the lower the total cost of production incurred, the lower the price charged to the end users of that product. Since electricity is a mainstream input to the manufacturing industry, electricity generation at lower marginal cost is an assurance of competitive output prices of manufactured goods, which leads to increased productivity and profitability levels of the manufacturing firms. The theory underpins the conceptual link of electric power outage dynamics and financial performance of firms for the dynamics of outages such as power outage frequency, time of outage, duration of power outage and outage notification has diverse cost implication which result to increased output prices which may adversely influence profitability of the firms. Further, transformation theory of (Shepherd, 1970) is also a dominant production theory in use today. The theory is based on Input, Process and Output (IPO). The theory seeks to optimize the production system towards optimal firm performance and consequently, higher customer value. Firm performance is the firm's effectiveness and efficiency in which it conducts its affairs (Chakravathy, 1986). Organizational performance is defined as a set of fiscal and non-fiscal parameters on the level of attainment of objectives and outcomes (Lebans & Euske, 2006). Barney, (2011) contends that firm performance is aimed at provision of financial earnings, return on investment (ROI), economic fees or shareholder earnings. Assessment of firm performance remains an argumentative issue amongst researchers. Some studies gauge performance with a single measure, yet epitomize this notion as unidimensional (Glick, Washburn & Miller, 2005). For instance, the Accounting affiliated indicators utilized to gauge financial performance are varying and some of those proxies are; return on equity, earnings per share, and return on assets (Al-Malkawi, 2007). Although most studies are in agreement that performance cannot be fully explained by a single measure due to various organizational objectives as well as contextual factors, this study considered the financial based Return on Assets to measure performance of firms in the manufacturing sector in Kenya, which are also members of Kenya Association of Manufacturers (KAM). The choice of this class of firms is backed by the following reasons: First, electricity is a major input of the firms' production processes, therefore a disruption in electricity supply has significant impact on the operations of the firms and second, manufacturing firms in Kenya comprise of firms in varying categories of industries that provide a heterogeneous analysis of impact of electric power outage dynamics on the performance of firms.

Literature Review

The aspect of electric power outage dynamics has become a matter of great concern to most of the users of electricity. Efforts to

determine the economic implications of EPOD by scholars resulted to diverse research findings. For instance, Siddiqui, et al. (2012) explored the cost of energy not served in Pakistan that occurred due to power outages. The study utilized survey technique and was carried out for four major industrial cities. The aim of the study was; to determine the extent to which energy not served influenced production output of firms in Pakistan; to assess the impact of energy not served on employment level; to examine the impact of energy not served on cost of production and to establish the impact of energy not served on supply of orders. To estimate the impact thereof, output loss was measured using two-dimensional methodologies, one, checking for changes in the duration of outages and second, evaluating changes in the hours of shifts. To select the sample size, stratified random sampling technique was utilized. Hence 339 firms which constituted almost 8 percent of the total population was considered. The survey data revealed that workers did not lose their jobs as the management sought alternative energy arrangements which ensured continuous production, however, the additional source of energy resulted to increased production cost of the firms. Further, energy shortages translated into delayed execution of orders placed for delivery. The study opined that the total industrial production loss fluctuated between 12 percent and 37 percent and that the most affected province was Punjab.

Fisher-Vanden, Mansur and Wang (2015) examined the response level of China based organizations on the electric power scarcity they experienced from 1999 to 2004. The study considered a panel data of twenty-three thousand (23,000) intensive energy user-Chinese firms. The rationale of undertaking such a study was that the Chinese firms once faced by blackouts caused by fast-growing demand coupled with regulated electricity decided to purchase intermediate goods that they previously produced directly and also to improve their efficiencies in technical undertakings. Factor-neutral and factor-biased properties of electricity scarcity was utilized by the study to establish the magnitude of productivity losses incurred. The research findings revealed that firms developed optimization strategies among factors in response to scarcity of electricity by shifting from energy into materials. While outsourcing was expensive, Chinese firms avoided extensive losses in production by adopting the new strategy. Unit production costs increased by 8% as a result of rise in power shortage. Hence, the affected firms preferred to purchase intermediate goods than engage in primary manufacture of raw materials. However, the study did not establish any evidence of those firms increasing their self- generation. Those observations were found to be common with textiles, timber, chemicals, and metals firms.

Growitsch et al. (2013) investigated the values of lost load for data sets of industry and households in Germany in order to estimate the cost of power interruptions for various regions and sectors and for every hour of the year. The outcome of the study was that there existed a serious cost effect of electric power outages that varied significantly over time, between sectors and regions. That is, dynamic Values of Lost Load (VoLLs) varied significantly overtime,

between sectors and regions. On average, total national outage costs amounted to approximately 430 Mio € per hour. Results further emphasized the southern and western part of Germany had the highest estimated VoLLs. The study also quantified the costs of outages through a macroeconomic approach that provided outage cost estimates in different regions and sectors in Germany. In summary, the study established that firms in varying regions and industries were impacted differently by the electric power outages. The study focused on outage costs and did not elaborate the aspects of power outage and the extent this shortfall impacted on performance.

In the study of Frederick and Selase, (2014), the aim was to analyze the influence of electric power variation on small and medium enterprises (SMEs) profitability and competitiveness in Ghana. The country had achieved middle-income status and needed to sustain this condition. The research paper utilized a case study approach with a main target group for the case study being SMEs with operations located within the Accra business district in Ghana. The study utilized cross-sectional survey and systematic sampling technique, that was considered most appropriate to select a sample size of 70 Ghanaian SMEs. The criteria that was used to select an SME firm was the location and dependence on the level of electricity as a major input for business processes. Structured questionnaires were utilized to collect data related to power fluctuations, firm profitability and firm competitiveness. The study outcome was that unreliable power supply resulted in firm's inability to increase the quantity and quality of their products that further led to poor sales and profitability. Hence both Return on Investment (ROI) and Return on Assets (ROA) for the SMEs were adversely influenced by the low profitability levels experienced by the aforementioned firms.

Abotsi (2016) carried out a study to evaluate the effect of power outages on production efficiency of businesses in Africa that included manufacturing, services and retail sectors. The study was based on secondary data obtained from the data bank of the World Business Environment Survey directed by the World Bank. A two-tail Tobit and stochastic production frontier models were used to carry out the data analysis. The outcome of the study indicated that frequent electric outages impacted the production proficiency of African based firms in a negative manner. Cole, Elliott, Occhiali and Strobl (2018) assessed the scope to which power outages impact the turnover for organizations in the African continent. Using World Bank Enterprise Surveys data for 14 countries, it was evident that firms that did not own a generator were more negatively affected in sales due to unreliable power supply. It was established that a downsizing of the expected outage levels to those achieved by the South Africa economy during the study time span would result to the organization's overall turnover rise by 85.1 per cent. This would lead to 117.4 per cent rise for firms without generator facility.

Quarshie, Agyeman, and Bonn, (2017) conducted a study on manufacturing firms listed on the Ghana stock exchange. The study sought to establish whether diverse outcomes were realized in relation to power outage impacts on firm performance. The

population used was all the manufacturing companies listed at the Ghana Stock Exchange (GSE) for the period 2007-2013. Quantitative data analysis was utilized through descriptive statistics, averages and variances to make conclusions. It was discovered that the difference in Return on Equity (ROE) for power outage and non-power outage years, were not significant and that power outage did not affect ROE of manufacturing firms. On the other hand, power outage had effect on asset management ratio or asset turnover ratio of manufacturing firms. ROA ratio of manufacturing firms was higher in non-power outage periods than during power outage periods. The paper concluded that power outages in the short run, do not explain much of the gap in productivity and that manufacturing firms in the long run maybe affected by power outages.

Research Problem

The linkage between electric power outage dynamics (EPOD) and financial performance of manufacturing firms has resulted to mixed debate amongst scholars over the years. The conceptual implications and the methodology used to assess the extent to which these dynamics influence firm productivity is yet to be resolved. Studies on the extent to which electric power outages affects performance of firms have been carried out in well-developed economies including Germany, China, India and Pakistan. Whereas little attention has focused on few developing countries in Africa with the exception of Nigeria, to which a considerable number of studies have focused. Growitsch, Malischek, Nick and Wetzel (2013) in a study which was conducted in Germany established that a significant effect of cost increase in firms was experienced as a result of power outages. The costs varied significantly over time, between sectors and regions. Siddiqui et al. (2012) in a study of four major industrial cities in Pakistan identified industrial loss, delay in delivery of supplies and increased costs as major negative impacts of unreliable power, however, employment was not negatively affected by investment in backup energy. In Africa, a study carried out in Nigeria by Adenikinju (2005) concluded that unreliable electricity imposed significant costs to businesses with most costs relating to investment in backup generators. Contrary, Cissokho and Seck (2013) in a study in Senegal had mixed results; the study established that electric power outage dynamics; frequency, duration had negative consequences on the businesses. Although the influence of the aforementioned electric power outage dynamics was adverse, other studies revealed that a positive impact on technical and scale efficiencies occurred. Studies in Kenya have been very scarce, with the country mainly being included in generalized studies based on panel data sets by Oseni & Pollitt (2013) and Steinbuks & Foster (2010). The studies concluded that firm characteristics influenced firm performance more than power outages.

Research Methodology

This current study made use of positivism philosophical paradigm and descriptive survey research design respectively. A population of 447 firms whose main area of focus is manufacturing in Kenya with membership of Kenya Association of Manufacturers was considered out of which a sample size of 138 firms was selected using

Kate (2006) formula. The sample computation was based on 95% confidence level and (±5%) precision. Structured questionnaires were utilized to collect data which involved drop and pick methodology for five years from 2014 to 2018. Questionnaire return rate was used to present the percentage of the successfully returned questionnaires. Data analysis was undertaken using SPSS computer software version 21 which focused on two perspectives, one; descriptive data analysis, whereby results were presented using two aspects of statistics, one; frequency, percentage, average and standard deviation and two, best of fit tests. Electric power outage dynamics was the predictor variable and was operationalized using power outage frequency, power outage duration, power outage notification and time of power outage. Financial performance was the response variable and was measured using return on Assets.

Validity and Reliability

The questionnaire was constructed to ensure efficient measurement of the variables in the study. Further validation was done through a pilot study of three (3) firms under the research group. The study applied cronbach's alpha coefficient to test the reliability of results.

Questionnaire Return Rate

To determine the questionnaire, return rate, the number of questionnaires received from the respondents as compared to those issued was analyzed and the results indicated in Table 1

Table 1: Questionnaire Return Rate

Particulars	Returned	Not Returned	Distributed Questionnaires
Frequencies	73	65	138
Percentages	53%	47%	100%

Out of 138 questionnaires which were distributed, 73 were returned inclusive of six which were totally spoiled (returned with no useful information). Therefore, 67 were properly filled and returned. This translates to a 51% (73-6)/132) questionnaire return rate. This response rate is acceptable as per Richardson (2005) who regards a questionnaire return rate of at least 50% as being acceptable in social research survey.

Electric Power Outage Dynamics

Electrical Power Outage Dynamics was represented by four indicators; power outage frequency, power outage duration, power outage notification, and time of outage. The study investigated each component of EPOD to establish the general trend within the period given.

Power Outage Frequency

The rate at which power supply is on and off is paramount to manufacturing firms. This is because the more frequent the power outage, the more unreliable it is. Therefore, each firm's officials were requested to give their opinion pertaining the extent to which power outage occurred (frequency) in a month and responses were obtained as represented in Table 2

Table 2: Power Outage Frequency

	Frequency	**Percent (%)**
X<5 Times	25	37
5-10 Times	34	51
11-15 Times	4	6
16-20 Times	1	1
Over 20 Times	3	5
Total	67	100

Majority of the firms (88%), reported up to 10 cases of blackout occurrences in a month, whereas, 12% of the manufacturing firms experienced over 10 outages in a month.

Power Outage Duration

The time span within which the firm experiences power outage is of great concern to most of the players in the manufacturing industry. Responses obtained from firms on the average outage duration in a month is shown in Table 3

Table 3: Power Outage Duration

	Frequency	**Percent (%)**
X<5 minute duration	4	6
5-20 minute duration	20	30
20-60 minute duration	32	48
1-5 hours duration	9	14
Over 5 hours duration	2	2
Total	67	100

84% of the firms in the study experienced power outage for less than one hour. 14% of the firms experienced power outage for between 1 and 5 hours, while 2% of the firms had outage of over 5 hours for each outage in an average month.

Power Outage Notification

Making users of electric power aware of scheduled/predictable power outage is valuable. This is because early alerts enable the users to make alternative arrangements to avoid production stoppages. This study endeavored to establish the extent to which manufacturers were notified of an envisaged power outage before it occurred. Using a likert scale of three, the respondents were requested to portray the number of times firms they were working in were notified of power outages in advance. The responses were as per Table 4

Table 4: Incidence of Outage Notification

Notification	**Frequency**	**Percent (%)**
No	11	16
Some times	28	42
Yes	28	42
Total	67	100

From Table 4, 42% of respondents were always notified of foreseeable power outages before they occurred. Notification of outage for 42% of the firms was not consistent, with outage only being communicated some of the time. The result of timely communication of outage provided firms opportunity to put in place coping mechanisms in order to mitigate negative impact of power outages on operations. The remaining 16% of the electric power users did not receive any communication of outages before they occurred.

Average Notification Duration

A further clarification was necessary to know on average the timing of the notifications made by the power suppliers for firms that gave a positive response on notification of outage. Therefore, the current study sought the average time within which the manufacturing firms were notified that there was to be power interruption. The outcomes were presented in Table

Table 5: Power outage Notification

Average Notification	Frequency	Percent (%)
5-60 min	3	6
1-12 hours	11	21
Over 24 hours	38	73
Total	52	100

From Table 5, 27% of firms were notified of an envisaged outage less than 24 hours before the outage occurred, while 73% of firms were informed of an outage over 24 hours prior to the outage. This implies that most manufacturing firms were notified of power outages in fairly good time, hence were in a position to make alternative power arrangements or discontinue operations in a timely manner to prevent damage of equipment and spoilage of raw materials among other negative effects. This action would assist in ensuring that there were minimal operations interruptions that would adversely affect performance.

Time of Power Outage

The time of outage was also a focus of the current study. The aim was to establish the implications of power outage on performance depending on when the outage occurred. Manufacturing firms in Kenya have varying operating times. Some firms operate for 24 hours a day, 7 days a week, others have operations between 8 and 12 hours or more per day. This study sought to capture the time of occurrence of outages in order to capture the various operation schedules of the various firms and the impact of power outage based on the time it occurred.

The response pertaining to time of outage is presented in Table 6.

Table 6: Time of Power Outage

Rate of occurrence	Daytime		Evening		Night		Total	
	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	%
None (0)	27	20.3	57.0	43.0	87.0	66.7	171	57.57
1-5 times	103	77.4	74.0	56.0	44.0	33.3	121	40.74
5-10 times	2	1.5	1.0	1.0	1.0	0.0	4	1.347
10-15 times	1	0.8	0.0	0.0	0.0	0.0	1	0.337
Total	133	100	132	100	132	100		

Most firms had a combined experience in time of power outages, recording outages in all three time classifications (daytime, evening or night), for both weekdays and weekends. For all categories of time, that is day, evening and night, there were very low incidents of power outage depicted by the fact that power outage hardly exceeded 5 times in a month. This provided sufficient opportunity for firms to carry on production shifts in the day, night or both.

Financial Perspective

The study further interrogated the financial performance trend for the manufacturing firms in Kenya for five years from 2014 to 2018. Descriptive data analysis from the data provided by the respondents was as shown in Table 7

Table 7: Financial performance

Var	n.	Mean	SD	CV	Min	Max	Sk	Kurt
ROA	67	13.986	14.358	102.7	21.85	56.67	0.142	4.554

The average return on assets among manufacturing firms was about 13.98%. Return on Assets among the firms had a variation of 102.7%. Return on Assets had a skewness value that is close to zero and a kurtosis value that is close to three. Therefore, it is likely to be normally distributed.

The linear regression function established for this study was as follows:

$$\mathbf{FIN = \beta_{10} + \beta_{11}OF + \beta_{12}OD + \beta_{13}ON + \beta_{14}TO + \varepsilon it},$$

Where;

FIN is financial performance of firm i in time t

OF is Power Outage Frequency of firm i in time t

OD is Power Outage Duration of firm i in time t

ON is Power Outage Notification of firm i in time t

TO is Time of Power outage of firm i in time t

β_{10} is the regression constant or y intercept

$\beta_{11\text{-}14}$ are regression coefficients of OF, OD, ON, and TO respectively.

ε_i is the random error term

Data analysis was performed to establish the association between electric power outage dynamics and financial performance using multiple regression models

Results and Discussion

Table 8: Regression Analysis Results of OF, OD, ON, TO and Financial Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.321[a]	.103	.045	.10449

a. Predictors: (Constant), TO, OD, ON, OF

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.078	4	.019	1.778	.145[b]
	Residual	.677	62	.011		
	Total	.755	66			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.180	.088		2.049	.045
	OF	-.038	.015	-.332	-2.561	.013
	OD	.008	.017	.061	.468	.641
	ON	.005	.018	.032	.248	.805
	TO	.002	.039	.008	.063	.950

a. Dependent Variable: FIN

The results of Table 8, portrayed that F statistic was 1.778 (p=.145). This implies that the model was not statistically significant at 95% confidence level, and hence it was inappropriate in estimating performance of the firms. The model was further subjected to other goodness of best fit tests namely (R2) and test of the slope (β). The two tests were explained as follows;

Coefficient of determination was (Adj.R^2= .045), which implies that power outage frequency, power outage duration, power outage notification and time of power outage taken together described 4.5% of variations in financial performance of manufacturing firms in Kenya. That is 95.5% of variations of firm performance was described by other aspects that were not incorporated in this model. In addition, test of the slope (the t-

test) was undertaken and the results revealed that for every unit alteration in power outage frequency, financial performance varied by .332 units which was negative and statistically significant with (p<05). Whereas, a unit adjustment of power outage duration translated to .061 unit direct alteration of financial performance of firms in Kenya undertaking manufacturing activities which was not statistically significant with (p>.05). For power outage notification, a unit variation resulted to .032 unit alteration of financial performance of Kenyan based manufacturing firms which was positive and not statistically significant with (p=.805). Lastly, it was revealed that a unit alteration in time of power outage resulted to .008 unit variation which was not statistically significant with (p=.950).

Therefore, the model developed from this analysis was presented as follows;

FIN= .180– .332OF+ .061OD + .032ON +.008TO

Where;

FIN is Financial Performance of organization i in time t

OF is power outage frequency of organization i in time t

OD is power outage duration of organization i in time t

ON is power outage notification of organization i in time t

TO is Time of power outage of organization i in time t

Conclusion

The multiple regression outcome portrayed that the four components of electric power outage dynamics had dissimilar implication on financial performance of manufacturing firms in Kenya. Power outage frequency has statistically significant negative influence on financial performance with (p<.05) while power outage duration had a direct link on financial performance of firms in Kenya undertaking manufacturing activities which was not statistically significant with (p>.05). Power outage notification had a positive association with financial performance of Kenyan based manufacturing firms although not statistically significant with (p=.805). Time of power outage had a positive relationship with financial performance which was not statistically significant with (p=.950). In general, it was concluded that the association between electric power outage dynamics and financial performance of manufacturing firms in Kenya was statistically significant due to significant influence of power outage frequency on financial performance. Nevertheless, the directional variations were guided by the specific electric power outage dynamics components estimating firm performance. Therefore, the study concludes that managers in manufacturing firms should provide strategies for mitigation of power outages due to its negative impact on manufacturing firms' financial performance. The strategies adopted should be adequate to safeguard the firms' operations if frequent power outages are experienced. On the other hand, power generation, transmission and distribution firms in Kenya should address power supply problems in order to ensure that efficiencies

are sustained in the country's electric power system, thus ameliorating negative effects of power outages on manufacturing firms' performance. The study findings are supported by Frederick and Selase, (2014), whose aim was to analyze the influence of electric power variation on small and medium enterprises (SMEs) profitability and competitiveness in Ghana. The study outcome was that unreliable power supply resulted in firm's inability to increase the quantity and quality of their products that further led to poor sales and profitability.

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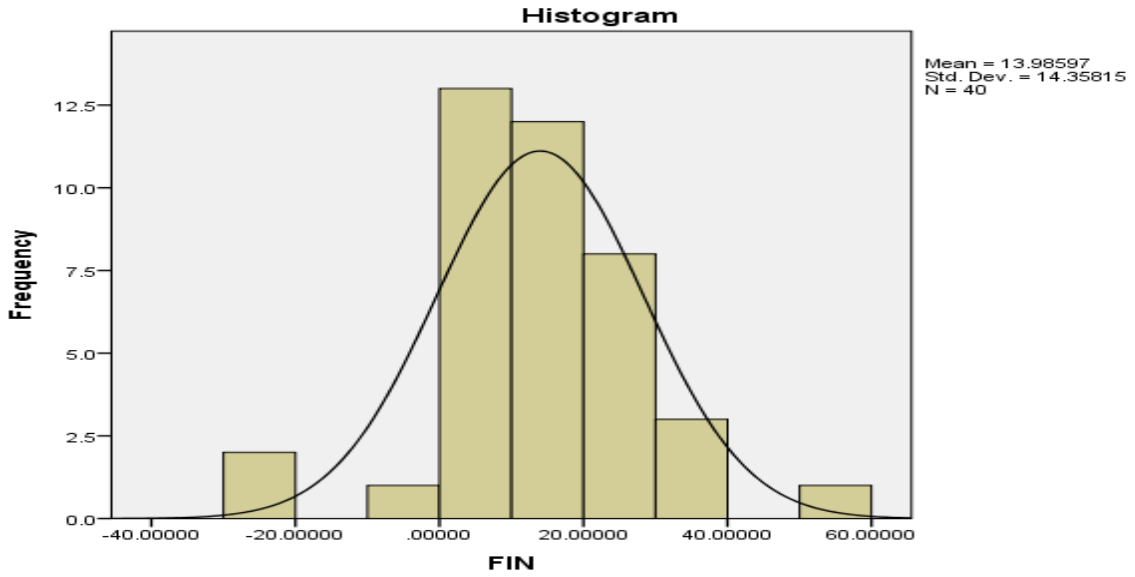
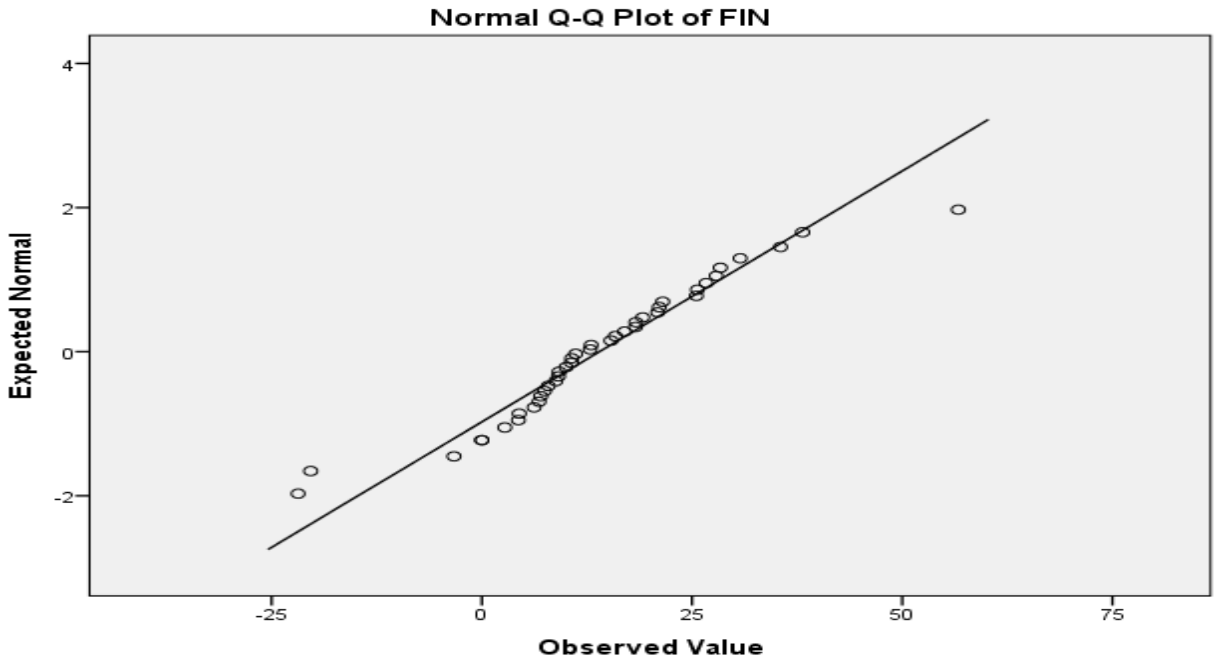
Appendices

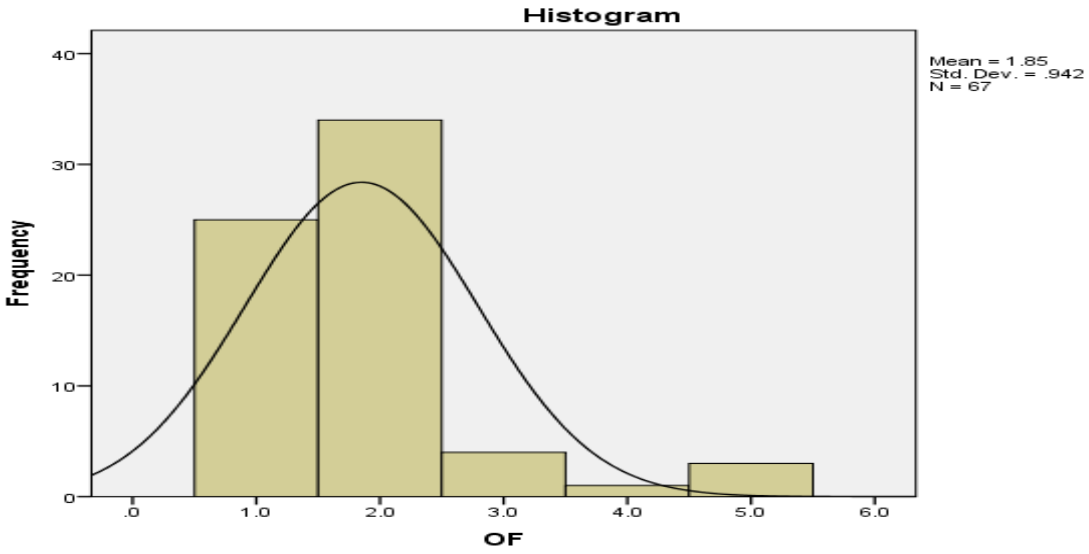
Appendix I: Normality Test Summary for Individual Study Variables

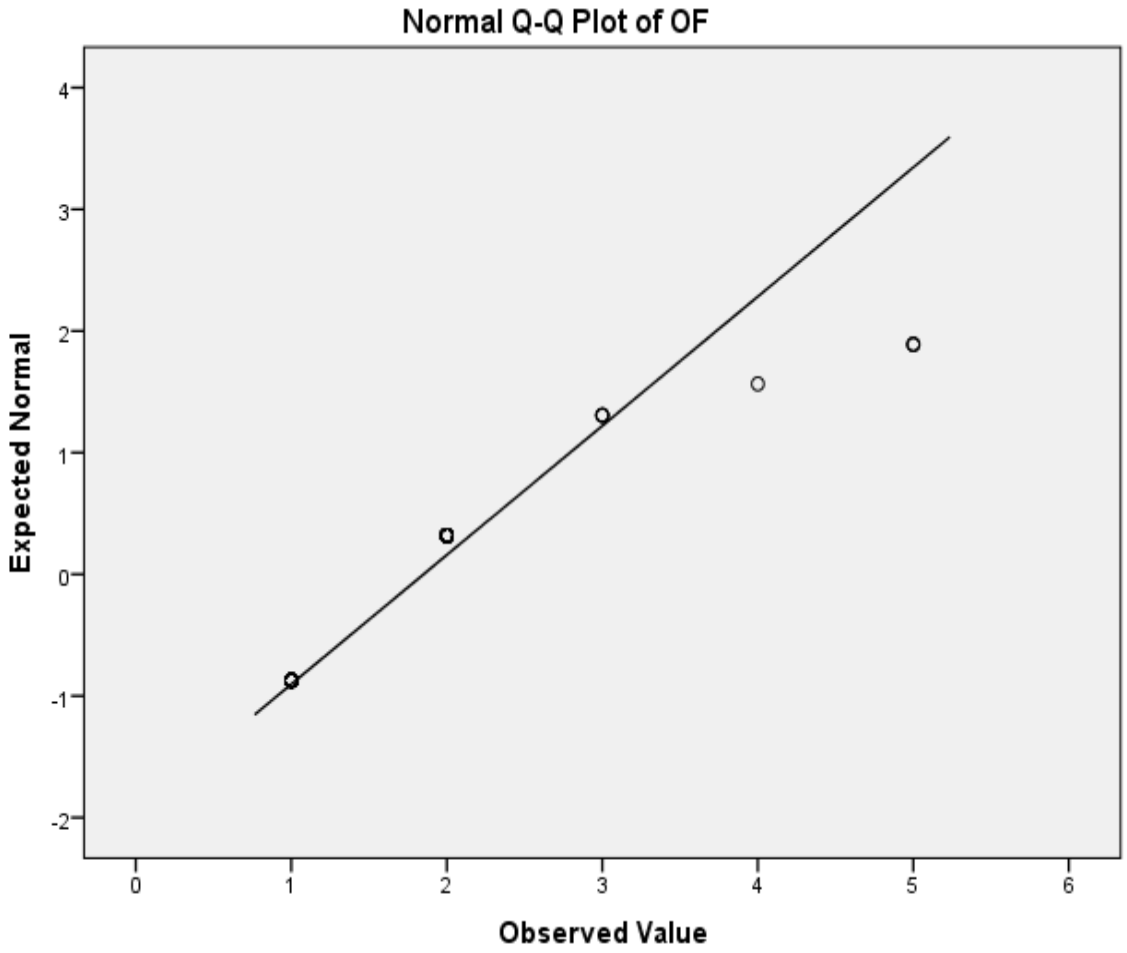
Financial Performance



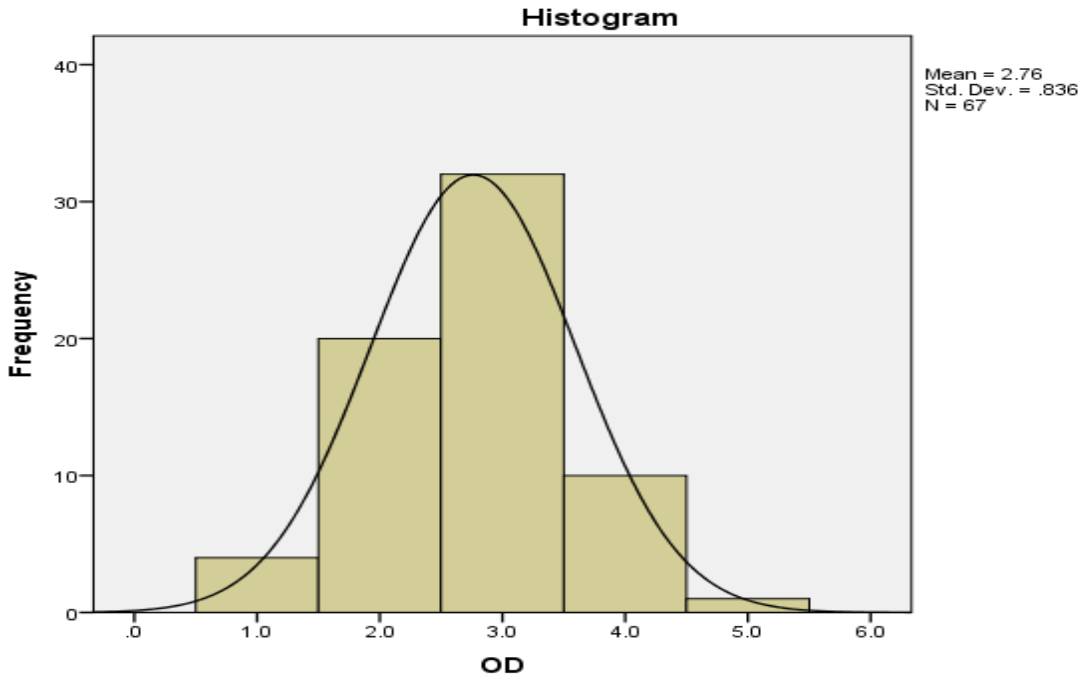


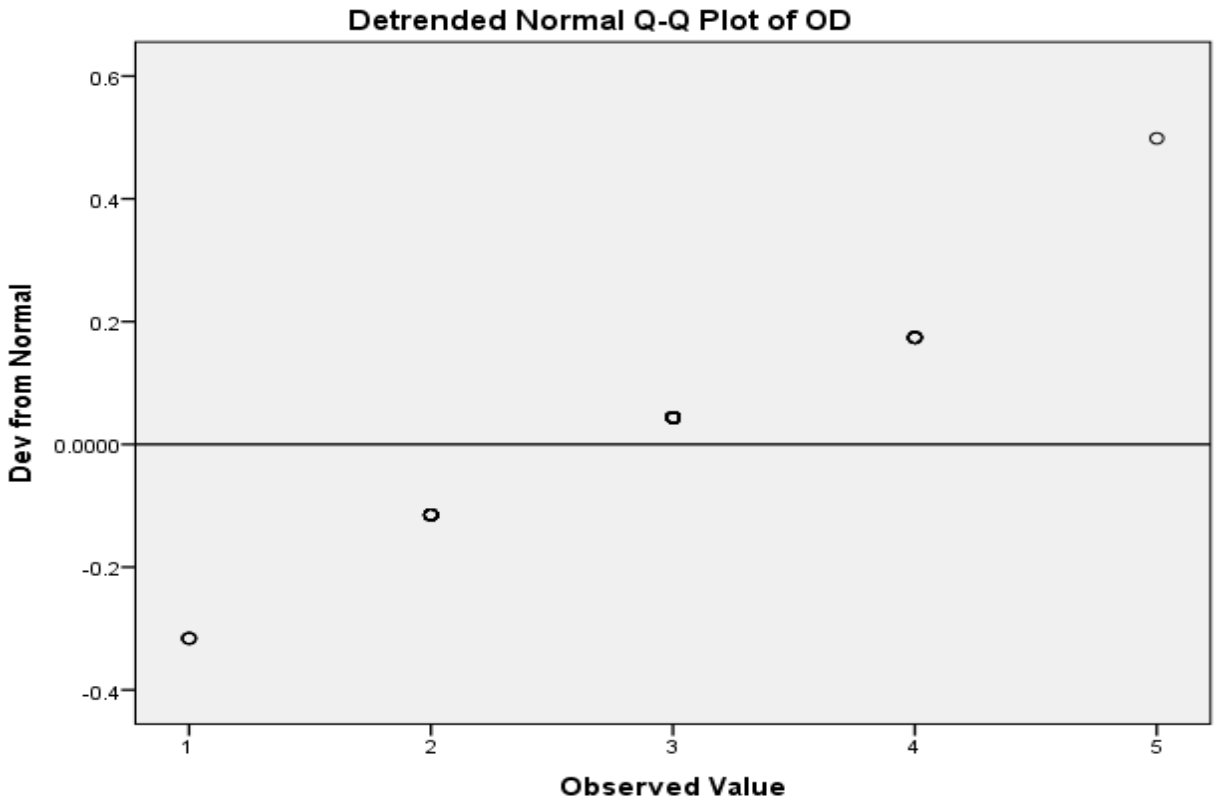
Power Outage Frequency



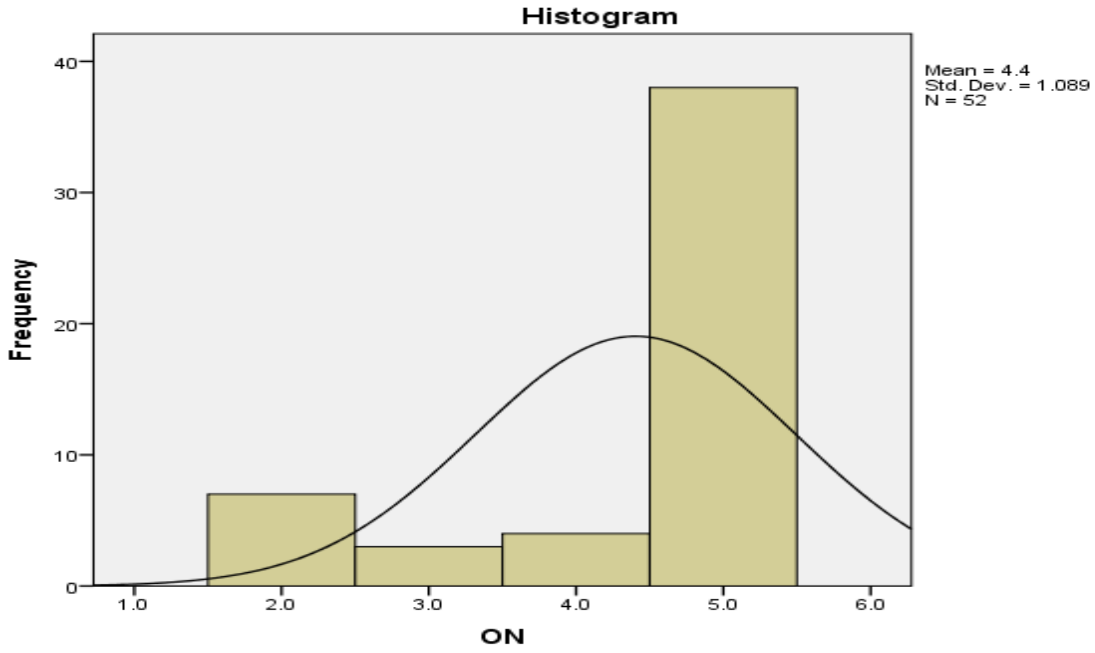


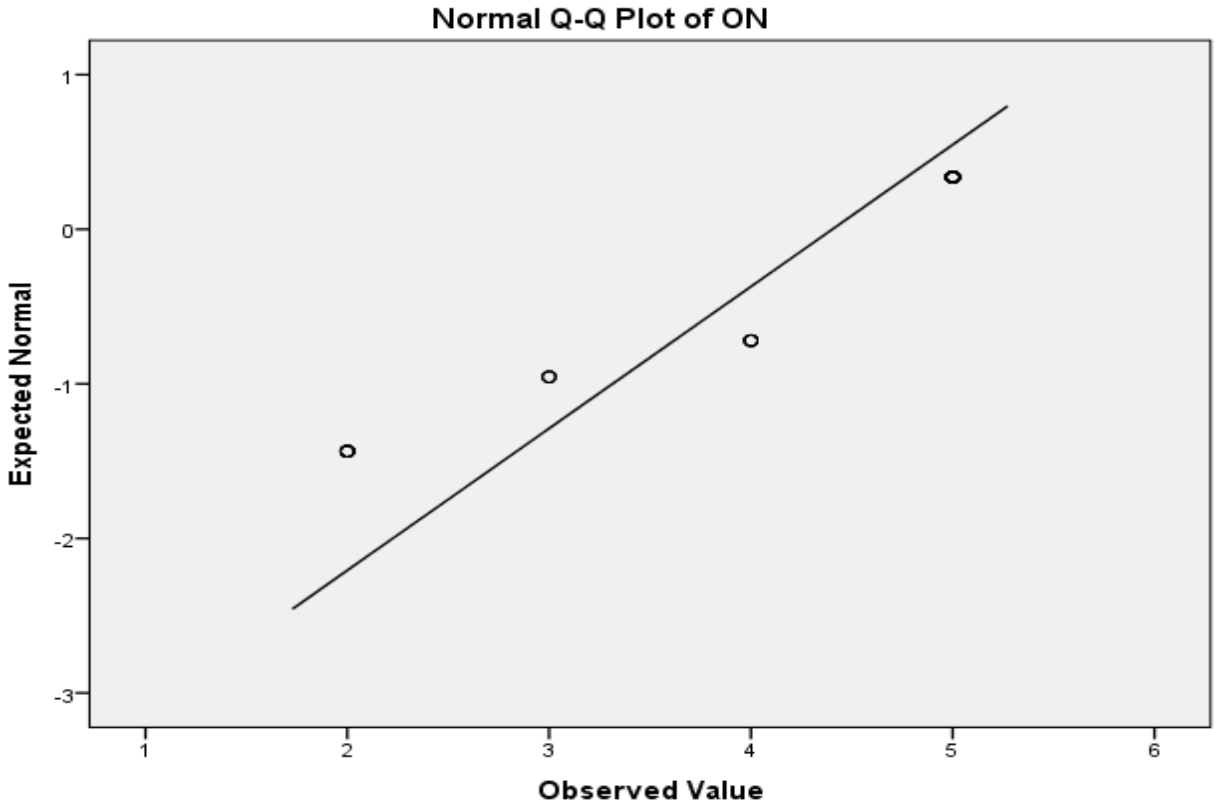
Power Outage Duration





Power Outage Notification





Time of Power Outage