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Relationship between Power Supply Interruptions and Financial Performance of Manufacturing Companies in Machakos County

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Abstract

The importance of power supply to economic development of any nation cannot be overemphasized. Availability and access to reliable electricity supply has a rippling effect on productivity of manufacturing firms. Unreliable power leads to disruptions in production, loss of perishable goods, damage to sensitive equipment and loss of orders. The study examined the relationship between power supply interruptions and manufacturing companies' financial performance in Machakos County. The study employed descriptive research design. The population for this study constituted the 69 manufacturing firms in Machakos County. The study found that scheduled maintenance and financial performance are positively and significantly related. Equipment vandalism and financial performance are negatively and significantly related. It was also established that response time and financial performance are positively and significantly related. Repair costs and financial performance are negatively and significantly related. In conclusion, electricity is necessary for the operation of any manufacturing company and any interference with electricity supply makes manufacturing companies run into serious losses. The financial performance of manufacturing companies in Machakos County are always affected by; scheduled maintenance by power utility, vandalism of electrical equipment, the response time by power utility staff to restore power and the cost the companies incur in terms of paying losses as a result of damage caused by power outage. Due to the important nature of electricity in the manufacturing industry, there is need to create clear policy framework protecting manufacturing companies from regular power outage which has an adverse effect on the operations of the manufacturing companies in the country. Scheduled maintenance by should be done in such a way that it does not interfere with the normal operations of manufacturing companies. The government and

the utility company should ensure that there are vigilant groups are formed to safe guard power equipment and power lines against vandalism which has become a major setback to the utility company in its attempt to maintain constant power supply.

Keywords: *scheduled maintenance, equipment vandalism, response time, interruption repairs, financial performance, manufacturing companies, Machakos County*

1.1 INTRODUCTION

Power interruption is a challenge in many developing nations. Power interruption negatively impacts firm production in Sub-Saharan Africa and developing nations. Power interruption is linked to low production capacity, poor infrastructure and over reliance on hydro power (Alam, 2013; Moyo, 2013). Economies are dependent on sustainable power supply for manufacturing process. A failure in the power supply system tends to propagate the ripple effect rapidly to other infrastructure sectors. The ripples of electricity supply shocks often reach beyond their first-order effects. This shows that the socio-economic cost of power interruptions is a lot when the cascading effects and interdependencies among infrastructures are considered (Kjølle, Utne & Gjerde, 2012).

Power supply interruption can occur due to scheduled maintenance and unscheduled outages. The scheduled interruption occurs mainly to carry out periodic maintenance of the power supply infrastructure. However unplanned interruption is caused by unpredictable events such as storms, accidents, vandalism and equipment failure. The intent of periodic maintenance is to keep the flow of electricity in steady supply free from unpredictable interruptions (Enofe & Aimienrovbiye, 2010). The scheduled maintenance activities should always be performed periodically for surety that the power supply equipment is on the right conditions (Akiri, Ijuo & Apochi, 2015). The maintenance requirements of the different components of the transmission network vary both in terms of the number of weeks required in performing them and their urgency (George, 2012). However, in the process of doing periodic maintenance, there is always power interruption that interferes with operations of a manufacturing company.

Another cause of power interruption is vandalism. Vandalism of electricity transmission equipment in Kenya has become a menace and a costly affair to the society in terms of safety and low economic activities (Bill, 2014). Particularly, transformer vandalism has been on the rise and happens almost everywhere within the country (Dzansi, Rambe & Mathe, 2014). As the nation continues to grapple with persistent power outages and unreliable electricity supply, this critical electricity sector is currently beset by the twin problems of theft and vandalism of its transformers and power-line cables (Korir & Ayienga, 2014). Vandalism of electric equipment is catalyzed by the existence of a "market" for the stolen items. Sometimes these stolen transformers and other equipment surprisingly turn up for supply by contractors in the same electricity sector (Amadi, 2015). The damage to these electricity supply equipment attracts costs to both the supplier of power and the consumer. Power consumers then pay for maintenance or replacement of electrical equipment through operation and maintenance costs which is factored in the tariffs.

Power failures can occur under a variety of circumstances. Many power outages are of a short duration (a few seconds or less) and generally present as an inconvenience rather than a danger (George, 2012). More serious outages can have dangerous or unpredictable consequences and are often the side effect of another emergency (Aghion & Holden, 2011). While power failures are unpredictable, they are also one of the easiest emergencies to be prepared for. The response time to power outage by Kenya Power and Lighting Company Limited is not always short (Korir & Ayienga, 2014). The manufacturing company might need to wait for long for supply in the company to be restored. Long waiting without power costs the manufacturing firms delayed production and opportunity costs.

The cost of interruption escalates the costs of production of manufacturing companies. The annual costs from unexpected interruptions are determined by four variables: Failure rate, repair time, load and specific interruption cost (Ghajar & Billinton, 2009). The customer surveys show that the cost per interruption has considerable variation depending on the time of occurrence (Kavishe, 2015). On average for the industrial and commercial sectors in Kenya, the cost of repairs tends to shoot up depending on the damages caused by power interruptions. There is a strong positive correlation between the number of failures and cost per interruption.

A notable impact of power interruption has on business activities is operational cost. Cost is a variable contribution to the estimation of benefit. Profit is just feasible where cost of generation is less than the input amount. As a fixed cost, firms accessing reliable power supply realize stable increasing profits (Andersen & Dalgaard, 2013). Low levels of power infrastructural facilities drive up costs of accessing electricity for most manufacturing firms. As a result of power instability, manufacturers are slammed with increased operation and maintenance costs (Lai, Wang, Burgos, Pei, Boroyevich, Wang & Karimi, 2008). This increase in costs as a way of identifying expenses as a result of power efficiencies is valuable in manufacturing companies' growth (Haanes *et al.,* 2011).

In Kenya, power interruptions result to 7% lost private sector sales revenue translating into 2% of total Gross Domestic Product (GDP) and 1.5% of GDP growth (Ministry of Energy, 2011). Despite the fact that generation capacity is not the only source of power disturbances, outdated power infrastructure has led to unreliable power supply. With the power requirement projected to rise by 6% annually by 2019 (ERC, 2016), power supply should be increased or else the manufacturing industry would be impacted negatively (Ministry of Energy, 2011).

The manufacturing sector real value added rose by 0.2 per cent in 2017 compared to a growth of 2.7 per cent in 2016. Output volume of the sector however, declined by 1.1 per cent mainly on account of reduced production of food products, beverages, tobacco, leather and related products, rubber, plastics and non-metallic minerals sub sectors (Economic Survey, 2018). This can also be linked to a decline production costs arising from higher cost of petroleum and electricity inputs. Therefore, adequate, quality and

reliable power supply as well as affordable electricity is key to boost the manufacturing sector's growth (Panteli & Mancarella, 2015).

A strong manufacturing base for any economy is the foundation upon which long-lasting economic frameworks are made. Therefore, for Kenya to achieve the intended growth of GDP contribution of 15% by 2025, focus on manufacturing sector and enabling its competitiveness globally is critical. From Vision 2030, the role of the manufacturing sector is to create employment and wealth with an overall goal to increase its contribution to the GDP by at least 10% per annum (Kenya Vision, 2030).

Machakos County hosts many manufacturing companies from different sectors especially the energy intensive industries namely cement and steel. These companies in Machakos County rely heavily on electricity for their daily operations. They are supplied at different voltages by the power utility i.e. 66kV, 33kV, 11kV and 415 Volts. In this study, the focus will be on industries supplied at 11kV and above. The proximity to these companies and the vastness in terms of their operations is ideal for this study to get a relationship between power supply interruptions and financial performance. According to Economic Survey 2017, the number of power interruptions in manufacturing sector rose from an average of 7 cases a month in 2015 to an average of 13 cases a month in 2016. In 2016, the manufacturing sector lost an approximated KES 35million as a result of power interruptions (Department of Trade, Economic Planning, Investment and Industrialization, 2017). As a result perpetual power interruptions undermine financial performance of manufacturing companies.

1.2 Statement of the Problem

Power supply in Kenya is generally known for its unreliability and high disruption costs that affect production efficiency and competitiveness (Majiwa, 2014). Unreliable power leads to disruptions in production, loss of perishable goods, damage to sensitive equipment and loss of orders. According to Economic Survey (2017) published by Kenya National Bureau of Statistics, the number of power interruptions in Machakos County sector rose from an average of 7 cases a month in 2015 to an average of 13 cases a month in 2016. Based on World Bank enterprises survey, Kenya has an average of 56 days annually with power interruptions while USA has 1 day in 10 years. More than half of the big firms in Kenya have back-up generators which is an indication of low dependability and reliability of the power supply from the power utility (Public Utility Research Centre University of Florida, 2013).

This study investigates the relationship between power supply interruptions and financial performance of manufacturing firms in Machakos County. Several studies have been done over the impacts of power interruption and survival techniques employed by manufacturing sector in developing economies (Alam, 2013; Reinikka & Svensson, 2002; Fisher-Vanden et al, 2012 and Kavishe, 2015). Other scholars focused on costs of power interruption across the globe (Hamachi La Commare, 2013, Moyo, 2013; and Fernandes 2006). In spite of wide scholarly investigation on power interruptions across the globe, little focus has been done on relationship between power supply interruptions and

financial performance of manufacturing companies. The fills this knowledge gap by focusing on the relationship between power supply interruptions and financial performance of manufacturing companies in Machakos County.

1.3 Objectives of the Study

1. To examine the effect of scheduled maintenance on financial performance of manufacturing companies in Machakos County.
2. To assess the effect of equipment vandalism on financial performance of manufacturing companies in Machakos County.
3. To evaluate the effect of response time on financial performance of manufacturing companies in Machakos County.
4. To analyze the effect of cost of interruption repairs on financial performance of manufacturing companies in Machakos County.

2.0 LITERATURE REVIEW

2.1 Theoretical Literature Review

The theoretical literature review sought to establish theories that informed this study.

2.1.1 Control Theory

Control theory estimates solutions for proper corrective action resulting into system stability. Systems have inputs and outputs related through an equation resulting into a product after processing (Glad & Ljung, 2014). Setting goals, expenses and plans constitute parameters for a control system. Control itself exists to keep performance or a situation inside what is normal, permitted or acknowledged (Dong & Petersen, 2010). Control designed within a procedure is internal in nature. It happens with a mix of interrelated segments, for example, social environmental setting affecting employees' behavior, data is important in control, guidelines and procedures. Internal control structure is a pan showing how internal control comprises of these components (Keitany, 2000). Control theory was therefore applicable since it informs the interruption check controls for revenue generation. Control Theory was thus the main theory informing this study. Control Theory is relevant as it highlights actions to be taken in case there is anomaly in the system. For this case, it shows the corrective action in case there is power interruption in the manufacturing sector.

2.1.2 Transaction Cost Theory

Transaction Cost Economics (TCE) was expounded in the work of Williamson (Williamson, 2010). Essentially, it means that there is a joined group or arrangement of agreements among the different players emerging in light of the fact that it is apparently difficult to have a contract that serves perfectly the interests of managers and agents in a corporate platform. Aghion and Holden (2011) highlight the rationale of a firm's existence in the context of a framework of the effectiveness of internal as opposed to

external contracting. Coase argues that the task of a market costs something and by shaping an association and permitting some expert (a business person) to coordinate the assets, certain advertising costs are spared. The entrepreneur needs to do his capacity at less cost, considering the way that he may get components of generation at a lower cost than the market exchanges which he supersedes. Brown (2008) builds on the earlier works of Coase and gives a justification to the development of bigger firms that basically give their own inner capital market. He expresses that the expenses of any misaligned activities might be lessened by sensible decision of administration structure instead of only realigning benefits and valuing them out.

Transaction cost is relevant to this study as it ensures that Kenya Power's internal as opposed to external contracting ways of improving its operation effectively is to lower the power outage cost. The power supply interruption checks will maximize revenue generation.

2.2 Conceptual Framework

The conceptual framework shows a pictorial representation of the relationship between the study variables. Figure 1 shows the conceptual framework.

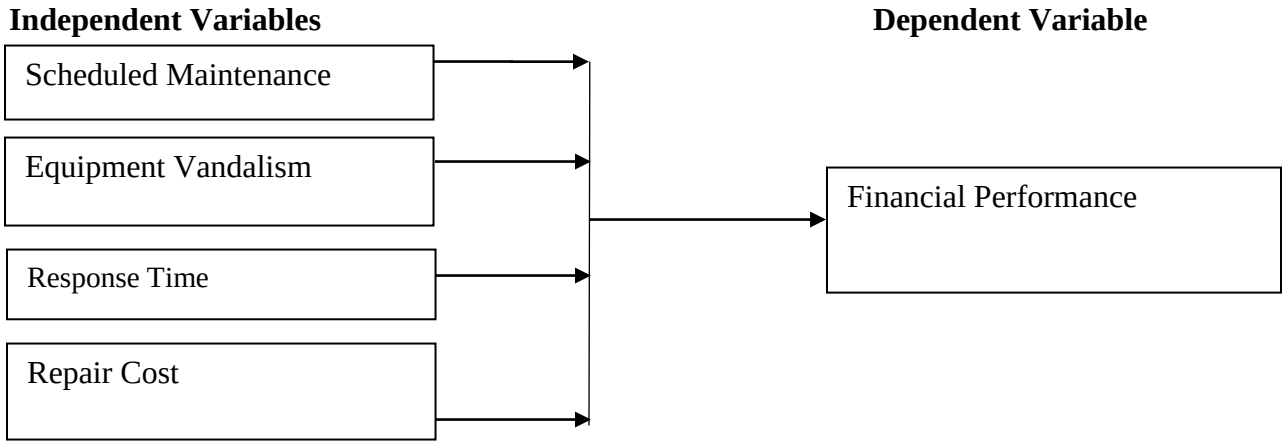

Figure 1: Conceptual Framework

3.0 DATA COLLECTION PROCEDURES AND RESEARCH INSTRUMENTS

The study employed descriptive research design. The target population was 69 production managers, that is, one production manager from each of the 69 manufacturing firms in Machakos County. Since the population is small; this study adopted census approach to obtain data from all the 69-targeted manufacturing firms. Primary data was collected through the administration of the questionnaires. Statistical package for social sciences (SPSS) version 21 was used during analysis. The study generated both descriptive and inferential statistics. Descriptive statistics included percentages and frequencies while the inferential included multiple linear regression model and correlation.

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4.0 RESEARCH FINDINGS AND DISCUSIONS

4.1 Response Rate

The number of questionnaires that were administered was 69 and a total of 63 questionnaires were properly filled and returned but some of the respondents returned the questionnaires unduly filled while others did not return them completely despite a lot of follow up. Out of the 69 questionnaires administered 63 were filled and returned representing 91.3 percent. This response rate is considered satisfactory to make conclusions for the study.

4.2 Descriptive Statistics

This section contains descriptive analysis for scheduled maintenance, equipment vandalism, response time and cost of interruption repairs. A Likert scale was used to present the results. The results were presented in form of percentages, mean and standard deviations. To achieve this, the respondents were requested to indicate their levels of agreement on a five point Likert scale. (1 = strongly agree, 2 = Agree 3 = Neutral, 4 = Disagree, 5 = strongly disagree). For the purposes of interpretation 4 & 5 (disagree and strongly disagree) were grouped together as disagree, 1 & 2 (strongly agree and agree) were grouped as agree while 3 was neutral.

4.2.1 Scheduled Maintenance

The first objective of the study was to examine the effect of power scheduled maintenance on financial performance of manufacturing companies in Machakos County.

Table 1: Scheduled Maintenance

Indicator	strongly agree	agree	neutral	disagree	strongly disagree	Mean	SD
Maintenance duration delays the operations of the company	7.9%	17.5%	12.7%	47.6%	14.3%	3.4	1.2
Our company has a generator which acts as a power backup during maintenance	13.7%	7.5%	15.9%	38.6%	24.3%	2.9	1.4
The company invites the power supply agency to do periodic maintenance	9.5%	20.6%	20.6%	33.3%	15.9%	3.3	1.2
The periodic power maintenance by KPLC minimizes cases of power outage	9.5%	41.3%	15.9%	14.3%	19.0%	2.9	1.3

Table 2 presents responses on the effect of scheduled maintenance on financial performance of manufacturing companies in Machakos County. 25.4% (7.9%+17.5%) of the respondents agreed that maintenance duration delays the operations of the company while 61.9% did not agree to this statement. As to whether the company has a generator which acts as a power backup during maintenance, 21.2% (13.7%+7.5%) of the respondents agreed. This result is in agreement with the findings of Carlsson, Demek and Tesema (2018) from a study on cost of power outages for manufacturing firms in

Ethiopia which indicated that, about 14% of firms owned backup generators that are used during power outages. 30.1% (9.5%+20.6%) of the respondents did agree to the fact that the company invites the power supply agency to do periodic maintenance. Regarding the statement as to whether periodic power maintenance by KPLC minimizes cases of power outage, 50.8% (9.5%+41.3%) agreed. These results concur with the results of the study conducted by Jayalath, Varadan, Wijetunga, Comester, Fernando, Wijeratna and Dinamulla(2012) on economic effect of poor power quality on industry which concluded that, major economic effects of power interruption, both planned and unplanned, is the loss of yield in the industrial sector. The results are also in agreement with the findings of Andersen and Jensen (2014) which indicated that periodic power maintenance helps company minimize cases of power outage. Further the results confirms the findings of Richwine (2004) which concluded that, an hour or day or percent of scheduled outage is normally much less costly (in terms of replacement energy cost) than an hour or day or percent of forced outage, since a generating company attempts to schedule its scheduled outages during periods of minimum demand The mean score of the responses was 3.1 which show that there was a general agreement with the statements on effects of scheduled maintenance on financial performance of manufacturing companies in Machakos County. The standard deviation was 1.3 which shows that the responses were spread around the mean response.

4.2.2 Equipment Vandalism

The second objective of the study was to assess the effect of power equipment vandalism on financial performance of manufacturing companies in Machakos County. The results of this study are as depicted in Table 2.

Table 2: Equipment Vandalism

Indicator	strongly agree	agree	neutral	disagree	strongly disagree	Mean	SD
Rate of vandalism to the electric line within the locality is high	14.3%	42.9%	15.9%	7.9%	19.0%	2.7	1.3
There are security personnel to oversee company's power equipment	15.9%	15.9%	42.9%	15.9%	9.5%	2.9	1.2
The replacement of vandalized equipment, costs the company a lot of money	23.8%	47.6%	14.3%	9.5%	4.8%	2.2	1.1
The company is at times compelled to pay for replacement of electrical equipment	17.5%	28.6%	30.2%	14.3%	9.5%	2.7	1.2
The company has invested in vandalism check devices	17.5%	23.8%	23.8%	12.7%	22.2%	3.0	1.4

Table 2 presents responses on how equipment vandalism affects financial performance of manufacturing companies in Machakos County. 57.2% (14.3%+42.9%) of the respondents agreed that rate of vandalism to the electric line within the locality of Machakos county is high. These results are in agreement with the findings of Onohaebi (2009) which indicated that power equipment vandalism is one of the greatest contributors to frequent power outages facing Nigeria's rural areas. According to the study, vandalism of power transmission lines by unscrupulous individuals for selfish gains is very rampant in Nigeria which is one of the major causes of frequent power outages in Nigeria. 31.8% of the respondents agreed that there are security personnel to oversee company's power equipment. On the question as to whether the replacement of vandalized equipment costs the company a lot of money, 71.4% agreed which is in agreement with the findings of Balducci, Roop and Weimar (2012) which indicated that Industrial operations are highly sensitive to power disruptions. They pointed out that a momentary power outage can shut down manufacturing operations for several minutes or hours. Industrial sector customers experienced lost production, idle facilities and labor, damaged and spoiled product and damaged equipment in the event of a sustained power outage. 46.1% of the respondents did agree to the fact that the companies within Machakos County are at times compelled to pay for replacement of electrical equipment.

Further 41.3% of the respondents agreed that their company has invested in vandalism check devices. The findings agree with Majiwa (2014) who conducted a study on the impact of power transformers vandalism on electricity utility business in Kenya and concluded that, constant vandalism of transformers costs KPLC a lot of money in replacing them. The mean score of the responses was 2.4 which show that there was a general disagreement with the statements on how equipment vandalism affects financial performance of manufacturing companies in Machakos County. The standard deviation was 1.3 shows that the responses were spread around the mean response.

4.2.3 Response Time

The third objective of the study was to evaluate the effect of response time on financial performance of manufacturing companies in Machakos County. The results of this study are as depicted in Table 3.

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Table 3: Response Time

Indicator	strongly agree	agree	neutral	disagree	strongly disagree	Total	Mean	SD
The response time as a result of power outage interferes with company operations	22.2%	15.9%	23.8%	17.5%	20.6%	100.0%	3.0	1.4
At times the company has to wait for more than 24 hours for repair to be done.	22.2%	15.9%	15.9%	23.8%	22.2%	100.0%	3.1	1.5
The company is swift in alerting KPLC in case of power outage	28.6%	22.2%	12.7%	14.3%	22.2%	100.0%	2.8	1.5
The time taken to repair damaged power equipment is relatively high	15.9%	22.2%	12.7%	20.6%	28.6%	100.0%	3.2	1.5

Table 3 presents responses on how response time affects financial performance of manufacturing companies in Machakos County. Thirty eight point one 38.1% (22.2%+15.9%) of the respondents agreed that the response time as a result of power outage interferes with company operations, which is in agreement with the findings of Balducci, Roop and Weimar (2012) which indicated that Industrial operations are highly sensitive to power disruptions. They pointed out that, a momentary power outage can shut down manufacturing operations for several minutes or hours. Industrial sector customers experience lost production, idle facilities and labor, damaged and spoiled product and damaged equipment in the event of a sustained power outage. The results also concurs with the findings of Doe and Asamoah (2014) on the effects of power fluctuations on performance of companies in Accra, Ghana which concluded that the higher the frequency and longer the duration of interruptions, the greater the cost incurred by companies and vice versa and lesser or greater their ability to sustain their production interests. Finally these results are in support of the findings by Clement (2010) on the effects of power outages on production in some selected companies in Benin City which indicated that due to power outage, production targets were not met and equipment were damaged due to fluctuation of power supply. This led to increased cost of production, unemployment, reduced efficiency, poor planning, wastage of material, loss of man hours, discomfort of personnel and poor quality products/services. Another 38.1% of the respondents agreed that at times the company has to wait for more than 24 hours for repair to be done.

On the statement as to whether the company is swift in alerting KPLC in case of power outage, 50.8% agreed, further, only 38.1% of the respondents agreed that the time taken to repair damaged power equipment is relatively high while 49.2% indicated the response time was low. These results concurs with Amadi (2015) that the response time to power outrage in Sub-Saharan Africa was extremely very low with some region staying up to weeks without power. The mean score of the responses was 3.1 which show that there was a general agreement with the statements on how equipment vandalism affects financial performance of manufacturing companies in Machakos. The standard deviation was 1.5 which shows that the responses were spread around the mean response.

4.2.4 Repair Cost

The fourth objective of the study was to analyze the effect of cost of interruption repairs on financial performance of manufacturing companies in Machakos County. The results of this study are as depicted in Table 4.

Table 4: Repair Cost

Indicator	strongly agree	agree	neutral	disagree	strongly disagree	Total	Mean	SD
If the company damages the KPLC equipment allocated within their premises, it incurs the repairing costs	12.7%	15.9%	22.2%	17.5%	31.7%	100.0%	3.4	1.4
The company incurs heavy costs to repair equipment damaged by power interruptions	20.6%	17.5%	15.9%	19.0%	27.0%	100.0%	3.1	1.5
The company loses revenue and opportunity costs when KPLC repairs causes power interruptions in plant.	20.6%	15.9%	20.6%	22.2%	20.6%	100.0%	3.1	1.4
KPLC compensates the company the cost of damaged equipment if confirmed that it was by electric fault from the grid.	25.4%	14.3%	23.8%	17.5%	19.0%	100.0%	2.9	1.5

Table 4 presents to findings on how the cost of interruption repairs affects financial performance of manufacturing companies in Machakos County, twenty eight point six 28.6% (12.7%+15.9%) of the respondents agreed that if the company damages the KPLC

equipment allocated within their premises, it incurs the repairing costs. Regarding the statement that the company incurs heavy costs to repair equipment damaged by power interruptions, thirty eight point one (38.1%) of the respondents agreed which is in agreement with the findings of Carlsson, Demek and Tesema (2018) which asserted that, in many developing countries, firms are suffering from power outages that are both frequent and of long duration, which makes it difficult to plan and undertake production activities as well as make company incur a lot of charges in repairing equipment destroyed during the power outage.

Of the respondents interviewed, 36.5% agreed that the companies within Machakos County loses revenue and opportunity costs when KPLC repairs cause power interruptions in plant, this is in agreement with the report by the U.S energy regulatory authority(2014) that when power outages occur, sites may go down and result in lost customers and lost revenue. When customers can't access company's website, they may have no way to purchase products. This one-time power outage could impact how they perceive the company. A damaged reputation can have long-term effects on the company's revenue. Gaining these customers back might require significant marketing efforts, which can be costly to the company. Further, 39.7% of the respondents agreed that KPLC compensates the company the cost of damaged equipment if confirmed that it was caused by electric fault from the grid. The results are in agreement with Wacker and Billinton (2009) in a study which concluded that the longer the duration of the power interruption, the more the consumers' interruption cost. The mean score of the responses was 3.1 which show that there was a general agreement with the statements on how the cost of interruption repairs affects financial performance of manufacturing companies in Machakos County. The standard deviation of 1.5 shows that the responses were spread around the mean response.

4.2.5 Financial Performance

The study sought to establish the effect on financial performance of companies in Machakos County based on certain key performance indicators. The results of this study are as depicted in Table 5.

Table 5: Financial Performance

Indicator	strongly agree	agree	neutral	disagree	strongly disagree	Mean	SD
Company's net profit has been increasing over the years	20.6%	22.2%	15.9%	20.6%	20.6%	3.0	1.5
The profitability has increased over the years	27.0%	22.2%	19.0%	14.3%	17.5%	2.7	1.5
Operational efficiency has improved	20.6%	12.7%	11.1%	23.8%	31.7%	3.3	1.5
The asset valuation of the company has increased	27.0%	12.7%	25.4%	14.3%	20.6%	2.9	1.5
Market share has improved	22.2%	27.0%	25.4%	19.0%	6.3%	2.6	1.2

Table 5 presents responses on the financial performance of manufacturing companies in Machakos County. Forty two point eight 42.8% (20.6%+22.2%) of the respondents agreed that their company's net profit has been increasing over the years. Regarding whether the profitability of the company has increased over the years, 49.2% agreed. 33.3% of the respondents agreed to the fact that the operational efficiency of the companies in Machakos County had improved while 39.7% agreed that the asset valuation of their company had increased. Further, 49.2% of the respondents agreed that the market share of the company had improved. The mean score of the responses was 2.9 which show that there was a general agreement with the statements on financial performance of manufacturing companies in Machakos County. The standard deviation was 1.5 showing that the responses were spread around the mean response. Figure 2 illustrates the performance of manufacturing companies in Machakos County measured using net profit, market value and asset valuation. The trend analysis shows that net profit, market value and asset valuation were lower in 2013, rose through 2014-2016 but later dropped in 2017. The lower values in 2013 and drop in 2017 could be attributed to frequent electricity interruptions.

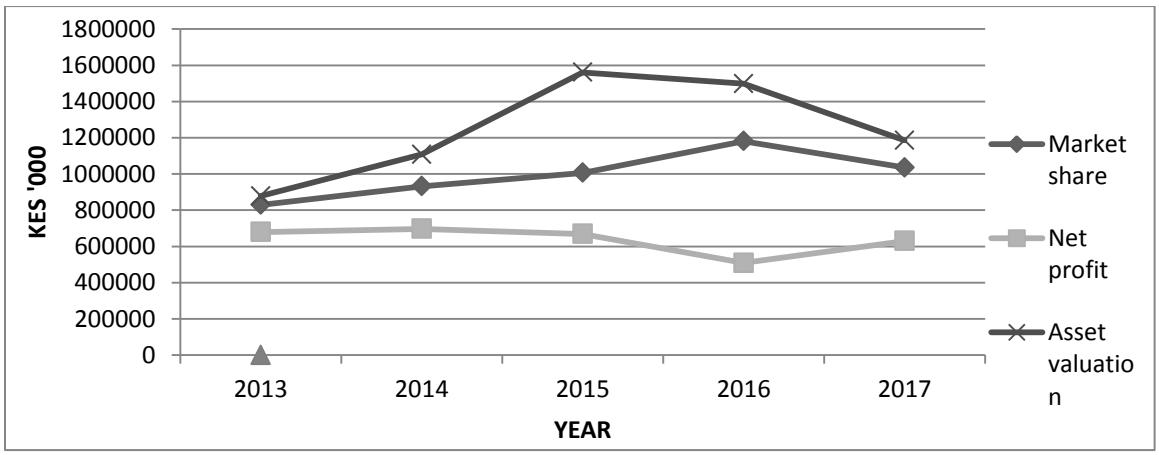

Figure 2: Financial Performance

4.3 Correlation Analysis

Correlation analysis is the statistical tool that can be utilized to determine the level of association between two variables (Levin & Rubin, 1998). Prior to carrying out a multiple regression analysis, a correlation matrix was developed to analyze the strength of association between the independent variables as. A correlation of ±1.0 means there is a perfect positive or negative relationship (Hair et al., 2010). Also, the relationship is considered small when r = ±0.1 to ±0.29, while the relationship is considered medium when r = ±0.30 to ±0.49, and when r is ±0.50 and above, the relationship can be considered strong.

Table 6: Correlation Matrix

Indicator		Financial performance	Scheduled maintenance	Equipment vandalism	Response time	Repair costs
Financial performance	Pearson Correlation	1.000				
	Sig. (2-tailed)					
Schedule maintenance	Pearson Correlation	0.627**	1.000			
	Sig. (2-tailed)	0.000				
Equipment vandalism	Pearson Correlation	-0.556**	-0.514**	1.000		
	Sig. (2-tailed)	0.000	0.000			
Response time	Pearson Correlation	0.599**	.560**	-0.350**	1.000	
	Sig. (2-tailed)	0.000	0.000	0.005		
Repair costs	Pearson Correlation	-0.536**	-0.342**	0.409**	-0.441**	1.000
	Sig. (2-tailed)	0.000	0.006	0.001	0.000	

Results in Table 6 indicated that scheduled maintenance and financial performance are positively and significantly associated (r= 0.627, p=0.000), these results are in agreement with Andersen and Dalgaard, (2013) who in their study concluded that, scheduled maintenance and financial performance of companies in Nigeria have positive and significant association. The results are also in agreement with Simon-Oke and Olayemi (2012) that that frequent electricity maintenance and supply in Nigeria under the reviewed period impacted negatively on the manufacturing productivity growth, due to unnecessary government's spending on non-economic and unproductive sectors. Power supply interruption can occur due to scheduled maintenance and unscheduled outages. The scheduled interruption occurs mainly to carry out periodic maintenance of the power supply infrastructure. However unplanned interruption is caused by unpredictable events such as storms, accidents, vandalism and equipment failure. The intent of periodic maintenance is to keep the flow of electricity in steady supply free from unpredictable interruptions. The scheduled maintenance activities should always be performed periodically for surety that the power supply equipment is on the right conditions. The maintenance requirements of the different components of the transmission network vary both in terms of the number of weeks required performing them and their urgency. However, in the processes of doing periodic maintenance, there is always power interruption that interferes with operations of a manufacturing company.

The results further indicated that equipment vandalism and financial performance are negatively and significantly associated (r= -.556. p=0.000), the results concur with the findings by Majiwa (2014) which indicated that; KPLC equipment vandalism and financial performance of companies are negatively and significantly associated. The results agree with Amadi (2015) that inadequate power generating capacity, vandalism; weak and dilapidated electrical transmission and distribution network, inadequate power infrastructure facilities, etc. are the chief causes of incessant power outages in the Port Harcourt metropolis. The results are also in agreement with Dzansi, Rambe and Mathe (2014) that personal traits (employee perceptions and attitudes), organizational factors (such as organizational climate) constitute presage factors that trigger psychological dispositions to rob the company of its material assets (copper cables) in general and ultimately steal and vandalize copper cables in particular. Vandalism of electricity transmission equipment in Kenya has become a menace and a costly affair to the society in terms of safety and low economic activities (Bill, 2014). Particularly, transformer vandalism has been on the rise and happens almost everywhere within the country (Dzansi, Rambe & Mathe, 2014). As the nation continues to grapple with persistent power outages and unreliable electricity supply, this critical electricity sector is currently beset by the twin problems of theft and vandalism of its transformers and power-line cables (Korir & Ayienga, 2014). Vandalism of electric equipment is catalyzed by the existence of a "market" for the stolen items. Sometimes these stolen transformers and other equipment surprisingly turn up for supply by contractors in the same electricity sector (Amadi, 2015). The damage to these electricity supply equipment attracts costs to both the supplier of power and the consumer. Power consumers then pay for maintenance or replacement of electrical equipment through operation and maintenance costs which is factored in the tariffs.

Further results indicated that response time and financial performance are positively and significantly associated (r=.599, p=0.000), the results are in agreement with Gitura (2012) which reported positive and significant association between response time to power outage and the financial performance of manufacturing companies in Kenya. The results also agree with Kile and Skowronski (2010) who conducted a study on the impact of 2010 power outages on public health and emergency response in USA and the study established that response time to power interruption was a problem. Power failures can occur under a variety of circumstances. Many power outages are of a short duration (a few seconds or less) and generally present as an inconvenience rather than a danger. More serious outages can have dangerous or unpredictable consequences and are often the side effect of another emergency (Aghion & Holden, 2011). While power failures are unpredictable, they are also one of the easiest emergencies to be prepared for. The response time to power outage by Kenya Power and Lighting Company Limited is not always short (Korir & Ayienga, 2014). The manufacturing company might need to wait for long for supply in the company to be restored. Long waiting without power costs the manufacturing firms delayed production and opportunity costs.

Finally, results in Table 6 indicated that repair costs and financial performance are negatively and significantly associated(r= -.536, p=0.000), which is in agreement with

Von Ketelhodt and Wöcke, (2008) who concluded that electricity repair costs and financial performance of small businesses in India are negatively and significantly associated. Repair costs has greatly increased business running costs, the costs of production of goods and services and the consumers paying more to access basic goods and services. Owning and maintaining private electricity generating plants to curb power shortages coupled with the associated costs is a herculean task. The heavy losses of power generation, transmission and regulation institutions through maintenance and replacement costs on electrical infrastructure (for example, sub-stations, mini sub-stations, transformers and copper cables) strain manufacturing companies by eating into their revenue. The cost of interruption escalates the costs of production of manufacturing companies. The annual costs from unexpected interruptions are determined by four variables: Failure rate, repair time, load and specific interruption cost (Ghajar & Billinton, 2009). The customer surveys show that the cost per interruption has considerable variation depending on the time of occurrence (Kavishe, 2015). On average for the industrial and commercial sectors in Kenya the cost of repairs tends to shoot up depending on the damages caused by power interruptions. There is a strong positive correlation between the number of failures and cost per interruption.

4.4 Regression Analysis

The results presented in Table 7 present the overall fitness model used of the regression model in explaining the study phenomena.

Table 7: Model Fitness

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.764	.583	.555	.42121

Scheduled maintenance, equipment vandalism, response time and repair cost were found to be satisfactory in explaining financial performance. This is supported by coefficient of determination also known as the R square of 58.3%. This means that independent variables explain 58.3% of the variations in the dependent variable which is financial performance of the company. Electric interruptions occur when system capacity, due to severe power outages, is insufficient to meet the system load levels. During these periods of inadequacy, outage costs will be borne by the utility production of goods in the company. The utility outage costs include loss of revenue, loss of future sales and increased repair expenditure and maintenance. Table 8 provides the results on the analysis of the variance (ANOVA). Power interruption is a challenge in many developing nations. Power interruption negatively impacts firm production. This is because it is used for varied purposes ranging from production, storage, powering of office equipment and product display. Consequently, the use of electricity serves as input for production. This makes electricity an essential commodity for all industry types- manufacturing, service and distribution. Various sectors of the economy such as manufacturing require sufficient amounts of electricity to run the production unit. The results agree with Dorcas, Agyeman and Bonn (2017) that power outage has effect on asset management ratio or

asset turnover ratio of manufacturing firms and that Return on Asset ratio of manufacturing firms is higher in no-power outage periods than power outage periods. According to Allcott, Collard-Wexler & O'Connell (2015) power outages alone in the short run, do not explain much of the gap in productivity and concludes that manufacturing firms in the long run can be affected by power outages.

Table 8: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	14.416	4	3.604	20.313	.000
Residual	10.290	58	.177		
Total	24.706	62			

The results indicate that the overall model was statistically significant. Further, the results imply that the independent variables are good predictors explaining the financial performance of the company. This was supported by an F statistic of 20.313 and the reported p-value of 0.000 which was less than the conventional probability significance level of 0.05 implying that the independent variables (Scheduled maintenance, equipment vandalism, response time and repair Cost) were significant in predicting the dependent variable (financial performance of company). The results agree with Moyo (2012) that power outage variables (measured using hours per day without power and percentage of output lost due to power disruptions) have a negative and significant effect on productivity. The results are also in agreement with Akiri, Ijuo and Apochi (2015) that electricity generation and supply impacted positively on the manufacturing productivity growth, but the coefficient is very low due to inadequate and irregular supply of electricity especially to manufacturing subsector in the economy resulting from government's unnecessary spending on non-economic and unproductive sectors. According to Osobase and Bakare (2014) a positive nexus exist between electricity generation and index of manufacturing production. Regression of coefficient results is presented in Table 9.

Table 9: Regression of Coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.179	.425		5.122	.000
Schedule maintenance	.243	.094	.289	2.580	.012
Equipment vandalism	-.155	.072	-.223	-2.158	.035
Response time	.211	.089	.256	2.373	.021
Repair costs	-.128	.055	-.233	-2.350	.022

Thus, the overall model for the study is $Y = 2.179 + .243A_1 - 155A_2 + .211A_3 - .128A_4$

Where:

Y= Financial Performance

A_1= Scheduled Maintenance

A_2= Equipment Vandalism

A_3= Response Time

A_4= Repair Cost.

On the estimated regression model above, the constant value of 2.179 shows that if the selected independent variables (scheduled maintenance, equipment vandalism, response time and repair cost) are rated zero, financial performance of manufacturing companies in Machakos County would be 2.179 implying that there are other factors affecting financial performance of manufacturing companies in Machakos County though not included in the model. The coefficient of .243 shows that a unit increase in schedule maintenance would lead to an increase in the financial performance of manufacturing companies in Machakos County by .243 units. A unit increase in the cases of equipment vandalism would lead to a reduction increase in the financial performance of manufacturing companies in Machakos County by -155 units. A unit increase in response time would lead to a decline in the financial performance of manufacturing companies in Machakos County by 0.211 units. Further, a unit increase in repair cost would lead to a reduction increase in the financial performance of manufacturing companies in Machakos County by -0.128 units. The multiple regression model indicated that schedule maintenance had the greatest effect on financial performance with a coefficient of 0.243, followed by that of response time (0.211), repair costs (-0.128) and finally equipment vandalism with a coefficient of-0.155.

Regression of standardized coefficients results in Table 4.12 shows that schedule maintenance and financial performance are positively and significantly related (r=.243, p=0.001). The coefficient of .243 shows that a unit increase in schedule maintenance would lead to an increase in the financial performance of manufacturing companies in Machakos County by .243 units. The results are in agreement with Akiri, Ijuo and Apochi (2015) in a study on electricity supply and the manufacturing productivity in Nigeria and the study concluded that, there existed a positive and significant relationship between electricity schedule maintenance and financial performance of manufacturing companies in Nigeria. The study indicated that, the more maintenance carried out, the higher the financial realization by the manufacturing companies. Solomon (2013) in a study on maintenance practices and performance of power sector in Kenya found that Kenya Electricity Generating Company (KenGen) has in place good maintenance practices.

The table 9 further indicates that equipment vandalism and financial performance are negatively and significantly related (r=-.155, p=0.012). A unit increase in the cases of equipment vandalism would lead to a reduction increase in the financial performance of

manufacturing companies in Machakos County by -155 units. The results are consistent with the findings of Majiwa (2014) which concluded that there existed negative and significant relationship between electricity equipment vandalism and the financial performance of businesses in Nairobi. The results are also consistent with Campbell (2012) that customers experience power interruptions due to vandalism to electrical equipment. Vandalism to electrical equipment jeopardizes the individuals' safety, the public's safety as well as the safety of employees working in companies.

It was also established that response time and financial performance are positively and significantly related (r=.211, p=0.021), which is in agreement with the findings by (Amadi, 2015). Amadi (2015) conducted a study on impact of power outages on developing countries: evidence from manufacturing companies in Niger delta, Nigeria, a study which reported a positive and significant relationship between response time to power outage and financial performance. The results are also in agreement with Küfeoğlu (2015) who conducted a study on economic impacts of electric power outages and evaluation of customer interruption costs in Europe and found that the response time to power outrages was poor amongst some countries in Europe. Electricity has become a vital part of the modern societies.

Finally, the study established that repair costs and financial performance are negatively and significantly related (r-.128, p=.022). The results are consistent with the findings of Wacker and Billinton (2009) which indicated that there was a negative and significant relationship between repair costs and financial performance of businesses in Canada. The high cost of power outages has negatively affected performance of manufacturing firms and more so to the economy. The variations in the outage costs of electricity tend to differ across firms. The results are also consistent with Wacker and Billinton (2009) who argue that knowing the value of uninterrupted electricity supply is of paramount importance as it helps to balance between the benefits of electrical reliability improvement and infrastructure investment. The longer the duration of the power interruption, the more the consumers' interruption cost. The results are also in agreement with Oseni and Pollitt (2013) who did a study on the economic costs of unsupplied electricity and established that unmitigated costs still account for the larger proportion of the total outage costs despite high prevalence of backup ownership among the firms.

The importance of electricity to the economic development of any nation cannot be overemphasized. Access to reliable electricity supply increases the productivity and welfare of society. To business enterprises, electricity serves as an indispensable input. Stable electric supply is necessary in running many industrial machines. Virtually all business activities, especially industrial units, require constant and effective flow of electricity.

Adequate and reliable power supply is fundamental to the rapid and sustainable socio-economic development of a people or nation. Constant electricity supply is a prerequisite to the rapid and sustainable socio-economic growth of any country. But inadequate and

unreliable access to electricity services is a problem facing manufacturing firms. Any power outage, even of the shortest duration, has severe economic impact on the financial performance of manufacturing firms. Business and social activities in the area are becoming rapidly more dependent on electricity and there is no likelihood that the potential impacts of power outages on industries would abate in the nearest future.

5.0 CONCLUSION

In conclusion, electricity is necessary for the operation of any manufacturing company and any interference with electricity supply make manufacturing companies run into serious losses. From the results of this study, it is clear that companies suffer a great deal anytime there is power outage. As reported in this study, the financial performance of manufacturing companies in Machakos County are always affected by; scheduled maintenance to electricity by KPLC, vandalism of electricity transformers, the response time by KPLC to restore power and the cost the companies incur in terms of paying electricity bills and losses as a result of damage caused by power outage. The significance of power outage variable suggests that there is need for the Kenya Power Lighting and Company to come up with ways of improving energy generation and supply. This could also be supported by proper maintenance of electricity infrastructure.

Manufacturing firms tend to incur maintenance, purchase and installation costs due to inadequate and unreliable electric power supply. Thus an inadequate and unreliable supply of electricity imposes costs and therefore constrains on firms' operational performance of manufacturing firms. In conclusion, firms suffer tremendous costs due to serious supply deficit of electricity in manufacturing firms which greatly hampers businesses especially the small scale subsector.

6.0 RECOMMENDATIONS

Recommendation for policy

The large power customers who mainly consist of industrial customers consume the bulk of the electricity by the company. Therefore, any interruption affecting this segment of customers is going to result to negative effects to the manufacturing firm, the power utility and ultimately the country's economic growth. Due to the important nature of electricity in the manufacturing industry, there is need to create clear policy framework protecting manufacturing companies from regular power outage which has an adverse effect on the operations of the manufacturing companies in the country.

There should be an immediate upgrade of the power transmission and distribution infrastructures beginning with those at the distribution sub-sector to ensure that they can efficiently distribute the amount of electrical power being generated currently and in the foreseeable future. The number of power generating stations should be increased also to

meet the ever increasing demand for electricity. It is both important and necessary to avoid overloading of transmission lines and distribution transformers.

There should be regular and proper policing of electrical installations, equipment by the relevant security agencies. The Kenya Power and Lighting Company should as matter of urgent manufacturing sector interest make vandalism an illegal business by ensuring that suspected vandals are promptly prosecuted. Proper street lighting of areas where these installations are located too will reduce the activities of the vandals. The relevant agencies of government should liaise with community leaders to sensitive their people and help in policing electrical installations in their areas.

Recommendation for Practice

Scheduled maintenance by KPLC should be done is such a way that it does not interfere with the normal operations of manufacturing companies, this can be achieved by giving prior information to the manufacturers concerning scheduled maintenance to be carried out so as to prepare them psychologically to adopt any other alternative power source before the scheduled maintenance. This way the losses that come as a result of sudden power outage can be minimized. There should be frequent inspection and planned maintenance programme for all electrical installations and facilities. The high voltage transmission lines should be closely monitored and regularly inspected to avoid trees growing under and bridging the high tension (H.T.) lines.

Vandalism of electricity transmission equipment in Kenya has become a menace and a costly affair to the society in terms of safety and low economic activities. According to KPLC, electricity distribution transformer vandalism constitutes a great loss of revenue to Kenya Power; vandalism which is attributed to existence of a “market” for the stolen items such as transformer oil and electricity cables. The government should impose tough laws against those caught vandalizing or selling stolen electricity equipment. Further the security around the transformers should be enhanced to keep those with intensions of vandalizing the transformers at bay. The government or KPLC should ensure that vigilant groups vandalizing power equipment and power lines are introduced to guide against vandalism of power equipment which has become a major setback to KPLC in its attempt to maintain constant power supply.

KPLC should increase surveillance on vulnerable transformers and enhance coordination with community policing authorities within the affected localities also the company should also install transformers above high voltage lines beyond reach by the vandals so as to minimize cases of vandalism of power equipment. The Kenya Power generating Company should legislate against people who vandalize electrical installations and those people making illegal connections to electrical infrastructures. Persons who connive with distribution companies (DisCos) staff to avert/circumvent payment of electricity bills should equally be made to suffer stiff penalties for such offence (s).

The response time to power outage by Kenya Power and Lighting Company Limited is always long. When KPLC takes too long to respond to power outage, the manufacturing company is forced to wait for long for supply in the company to be restored. Long waiting without power costs the manufacturing firms delayed production and opportunity costs. The government should come with a policy stipulating the maximum response time beyond which if KPLC does not respond to the power outage, they compensate the manufacturers. This way KPLC will always try to respond swiftly to any power outage with fear of compensating manufacturers. Utility companies workforce should be overhauled from time to time to ensure that only qualified and technically competent persons drive the new efficient and sustainable electric power system. There should be in place also, regular on-the-job training and retraining of staff of the electricity supply companies to keep them abreast of latest developments in the power system world. This will ensure that response time to power shortage is acceptable.

The cost of interruption escalates the costs of production of manufacturing companies. The annual costs from unexpected interruptions are determined by four variables: Failure rate, repair time, load and specific interruption cost. The customer surveys show that the cost per interruption has considerable variation depending on the time of occurrence. On average for the industrial and commercial sectors in Kenya the cost of repairs tends to shoot up depending on the damages caused by power interruptions. To be able to minimize the cost that comes as a result of power outage, the manufacturing companies should inform KPLC early enough of any faults with the power systems of the company so that they are corrected in time before the damage is caused. Also, manufacturing companies should adopt the use of power efficient machine or appliances to reduce the power consumption which in turn will reduce the amount the company is paying on electricity.

REFERENCES

Aghion, P., & Holden, R. (2011). Incomplete contracts and the theory of the firm: What have we learned over the past 25 years? *Journal of Economic Perspectives*, 25(2), 181-97.

Akiri, S. E., Ijuo, O. A., & Apochi, M. P. (2015). Electricity supply and the manufacturing productivity in Nigeria (1980-2012). *IOSR Journal of Economics and Finance (IOSR-JEF)*, *6*(6), 90-94.

Alam, M. (2013).Coping with blackouts: Power outages and firm choices. *Department of Yale University*. ABC Publishing.

Allcott, H., Collard-wexler, A., & O'connellú, S. D. (2015). How Do Electricity Shortages Affect Productivity? Evidence from India, *Journal of Energy Technologies and Policy*, 23(4), 1-79.

Amadi, H. N. (2015). Impact of power outages on developing countries: evidence from rural households in Niger Delta, Nigeria. *Journal of Energy Technologies and Policy*, *5*(3), 51-58.

Andersen, T. B., & Jensen, P. S. (2014). Is Africa's recent growth sustainable? .*International Economic Journal*, *28*(2), 207-223.

Andersen, T. B., &Dalgaard, C. J. (2013).Power outages and economic growth in Africa. *Energy Economics*, *38*, 19-23.

Brown, R. E. (2008). *Electric power distribution reliability*. CRC press.

Campbell, R. J. (2012). *Weather-related power outages and electric system resiliency*. Washington, DC: Congressional Research Service, Library of Congress.

Cissokho, L., & Seck, A. (2013). *Electric Power Outages and the Productivity of Small and Medium Enterprises in Senegal*

Doe, F., & Emmanuel, S. E. (2014). The effect of electric power fluctuations on the profitability and competitiveness of SMEs: A study of SMEs within the Accra Business District of Ghana. *Journal of Competitiveness*, 6(3), 23-34

Dong, D., & Petersen, I. R. (2010). Quantum control theory and applications: a survey. *IET Control Theory & Applications*, 4(12), 2651-2671.

Dorcas, Q., Agyeman, B., & Bonn, J. (2017). Power Outages On Performance Of Selected Manufacturing Firms On The Ghana Stock Exchange. *European Journal of Business, Economics and Accountancy*, 5(6), *94-102*

Dzansi, D. Y., Rambe, P., &Mathe, L. (2014). Cable Theft and Vandalism by Employees of South Africa's Electricity Utility Companies: A Theoretical Explanation and Research Agenda. *Journal of Social Sciences*, *39*(2), 179-190.

Enofe, O. M., &Aimienrovbiye, G. (2010). *Maintenance impact on Production Profitability-A Case Study*. (Unpublished Thesis, Linnaeus University).

Fernandes, A. M. (2006). *Firm productivity in Bangladesh manufacturing industries*. The World Bank.

Fisher-Vanden, K., Mansur, E. T., & Wang, Q. J. (2015). Electricity shortages and firm productivity: evidence from China's industrial firms. *Journal of Development Economics*, *114*, 172-188.

Forkuoh, S. K., & Li, Y. (2015). Electricity power insecurity and SMEs growth: a case study of the cold store operators in the Asafo market area of the Kumasi metro in Ghana. *Open Journal of Business and Management*, *3*(03), 312-325

George, E.O. (2012). The Relationship between Electricity Power and Unemployment Rates in Nigeria. Iwoye, Nigeria: *Australian Journal of Business and Management Research* 2(2), 1-3.

Ghajar, R. F., &Billinton, R. (2009). Economic costs of power interruptions: a consistent model and methodology. *International Journal of Electrical Power & Energy Systems*, 28(1), 29-35.

Glad, T., &Ljung, L. (2014). *Control theory*. CRC press.

Haanes C., Siddiqui, R., Jalil, H. H., Nassir, M. & Malik, W. S. (2011).The Cost of Unserved Energy: Evidence from Selected Industrial Cities of Pakistan. *Working Papers No. 75* Pakistan Institute of Development Economics.

Hamachi La & Commare, K. (2013).A Quantitative Assessment of Utility Reporting Practices for Reporting Electric Power Distribution Events.In*2012 IEEE Power & Energy Society General Meeting*.

Jayalath, M. S., Varadan, S., Wijetunga, D. P., Comester, R., Fernando, R., Wijeratna, N. A. S., &Dinamulla, D. K. A. M. (2012). Assessment of economic impact of poor power quality on industry.

Kavishe, T. E. (2015). *Coping with Power Interruptions in Tanzania: An Industrial Perspective A Case Study of One Small Scale Animal Food Processing Industry in Moshi Municipality* (Master's thesis).

Kjølle, G. H., Utne, I. B., &Gjerde, O. (2012).Risk analysis of critical infrastructures emphasizing electricity supply and interdependencies. *Reliability Engineering & System Safety*, *105*, 80-89.

Küfeoğlu, S. (2015).Economic impacts of electric power outages and evaluation of customer interruption costs.

Lai, R., Wang, F., Burgos, R., Pei, Y., Boroyevich, D., Wang, B.& Karimi, K. J. (2008).A systematic topology evaluation methodology for high-density three-phase PWM AC-AC converters. *IEEE Transactions on Power Electronics*, 23(6), 2665-2680.

Linares, P., & Rey, L. (2013).The costs of electricity interruptions in Spain. Are we sending the right signals? *Energy Policy*, *61*, 751-760.

Majiwa, M. Y. (2014). *The impact of Electricity Distribution Transformer Vandalism on electricity utility business in Kenya: case study of Kenya Power and Lighting Company Ltd* (Doctoral dissertation, United States International University-Africa).

Marczyk, G., DeMatteo, D., &Festinger, D. (2005).*Essentials of research design and methodology*. John Wiley & Sons Inc.

Marr, B. (2012). *Key Performance Indicators (KPI): The 75 measures every manager needs to know*. Pearson UK.

Moyo, B. (2013). Power infrastructure quality and manufacturing productivity in Africa: A firm level analysis. *Energy policy*, 61(issue), 1063-1070.

Mpatane, L. M. (2015). *The impact of electricity supply on the manufacturing sector output in South Africa* (Doctoral dissertation).

Mugenda, O.M. & Mugenda, A.G. (2003). *Research Methods*: *Quantitative and Qualitative Approaches.* Nairobi: African Centre for Technology Studies.

Newing, H. (2011). *Conducting Research in Conservation*: Social Science Methods and Practice. New York: Routledge.

Olugbenga, T. K., Jumah, A. G. A., & Phillips, D. A. (2013). The current and future challenges of electricity market in Nigeria in the face of deregulation process. *African Journal of Engineering Research*, 1(2), 33-39.

Olusola, A.J., Olugbenga, O.M., Adeoluwa, Z.O., &Oluwagbemiga, O.E. (2013).Accounting Information on Investment in Nigerian Poultry Agricultural Sector. *Research Journal of Finance and Accounting,* 4(19), 24-34

Ongore, V. O., &Kusa, G. B. (2013).Determinants of financial performance of commercial banks in Kenya. *International Journal of Economics and Financial Issues*, 3 (32), 2146-4138.

Orodho, A. J., &Kombo, D. K. (2002).Research methods. *Nairobi: Kenyatta University, Institute of Open Learning*.

Oseni, M. O., & Pollitt, M. G. (2013). *The economic costs of unsupplied electricity: Evidence from backup generation among African firms*. (University of Cambridge, Faculty of Economics).

Osobase, A., & Bakare, A. T. (2014). The Nexus between Electricity Generation/Supply and Manufacturing Sector Performance in Nigeria (1975-2011). *International Journal of Management Sciences and Humanities*, *2*(2), 123-139.

Panteli, M., & Mancarella, P. (2015). The grid: Stronger, bigger, smarter?: Presenting a conceptual framework of power system resilience. *IEEE Power and Energy Magazine*, *13*(3), 58-66.

Reinikka, R., & Svensson, J. (2002).Coping with poor public capital. *Journal of development economics*, 69(1), 51-69.

Simon-Oke, O. O. & Olayemi, S. O. (2012). Electricity Crisis and Manufacturing Productivity in Nigeria. *Developing Country Studies*, *2*(4), 16-21.

Solomon, K. K. (2013). *Maintenance practices and performance of power sector in Kenya*.

Von Ketelhodt, A., &Wöcke, A. (2008). The impact of electricity crises on the consumption behaviour of small and medium enterprises. *Journal of Energy in Southern Africa*, *19*(1), 4-12.

Wacker, G., &Billinton, R. (2009). Customer cost of electric service interruptions. *Proceedings of the IEEE*, *77*(6), 919-930.

Williamson, O. E. (2010). Transaction cost economics: The natural progression. *American Economic Review*, 100(3), 673-90.