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Intervening Effect of Back up Generation on the Relationship between Electric Power Outage Dynamics and Financial Performance of Manufacturing Firms in Kenya

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Abstract:

Most past literature on the correlational link between electric power outage dynamics and performance of manufacturing firms in both developed and developing economies has portrayed dissimilar conceptual debate amongst scholars with little focus on the intervening role played by investment in back up generation. This study aimed at assessing the effect of investment in back up generation on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya. Positivism philosophical point of view and descriptive survey research design was utilized. It was hypothesized that the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in back up generation, which was tested at 95% confidence level. A population of 447 firms whose main area of focus is manufacturing in Kenya and were also members of Kenya Manufacturers Association was selected out of which a sample size of 138 firms was drawn using Kate (2006) formula and stratified random sampling methodology. Structured questionnaires were utilized to collect data which involved drop and pick approach. The research results indicate that investment in backup generation intervened the correlation between electric power outage dynamics and financial performance. This study outcome augments existing knowledge on the association amongst electric power outage dynamics; investment in back up generation, and financial performance, for it is evident that top management must be judicious in the decision on investment in back up generation in mitigating negative effects of power outage on financial performance of firms. The decisions are on whether investment in backup to address power outage challenges has positive or negative effects on firm performance, while at the same time considering the critical decision on the most optimal level of backup capacity to invest in. The study has also made an input to the academic literature arising from assimilation of two theories, namely; financial theory of investment, and transformation theory. The Kenya Association of Manufacturers (KAM) may use these research findings to guide their member firms on strategies to adopt to ensure continuous productivity and avoidance of damages due to electric power outage dynamics.

Keywords: Electric power outage dynamics, investment in back up generation, financial performance, manufacturing firms

1. Introduction

Electricity is a fundamental input factor for many production processes and is also the dominant source of energy for firms (Karen, Erin & Qiong, 2015). The major role of energy in most firm productivity endeavors renders any deficiencies negative to production efficiencies and further results into a reduction in output (Abotsi, 2015). Low stream of electricity is depicted by electricity reliability problems characterized by power outages and/or power quality fluctuations (Eto et al. 2001). Although adverse influence of electricity power outage is evident in most economies, the extent to which this damage occurs depends on other intermediating factors such as investment in back up generation (Wray & Tymoigne, 2008).

Oseni and Pollitt, (2013) and Foster and Steinbuks, (2009) generally defined investment in backup generation as expending capital towards self-generation of electricity aimed at insulation against perverse effects of electric power

outages. Further, Oseni and Pollitt (2013) defined investment in back up generation as the amount of capital utilized in acquisition of backup generation facilities to ensure continuation of processes during electric power outages. Investment in backup generation may be categorized in two ways; according to Moyo (2012), Steinbuks and Foster (2010), investment in back up generation is the capacity of self-generation relative to full demand of electric power in the organization. On the other hand, Allcott et al. (2014) and Adenikinju (2005) defined investment in back up generation as the amount of capital invested in power backup in relation to firm's total assets as represented in the balance sheet of the firm within a specific period of time.

Investment in back up generation is the most widely adopted strategy in response to the persistent undependability of electricity by business firms (Adenikinju, 2005). Therefore, firms are in a position to mitigate losses resulting from electric power outage through this action by a great extent. It has been revealed that most firms undertake capital investment in back up capacity in order to sustain processes when power outage occurs. Backup power generation, however, is an expensive option that raises the costs of production, (Siddiqui, Jalil, Nassir & Malik, 2012). For example, Eifert, Gelb and Ramachandran, (2008), Foster and Steinbuks (2009) portend that in Sub-Saharan Africa, electricity generated by firms for self-use during power outages costs three to ten times as much as the electricity purchased from the public grid. Beenstock (1991) further contends that even in circumstances where a firm uses a generator, it is still likely to experience loss in output, since a great amount of time and cost relate to restarting machines after a power outage, and the power generated from the backup equipment may not be adequate for full capacity production. Since electricity is a substantive input to the production process, investment decisions in goods that require energy as an input for the production process may be influenced by factors other than economic related ones, provided that resultant benefits of such investments can be realized. Organizational factors explain firm power generation investments decisions for they are key economic drivers in any country (DeCanio, 1998). Investment in back up capacity is an expensive undertaking for an asset that may scarcely be utilized yet is important to minimize negative impacts of power outage however scarcely these occur. Backup power production negatively impacts the scope of investments accessible to investors, reduces the competitive edge of the locally produced goods, hence curtail firms from enjoying economies of scale (Steinbuks & Foster, 2010). In addition, the capacity of backup equipment in relation to total power capacity required for a firm is a major resolution that determines the effectiveness of minimizing negative effects of outage on firm performance. The current study focused on investment in back up capacity perspective.

An electric power outage is a short or long-term loss (supply interruption) of electric power (Eto et al. 2001). 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). Therefore, these dynamics adversely impact firm performance in a variety of ways (Steinbuks & Foster, 2010). 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, these dynamics adversely impact firm performance in a variety of ways (Steinbuks & Foster, 2010). 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).

An electric power outage is a supply interruption of electric power (Fouzul, Dhananjay, Neelotpal & Deepak, 2012). Growitsch, Malischek, Nick and Wetzal (2013) also 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. Planned power outages are 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, and Juan-Pablo, 2014). This kind of power dynamics occur at designated time spans and are usually scheduled in advance and are sometimes accompanied by notifications 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, and Oseni, 2017). As a result of power outage, both domestic and commercial customers are adversely affected (Singh & Mangat, 2012). Power outage occurrences are characterized by specific aspects which define characteristics of the outage such as power outage frequency, power outage duration, power outage notification and time of power outage (Alam, 2014; Singh & Mangat, 2012).

Power outage frequency or number of occurrences refers to the number of power blackouts over a specific time period, either per day, week or on monthly basis. Power outages may also 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. 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 the 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 electricity 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 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 of electric power outage 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 at night. Further, it can occur during the working days from Monday to Friday or it can occur over the weekend, 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 amongst electric power outage dynamics, investment in back up generation and performance is underpinned by both transformation theory of Shepherd, 1970's and financial theory of investment proposed by Hyman Minsky in 1950s respectively. The transformation theory is the 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; whereas, Investment in back up generation is fortified by the financial theory of investment proposed by Hyman Minsky in 1950s which was further improved by Wray and Tymoigne (2008) who argues that investment decisions are important to activities of a business due to the fact that they have an impact on the overall business objectives. That is, a firm level of profitability depends on the suitability of its investment in fixed capital decisions. Whereby a trade-off between the marginal cost and marginal benefit of investing in back up generation need to be considered. Jorgenson, (1963) supported the aforementioned marginal idea for he portends that a rational firm would make investment in capital in situations where the marginal product of capital surpasses or matches the related marginal cost, and vice versa.

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 (Lebens & 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 uni dimensional (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 (ROA) 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 firm 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 heterogeneous analysis of impact of electric power outage dynamics on the performance of firms.

2. Literature Review

Most past studies on determinants of firm performance were bivariate where by the factors under investigation were categorized as pure predictors and hence ignored their intermediating role. Further, the research findings by scholars portrayed dissimilar results even in the studies in which the factors incorporated were similar. For instance, Mensah (2016) analyzed the effects of power outages on performance of firms and also assessed the effect of self-generation in minimizing the impact of outages. The study analyzed panel data of 2144 firms from 15 Sub Saharan countries at varying times between 2003 and 2014 and utilized a quasi-experimental approach. Exploratory analysis was utilized to assess the correlation between the number of power outages and firm revenue and productivity. To achieve these study objectives, an OLS estimation equation was developed. Power outage intensity was measured by the number of times firms experienced power blackout cases on average in a typical month. The study highlighted a downside with this measure as it did not provide additional information on timing and duration of the power outages as this ultimately defines the impact on the firm's production process and resultant response thereof. The study settled that electric power outage has negative impact on firm revenues and productivity and therefore on the general firm performance. The study further concluded that contrary to expectations that self-generation during outage periods may improve the negative

impacts of electric power outages on firm performance; reliance on self-generation may have long run negative impact on firm productivity.

Ado and Josiah (2015) analyzed the consequence of scarce productivity level of power to businesses in manufacturing, service provision and trading in Nigeria. The specific objective of the study was to determine the influence of electricity supply shortages on the operational activities of SMEs in the Nigerian economy. The study universe was 468 firms, 32% of which were manufacturing firms. The study also evaluated the firm's proportion of investment in back up facility as a percentage of total investment; 30% of the firms invested roughly 5% of their total investment on power back up generation, while 65% spent between 6-10% of their investment to provide access to alternative power source, while 5% spent more than 10% of total investment to backstop power outage effects due to power supply unreliability. Analysis was conducted using simple bivariate regression analysis and found that unreliable power supply imposed costs to the firms in many ways. The research finding revealed that small scale businesses experience insufficient and undependable supply of electricity in the north east sub-region of Nigeria, a factor that inflicted costs in many ways. As a result of this, most of the businesses invested in complementary electricity supply. This led to investments of substantial resources for back-up generation in order to mitigate losses as a result of the power outages. This action highly mitigated losses from outages; however, it denied the firms investments in other capital.

The study of Reinikka and Stevesson (2002) aimed at evaluating the effect of low public capital on firms. To estimate public capital, undependable and insufficient supply of power was used as the proxies. The firms which were considered for the study were 171 located in Uganda and which used firm-level data for evaluation. The firm level data revealed that the coping mechanisms of firms when faced with deficient public capital (services and infrastructure) were firms' investment in complementary capital, an investment in less productive capital. The study revealed that on average, the surveyed firms had no access to power from the national power system, for about 89 days in a year, this resulted in numerous firms investing in back up power generators. This cost represented an average of 16% of the overall investment value by the firm and 25 per cent investment value in properties, plants and equipment. The data also revealed that running a private power generator cost three times more than the cost of power from the national grid. Such costs included loss of productive man-hours, equipment spoilage, forgone sales, raw materials damages, interruption of production process, condensed profits and increased attention by management among others. The result of investment in backup generation was attained at the expense of less productive capital and reduced overall investment. This was caused by the fact that the cost of generators represented a significant portion of the value of investments for the firms and also constituted less productive capital.

Braimah and Amponsah (2012) carried out a study to assess the origins and impacts of regular and unexpected power outages on operations of small industrial firms in Ghana. The study sampled 320 firms obtained from three industry clusters. Secondary and primary data was utilized for the study to evaluate the impacts of power outages that occurred frequently and without notification on the operations of the firms. Structured questionnaires were managed at interviews to collect the primary data for selected institutions. On the other hand, secondary information was obtained on efforts made by successive governments in Ghana for supply of sufficient and dependable electricity for industrialization. For analysis purpose, the two categories of data, namely; primary and secondary was synchronized through the process of triangulation. The study revealed that in an average month, firms experienced blackouts for about 10.3 hours. Out of the 320 SMEs surveyed, 44% of the firms experienced stoppage in operations for various durations of power outage, while 56% of the firms continued operations since they owned alternative sources of electricity (generators). The paper concluded that electricity reliability is a critical component of efficient industrial operations and that numerous repeated blackouts increased the production costs of the firms in the study and therefore affected the effectiveness of meeting contract deadlines.

3. Research Problem

The linkage between electric power outage dynamics and financial performance of manufacturing firms has resulted to mixed debate amongst scholars over the years. Studies on the extent, to which electric power outages affect 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.

In a study undertaken by Siddiqui et al. (2012) in four major industrial cities in Pakistan, the study identified industrial loss, delay in delivery of supplies and increased costs as major negative impacts of unreliable power. However, the study revealed that employment was not negatively affected by investment in backup energy. Although a notable percentage of the total firms in manufacturing activities engaged substantial financial resources to acquire back up generation with an aim of sustaining production processes when power outage occurred, the study established that backup generation is an expensive option that raises the costs of production.

Fisher-Vanden, Mansur and Wang (2015) examined the response level of China based organizations on the power scarcity they experienced from 1999 to 2004. The research findings revealed that firms developed optimization strategies among factors in response to scarcity of electricity by shifting from energy into materials. 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. While outsourcing was expensive, Chinese firms avoided extensive losses in production by adopting the new strategy. However, the study did not establish any evidence of those firms increasing their

self-generation. 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. In Kenya, studies on the link between electric power outage and firm performance have been very scarce, with the country only being included in generalized studies based on panel data sets by Oseni & Pollitt (2013) and Steinbuks & Foster (2010).

Past studies revealed mixed outcome on the factors influencing firm performance. Majority of the studies portrayed that electric power outage had adverse influence on firm profitability. In other studies, investment in back up generation was classified as a pure predictor in the relationship between electric power outage and firm performance, whereas when investment in back up was integrated to mitigate power outages, the outcome of the intervention was varied, with some studies indicating positive influence of back up while others revealed negative outcome. The current study focused on the intervening role that investment in back up generation (capacity) has on the link between the relationship between electric power outage and financial performance. The study hypothesized that the relationship between electric power outage dynamics and financial performance of manufacturing firms in Kenya is not significantly intervened by investment in back up generation.

4. 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 and were also members of Kenya Manufacturers Association was considered out of which a sample size of 138 of such firms was selected using stratified sampling. 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. This study incorporated Electric power outage dynamics-frequency as the predictor variable. Whereas, financial performance was the dependent variable whereby Return on Assets was used as the proxy.

4.1. 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.

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

Table 1: Questionnaire Return Rate

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.

4.2. Electric Power Outage Dynamics

Electric Power Outage Dynamics (EPOD) was represented by one indicator: 'power outage frequency' as follows;

4.2.1. Power Outage Frequency

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

	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

Table 2: Power Outage Frequency

Power outage frequency for majority of the firms (88%) was reported to be up to 10 cases of blackout occurrences on average in a month, whereas, 12% of the manufacturing firms experienced over 10 outages on average in a month.

4.3. 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 3.

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

Table 3: Financial Performance

The average return on assets among manufacturing firms was about 13.98%. Return on Assets had low variation. 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. Coefficient of variation was wide, at 102.7% and reflects wide variation in financial performance of sampled firms.

To test the association (i.e. intervening effect) that exists for the three variables, namely; electric power outage dynamics, Investment in Back up Generation (capacity) and financial performance, two Baron and Kenny (1986) intermediation conditions has to prevail. First, causality condition whereby predictor and the criterion variable used must portray a significant causality relationship. Second, the predictor variable should be statistically insignificant in the presence of the intervening variable. To achieve this objective, stepwise regression model was used whereby a three-step procedure advocated by Baron and Kenny (1986) was adopted.

5. Results and Discussion

The regression results for the three (3) steps for the two factors (OF and CAPA) were summarized in the following tables as per each forecaster under consideration as per Table 4, 4^b and 4^c:

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.315 ^a	.099	.086	.10224		
a. Predictors: (Constant), OF						
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.075	1	.075	7.182	.009 ^b
	Residual	.679	65	.010		
	Total	.755	66			
a. Dependent Variable: FIN						
b. Predictors: (Constant), OF						
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.213	.028		7.676	.000
	OF	-.036	.013	-.315	-2.680	.009
a. Dependent Variable: FIN						

Table 4: Regression Results of Outage Frequency and Financial Performance

As per Table 4, F statistics was 7.182(p=.009). Hence the model was statistically significant (p<.05) and suitable to predict financial performance at 95% confidence level. The outcome of the analysis portrayed statistically significant link, for the model had (p-value<.05). The stepwise multiple regression model resulted to Adj. R² of .086, F of 7.182 and p=.009. This implies that OF explained 8.6% of the variations in financial performance. Whereas 91.4% of changes in financial performance was described by other factor aspects not incorporated in this model. Goodness of best fit test pertaining β coefficient revealed that power outage frequency (OF) was -.315 with a significance level (p=.009). Therefore, OF statistically significantly predicted the changes in financial performance for (p<.05). By extension, a cause-effect correlation existed between OF and financial performance which is a requirement for testing mediating effect according to approach used by Baron and Kenny (1986). Therefore, statistically significant cause-effect model existed while holding the intermediating factor constant. This is the first intermediating condition as per Baron and Kenny (1986) three step procedures. In step two, financial performance was substituted by capacity as the response factor then regression analysis was carried out to establish the level of correlational significance between power outage frequency (predictor factor) and capacity in backup generation (as the dependent factor). The results were presented in Table 5.

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.079 ^a	.006	-.009	1.2607		
a. Predictors: (Constant), OF						
ANOVA						
Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.642	1	.642	.404	.527 ^b
	Residual	101.721	64	1.589		
	Total	102.364	65			
a. Dependent Variable: CAPA						
b. Predictors: (Constant), OF						
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.742	.346		13.710	.000
	OF	-.105	.166	-.079	-.636	.527
a. Dependent Variable: CAPA						

Table 5: Results of Regression between Power Outage Frequency and Capacity

The computed F statistics was .404($p=.527$). Therefore, the model was inappropriate in predicting capacity variations for at 95% confidence level, it was not statistically significant with ($p>.05$) as per Table 5 output. Further evidence was portrayed by the value of Adj. R^2 produced which was -.009 implying that power outage frequency did not statistically significantly predict capacity in backup generation. On undertaking t-test, (β) value of OF obtained was -0.079 which was negative and not statistically significant for ($p=.527$). The results imply that that OF did not significantly predict capacity and a unit change in OF resulted to negative change of .079 which was small and not statistically significant with ($p > .05$). Hence, step two condition of intervening was not complied to as depicted in Table 5, for there was no statistical cause-effect correlation.

The last step was the third level of testing for intermediation where all the three variables were incorporated with power outage frequency being the predictor, capacity taking the position of intervening variable and financial performance was the response factor. The results were indicated in Table 6.

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.404 ^a	.164	.137	.10001		
a. Predictors: (Constant), CAPA, OF						
ANOVA						
Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.123	2	.062	6.160	.004 ^b
	Residual	.630	63	.010		
	Total	.753	65			
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.108	.054		1.987	.051
	OF	-.033	.013	-.293	-2.534	.014
	CAPA	.022	.010	.257	2.220	.030
a. Dependent Variable: FIN						

Table 6: Results of Intervening Effect of Capacity between Power Outage Frequency, and Financial Performance

As per Table 6, F statistics was 6.160($p=.004$). Hence the model was statistically significant ($p<.05$) and appropriate to predict financial performance at 95% confidence level. The multiple regression model produced Adj. R^2 of .137 which implies that power outage frequency and capacity in backup generation taken together described 13.7% of variations in financial performance. That is, 86.3% of variations in financial performance were explained by other factors not incorporated in this model. Further test of the slope depicts that a unit alteration in power outage frequency resulted to .293 unit transformation of financial performance which was negative and statistically significant with ($p=.014$).

Whereas, a unit alteration of capacity in backup generation resulted to .257 unit modification in financial performance which was positive and significant with ($p=.030$).

The results as per Table 6 depicted that the effect of the intervening variable (capacity in backup generation) on the outcome variable (financial performance) was statistically significant in the existence of the estimator factor (power outage frequency). The outcome partially satisfied the third Baron and Kenny (1986) approach for the independent factor did not fully lose its significant prediction power to the response variable as it ought to be. Therefore, capacity mediated the correlation between electric power outage dynamics (i.e. power outage frequency) and financial performance of manufacturing firms. The model developed was as follows;

$$FIN = .108 - .293OF + .257CAPA$$

Where;

FIN is financial performance of organization i in time t

OF is power outage frequency

CAPA is capacity of power back up generation of organization i in time t

6. Conclusion

The stepwise multiple regression results revealed that step one of best fit test pertaining the β coefficient revealed that Baron and Kenny (1986) intermediation step one was fulfilled for the relationship between power outage frequency (OF) and financial performance was statistically significant with ($p<.05$). Step two that tested the intervening effect was not met for the relationship between power outage frequency and financial performance was negative and not statistically significant with ($p>.05$). The results imply that that OF did not significantly predict capacity. The third step portrayed that both power outage frequency and capacity had statistically significant influence on financial performance with ($p<.05$). This implies that capacity intervened the link between power outage frequency (EPOD) and financial performance of manufacturing firms in Kenya. Therefore, top management of manufacturing firms should aim at addressing the frequency of power outage challenges by adopting strategies such as investment of sufficient capacity of power back up capacity that mitigates negative effects that would down scale financial performance. The study was affirmed by the study of Braimah and Amponsah (2012) carried out a study to assess the origins and impacts of regular and unexpected power outages on operations of small industrial firms in Ghana. The study revealed that in an average month, firms experienced blackouts for about 10.3 hours. Out of the 320 SMEs surveyed, 44% of the firms experienced stoppage in operations during power outage resulting in negative effect on performance, while 56% of the firms continued operations since they owned alternative sources of electricity.

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Appendix

Normality Test Summary for Individual Study Variables

Figure 1: Financial Performance

Figure 2: Power Outage Frequency

Figure 3: Investment in Back up Generation-CAPACITY