EFFECTS OF ELECTRIC POWER OUTAGE DYNAMICS ON THE PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

BY

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DECLARATION

This PhD Thesis is my original work and has not been submitted to any University or Institution.

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DEDICATION

This Thesis is dedicated to my dear husband Dr. Richard Ndubai and our children; Lisa and Tyna Ndubai. Their cherished inspiration and support was instrumental in accomplishing this thesis.

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ABBREVIATIONS AND ACRONYMS

BSC	Balanced Scorecard
CAPA	Capacity
CRM	Customer Relations Management
CS	Capital Structure
EPOD	Electric Power Outage Dynamics
EPRA	Energy Petroleum & Regulatory Authority
FIN	Financial Performance
GDP	Gross Domestic Product
GoK	Government of Kenya
GSE	Ghana Stock Exchange
IBUG	Investment in Backup Generation
INDU	Industry
INVEST	Investments
IPO	Input, Process and Output
KAM	Kenya Association of Manufacturers
KNBS	Kenya National Bureau of Statistics
KPLC	Kenya Power & Lighting Company
MM	Modigiliani & Miller
NFIN	Non-Financial Performance
OD	Outage Duration
OF	Outage Frequency
OLS	Ordinary Least Squares
ON	Outage Notification
PER	Total Performance
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
SBSC	Sustainability Balanced Scorecard
SMEs	Small and Medium Enterprises
SPSS	Statistical Package for the Social Sciences

TO	Time of Outage
TSLS	Two-Stage Least Squares techniques
VIF	Variance Inflation Factor
VOLL	Values of Lost Load
WBES	World Bank Enterprise Survey

ABSTRACT

Most manufacturing firms in both developed and developing economies are reliant on electric power supply for their existence. Therefore, instances of electric power outage are real operational threats to those firms especially in the African continent. Many firms invest in backup generation to mitigate negative effect of outages on firm operations; however, this action does not always result in positive outcomes. This study aimed at establishing the joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on manufacturing firm performance. More specifically, the study focused on the following specific objectives; to establish the influence of electric power outage dynamics on performance of manufacturing firms in Kenya, to assess the effect of investment in back up generation on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya, to determine the effect of firm characteristics on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya and to assess the joint relationship amongst electric power outage dynamics, investment in back up generation and firm characteristics on the performance of manufacturing firms in Kenya. The current study made use of positivism philosophical paradigm and descriptive survey research design respectively. The four null hypotheses were subjected to significance test whereby multiple regression models and stepwise multiple regressions models were incorporated. The sample size was 138 which was drawn from a population of 447 firms whose main area of focus is manufacturing in Kenya and were also members of Kenya Manufacturers Association. Structured questionnaires were utilized to collect data which involved drop and pick methodology. The research results indicate that electric power outage dynamics had statistically significant influence on firm performance. Investment in backup generation intervened the correlation between electric power outage dynamics and firm performance. Firm characteristics on the other hand had no statistically significant moderating effect on the link between electric power outage dynamics and firm performance. The joint influence of electric power outage, investment in backup generation and firm characteristics on performance was not statistically significant. Firms should consider the extent to which the individual components of electric power outage dynamics have on performance instead of focusing on composite aspects. Further, the capacity of power generation equipment that firms invest in has a significant effect in minimizing negative impact of power outage on firm performance and should be carefully considered. In addition, firm characteristics do not have a significant moderating influence on the impact of electric power outage on firm performance as their presence or absence do not determine the direction or strength of the correlation between electric power outage dynamics and firm performance. This is due to the fact that electric power is a significant input factor for all manufacturing firms in the study regardless of their varying characteristics.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Electricity is a fundamental input factor for many production processes and is also the dominant source of energy for firms (Karen, Erin & Qiong, 2015; Cissokho & Seck, 2013). The integral role of energy in most production processes renders any deficiencies negative to the firm production efficiencies and further results in low output (Abotsi, 2015). Poor supply of electricity is depicted by electricity reliability problems characterized by power outages and/or power quality fluctuations (Eto, Koomey, Lehman, Martin, Mills, Webber & Worrell, 2001). An electric power outage is a short or long-term loss (supply interruption) of electric power (Eto *et al.* 2001). 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).

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). These dynamics adversely impact firm performance in a variety of ways (Steinbuks & Foster, 2010). In order to offset the negative outcomes of electric power outages, many firms innovate or adopt diverse strategies to mitigate the adverse impact caused by electric power outages such as self-generation of power through backup generators (Alby, Dethier & Straub, 2012; LaCommare & Eto, 2004), transfer of electric power outage associated losses such as breakdown of the machinery used in manufacturing by taking insurance cover against the losses (Schoeman, T. & Saunders, M. (2018) and adoption of renewable power sources such as wind and solar energy (Czisch, 2006 & Hoffert *et al.* 2002). However, this self-generation of electricity increases firm production costs and significantly impacts their competitiveness due to higher cost of production (Moyo, 2012). The problem of power interruption is costly especially for smaller firms that often lack resources to purchase backup generators. Further, firm characteristics have a major bearing on the magnitude of impact of electric power outage on performance and also determine the coping mechanisms that firms adopt (Alam, 2014).

The interface between electric power outage dynamics and performance is underpinned by the financial theory of investment by Minsky in 1950's (Minsky, 1959), transformation theory of Shepherd, 1970's, trade off theory by Myers (Myers (1984) and pecking order theory by Myers and Majluf (Myers & Majluf, 1984). The financial theory of investment highlights the criticality of investment decisions to business activities and the resultant impact to performance of the business. The theory highlights the evaluation process that businesses undergo in making capital investment decisions. 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. The trade-off theory and pecking order theories are critical in evaluating the influence of alternative capital financing options on the impact of power outage on performance of firms. This is as a result of firms seeking to find the perfect balance between financing benefits and costs (optimal financing). This is a key element for financing of assets that are critical for firm operations, such as backup generators, required for mitigation of adverse impacts of power outage on firm performance.

This study focused on firms in the manufacturing sector in Kenya, which are also members of Kenya Association of Manufacturers (KAM). The choice of this class of firms is backed by the following reasons: First, electricity is a major input of the firms' production processes, therefore a disruption in electricity supply has significant impact on the operations of the firms. Second, most manufacturing firms are highly likely to invest in back up generation to backstop the significant negative impacts of outages on their operations. Third, manufacturing firms in Kenya comprise of firms in varying categories of industries that provide a heterogeneous analysis of impact of electric power outage dynamics on the performance of firms.

1.1.1 Electric Power Outage Dynamics

An electric power outage is a supply interruption of electric power (Fouzul, Dhananjay, Neelotpal & Deepak, 2012). Growitsch, Malischek, Nick and Wetzel (2013) also defined power outage as the stoppage of electricity power supply resulting to zero power supply. This irregularity may arise due to circumstances that are either planned/foreseen or unplanned/unforeseen by the power utility.

A planned power outages is an electricity shortage scheduled by the electricity suppliers and may be as a result of scheduled maintenance or due to a need to address an emergency (Moyo, 2012). A planned outage may also be necessitated by lack of sufficient power generation to meet the full demand of the end users (Scott, Darko, Lemma, and Juan-Pablo (2014). Planned power outages 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 that curtailed supply of electricity is experienced by individual customers (Fisher-Vanden, Mansur & Wang, 2015). Power outage duration is the amount of time spent without 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 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 and 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 of lost load in the middle of the week between eight am and six pm in the evening as compared to domestic users of electric power.

This study was motivated by the need to understand the effect of power outages on the operations of manufacturing firms in Kenya. This is due to the fact that manufacturing firm operations are heavily dependent on electricity as a major input to most processes, the absence of which would therefore be expected to have a negative effect on operations. This study therefore sought to understand these effects on various firm performance measures. In addition, there was need to evaluate the secondary steps taken by firms as a stop gap measure for provision of backup power when power outage occurred, seeking to understand the capacity/affordability of these options by various firms and, to what extent the stop gap measures functioned to alleviate the negative effects of power outage on firm's operations.

1.1.2 Investment in Back up Generation

Investment in backup generation is expending capital towards self-generation of electricity aimed at insulation against perverse effects of electric power outages (Oseni & Pollitt, 2013; Foster & Steinbuks, 2009). It is the most widely adopted strategy in response to the persistent undependability of electricity by business firms (Adenikinju, 2005). Oseni and Pollitt (2013) posited that firms mainly invest in backup generation to ensure continuation of processes during electric power outages. Therefore, firms are in a position to mitigate losses resulting from electric power outage through this action by a greater extent. However, 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.

Investment in backup generators by firms is done 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). Beenstock (1991), 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 firms' 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 shall incorporate two indicators for the variable investment in backup generation namely, capacity and investment.

1.1.3 Firm Characteristics

The level of profitability of a firm is dictated by its characteristics (Dean, Bülent & Christopher, 2000). Firm characteristics are defined as the managerial and demographic features that differentiate one organization from others such as firm size, leverage, liquidity, firm growth rate, asset growth, and turnover (Zou &Stan, 1998) even when operating in the same industry. It also describes the unique internal factors surrounding the firm. Further perspectives that are useful in distinguishing the firm and are categorized as firm characteristics are firm ownership layout, board of director features, firm age, ease at which a firm accesses debt from the capital bourse and available opportunities to grow (Subrahmanyam & Titman, 2001; McKnight & Weir, 2008). The current study concentrated on industry classification and capital structure as these aspects are known to have key implications on the overall performance of an organization (Jensen, 1986).

Kouki and Guizani (2009) defined capital structure as the combination of the debt and equity of a company. This structure is also referred to as the debt equity ratio or gearing ratio which is expressed as the quotient of long term debt to owners' claim. It is a ratio that depicts the level of utilization of both internal and external financial resources of an organization in facilitation of capital ventures within a certain time span usually per annum (Gill, Biger & Tibrewala, 2010).

One of the most efficient mechanisms to manage the cost of capital is through capital structure. An optimum capital structure is attained at the point of minimum cost of the capital (Ellili & Farouk, 2011). Corporate finance considers the cost of capital to be one of the most important issues and therefore, firm managers strive to maintain a capital structure that minimizes financial and business risks on the firm, while maximizing shareholders' wealth through positive effect on performance (Green, Murinde & Suppakitjarak, 2012).

The industry that a firm operates in is a significant factor in performance differentiation. The capital structure to firm performance linkage varies from one firm to another across various industrial set ups in any country. In some cases, the association could be positive and others negative (Dhillon, 1986). For firms involved in production and with a heavy reliance on electricity as a source of input to production, firm characteristics such as capital structure influence their coping mechanisms to avert the negative effects of power outages. The effect of electricity shortages and the resultant adaptation mechanisms has been found to differ across industries (Alam, 2014). Alby, Dethier and Straub (2012) provide that firms that are heavily dependent on electricity as resource inputs are affected by common occurrences of outages. However, some firm characteristics such as industry classification and capital structure could counter the adverse influence of blackouts.

1.1.4 Performance of Firms

Firm performance is the firm's effectiveness and efficiency in which it conducts its affairs (Chakravathy, 1986). Organizational performance is defined as a set of fiscal and non-fiscal parameters on the level of attainment of objectives and outcomes (Lebans & Euske, 2006). Barney, (2011) contends that firm performance is aimed at provision of financial earnings, return on investment (ROI), economic fees or shareholder earnings. Assessment of firm performance remains an argumentative issue amongst researchers. Some studies gauge performance with a single measure, yet epitomize this notion as unidimensional (Glick, Washburn & Miller, 2005), however, 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 adopted the sustainable balanced scorecard to measure the performance of manufacturing firms in Kenya. The evolution of performance measurement led Kaplan and Norton, in the early 90's to develop the model of the Balanced Scorecard (BSC). This was a new method of performance assessment as a result of difficulties of short-range focus and past attention in Management Accounting (Kaplan & Norton, 1992). The main focus of BSC is to overcome the sole reliance on financial performance (Horngren, Forster, Rajan, Ittner & Datar, 2010). The BSC provides a set of financial and nonfinancial parameters that characterize distinct requirements and competencies (Moller & Schaltegger, 2004). Sustainability Balanced Scorecard (SBSC) concept was recently developed to incorporate social and environmental considerations to the BSC for measurement of firm performance.

1.1.5 Manufacturing Firms in Kenya

Firms that engage in manufacturing activities in Kenya account for between 10% and 13% of Kenya's annual GDP. These firms are also the largest consumers of electricity in Kenya and collectively take up about 50% of power generated in the country (KPLC, 2018). The firms include industrial manufacturers of building and construction materials, chemicals, metals, plastics, paper, food and wood products among others. The KAM categorizes manufacturers based on various indices, one of which is annual turnover. Medium sized manufacturers are categorized as those with annual revenue ranging between sh.20 and 250 million Kenya shillings, big manufacturing organization have per annum turnover of between sh.251 million and sh.5 billion in a year, while the very large firms have over sh.5 billion in annual turnover.

Manufacturing firms are highly dependent on electricity for their business processes and are significantly affected by power outages. Majority of manufacturing firms underscore the constraints caused by power outages as this result in idle time and significant losses, while machine damages also occur. Most of the firms are forced to venture in alternative power generation in order to reduce damages that result from deficient power supply. The backup generators in industrial firms only provide a portion of required power as it would be uneconomic or very difficult to invest in full backup capacity for large scale operations with high electricity dependence.

1.2 Research Problem

Modernization has highly influenced numerous businesses to invest significant capital in machine and equipment towards improvement of productivity. Since electricity is a major direct and indirect input in the production process, its availability and reliability is significantly critical and any interruption in its supply (power outage), results in negative effects to the firm (Oseni & Pollitt, 2013). Frequent power outages connote a power reliability problem for firms' operations, that is compounded in circumstances when communication of the outage (notification) is not done. Long duration of power outages during periods of active firm operations impact manufacturing firms negatively due to the power availability problem. Notably, firms with 24-hour operation cycles are more severely affected as their operations do not have anticipated breaks and are therefore always impacted by power outages, no matter the time that outages occur.

Outages have significant effect on the production processes, resulting in; increase of production costs, increased operating uncertainties, production losses resulting from loss in output, machinery damage - all translating into financial losses (Jyoti, Aygul & Glenn, 2006). Disparities in the forms and measures of specific challenges brought about by power blackouts on overall performance of organizations remains unresolved. A notable percentage of the total firms in manufacturing activities engage substantial financial resources to acquire back up generation with an aim of sustaining production processes when power outage occurs. Backup generation however is an expensive option that raises the costs of production, (Siddiqui *et al.* 2012) and whose effect is inconclusive (Fisher-Vanden, Mansur & Wang, 2015). Firm characteristics have a bearing on the influence of electric power outage on performance.

Manufacturing sector is the largest consumer of electricity in Kenya (Onuonga, Etyang & Mwabu, 2011). The current study focused on manufacturing firms in Kenya, spanning across 12 categories of varying classifications of products. The share of manufacturing sector to GDP in 2017 was between 10% and 13% (KNBS, 2018). This share is expected to increase as the country advances towards greater industrialization levels. As a result of such adjustments, growth from these sectors is expected to increase substantively accompanied by a rise in power demand (GoK, 2007). The manufacturing sector in Kenya places a high value in security and stability of power supply due to the negative impacts that result from power outages.

Studies on the extent to which electric power outages affects performance of firms have been carried out in well-developed and a few developing economies including Germany, China, India and Pakistan. Very little attention has focused on countries in Africa with the exception of Nigeria, to which a considerable number of studies have focused. Globally, empirical literature records significant negative impact of outages on firm performance. Growitsch, Malischek, Nick and Wetzel (2013) in a study which was conducted in

Germany established that a significant effect of cost increase in firms was experienced as a result of power outages. The costs varied significantly over time, between sectors and regions. Fisher-Vanden *et al.* (2015) found that investment in back up generation was not an optimal outage management option for energy intensive firms in China. Siddiqui *et al.* (2012) in a study of four major industrial cities in Pakistan identified industrial loss, delay in delivery of supplies and increased costs as major negative impacts of unreliable power, however, employment was not negatively affected by investment in backup energy.

In Africa, Adenikinju (2005) in a study in Nigeria concluded that unreliable electricity imposed significant costs to businesses with most costs relating to investment in backup generators. Contrary, Cissokho and Seck (2013) in a study in Senegal had mixed results; the study established that power outage dynamics; frequency, duration had negative consequences on the businesses. Although the influence of the aforementioned electric power outage dynamics was adverse, other studies revealed that a positive impact on technical and scale efficiencies ocurred. Studies in Kenya 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). The studies concluded that firm characteristics influenced firm performance more than power outages.

Electric power outage dynamics have been measured using various indicators; Mensah (2016) used frequency of outage, Cissokho and Seck (2013) utilized frequency, duration and their severity for outage characteristics, while Alam (2014) used frequency. Allcott, Allan and Stephen (2014) and Karen, Erin and Qiong, (2015), utilized notification of outage. This study will incorporate four electric power outage measures namely; power outage frequency, power outage duration, power outage notification and time of power outage.

The effect of backup generation in mitigation of negative impacts of power outage is inconclusive, some studies highlight positive mitigation effects (Moyo 2012), others find negative effects (Mensah 2016), while yet others find mixed effects (Steinbuks & Foster, 2010; Cissokho & Seck, 2013). Further still, some firms do not have adequate financial capacity to invest in backup generators despite the requirement for alternative source of electricity to keep the operations going when power outage occurs. This study aims at determining the efficacy of investments in backup generation in minimizing negative consequences of electric power outages on firm performance.

The reviewed empirical literature also had varying indicators for representation of electric power outage impact on performance. Siddiqui *et al.* (2012), Growitsch, Malischek, Nick and Wetzel, (2013) used outage damage costs. Oseni and Pollitt (2013) and Foster and Steinbuks (2009) used the cost of operating back up generation facilities, Mensah (2016) and Cissokho and Seck (2013) adopted firm productivity, while Bernard and Anaman (2018), used revenues, profitability and growth rate to represent performance indicators while assessing power outage effects on performance of listed firms in Ghana. This study proposes a comprehensive mechanism of performance measurement using a contemporary framework as defined by SBSC that considers financial, customer, employee productivity and operations efficiency measures, but also incorporates social and environmental performance dimensions.

This study sought to fill the knowledge gaps as follows; First, the study sought to expand the operationalization of electric power outage dynamics by adopting four indicators in order to have a wider scope of evaluation of power outage effects, Second, the study analyzed firm performance using a comprehensive performance approach that evaluates impact on diverse qualities of firm performance that also include the effect of outages on broad categories of firm stakeholders. Third, this study aims at providing results of the effect of backup generation in mitigating outage impacts in the Kenya manufacturing industry context. Fourth, very little attention has been placed on evaluation of impact of power outage on Kenyan firms, except in generalized studies based on panel data sets, the outcomes of these studies provide generalized data that may not be fully relied on for Kenyan firms, a gap that this study seeks to fill. The focus of this study is on firms in the manufacturing sector in Kenya, whose reliance on electricity as an input factor of production is significant. The study shall answer the question; what is the influence of investment in back up generation and characteristics of the firm on the relationship between electric power outage dynamics and firm performance of manufacturing firms in Kenya?

1.3 Research Objectives

The general objective of this study is to investigate the relationship amongst electric power outage dynamics, investment in back up generation, firm characteristics and firm performance of manufacturing firms in Kenya. The specific objectives of this study were:

i. To establish the influence of electric power outage dynamics on performance of manufacturing firms in Kenya

ii. To assess the effect of investment in back up generation on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya

iii. To determine the effect of firm characteristics on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya

iv. To assess the joint relationship amongst electric power outage dynamics, investment in back up generation and firm characteristics on the performance of manufacturing firms in Kenya

1.4 Value of the Study

The contribution of the study to the existing body of knowledge in finance is threefold: First, the study shall provide extended knowledge on the influence of the study variables and the theories that anchor them, the result of which shall build on the existing body of knowledge by enriching current literature. The study shall assess the judiciousness of finance investment theory in determining the firm's capital investment decisions, transformation theory is aimed at assessing the effects of power outages to firm performance given the critical role of electricity in the production system and the negative consequences outages portend to the firm performance. The study will also interrogate capital structure theories by evaluating the relevance or otherwise of the structure of capital to firm performance.

Second, the study shall provide manufacturing firms in Kenya a detailed analysis and valuable quantitative information on the effects of electric power outage dynamics, investment in back up generation and firm characteristics on their performance, information that would be useful in improvement of power outage management practices. By reviewing firms in various categories, the study also seeks to explore whether there is heterogeneity in the management and effect of electric power shortages on various firms' performance.

Third, the study shall contribute to energy policy formulation and regulation of the electric power sector. Policy makers and energy regulatory authorities will have a perspective on the effect of electric power outage dynamics on performance of firms that shall further highlight the resultant need to put in place proper policies and infrastructure for efficient electricity supply to businesses in order to minimize or entirely eliminate detrimental outcome on their performance. The study further contributes to the Vision 2030 implementation, as it reinforces the proposition of energy as the fundamental enabler for all the three main Vision pillars; (economic, social and political), without which the Vision cannot be attained.

1.5 Organization of the Thesis

Chapter one provides the main concepts in the study, namely; electric power outage dynamics whose proxies were power outage frequency, power outage duration, power outage notification and time of power outage. Whereas intervening variable used was investment in back up generation, firm characteristics entailed industry and capital structure and the criterion variable was firm performance divided into non-financial, financial and overall performance. Contextually, the focus of the study was on Kenya Manufacturers Association registered firms. This chapter presents the background thereof, the specific research objectives and the value of the study.

Chapter two covers both the theoretical and empirical literature review that supported the study. Firm performance and electric power outage dynamics variables are underpinned by the transformation theory that advocates for optimization of distinct production processes to enhance performance efficiencies. Investment in back up generation is supported by financial theory of investment and firm characteristics were based on both tradeoff theories and pecking order theory. The theoretical foundations aforementioned were followed by past empirical literature pertinent to the study which was summarized in a conceptual framework with hypotheses therein.

Chapter three entails the methodology of research, which comprises of the philosophy that guided in the building of new knowledge, research design, target population and the size of the sample chosen. Methods of data collection, operationalization of variables and methods of data analysis used are also presented in this chapter.

Chapter four starts with descriptive statistics, trend analysis presented in figures, histograms and tables. The chapter also contains the diagnostic tests, correlation analysis and chapter summary.

Chapter five entails testing of significance level of the interrelationships amongst the study constructs. The chapter highlights the four hypotheses and concludes with discussions of the study findings.

The sixth chapter focused on the summary of the study, conclusions and recommendations. The chapter further discloses the knowledge contributions of the study in relation to firm policies practices and theory and also presents suggestions of areas of further research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Chapter two outlines both theoretical and empirical literature on the linkage amongst outage dynamics, investment in back up generation, firm characteristics and performance. The chapter also contains an analysis and presentation of research gaps obtained from past literature reviews. To summarize the study, the chapter ends with presentation of diagrammatic conceptual framework depicting the association amongst the study variables.

2.2 Theoretical Review

The study is anchored on four theories, namely; financial theory of investment transformation theory, trade-off theory and pecking order theory. The theories give impetus on the relationship amongst electric power outage dynamics, investment in back up generation, firm characteristics and firm performance.

2.2.1 Financial Theory of Investment

The financial theory of investment was initially proposed by Hyman Minsky in 1950s and has been improved by several authors, the latest being Wray and Tymoigne (2008). The theory 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. A firm's level of profitability depends on the suitability of its investment decisions. Investment in fixed capital has duality in outcome that is compared against each other; (anticipated) benefits and relative costs that often determine the firm's decision to incur such expenditure. Jorgenson, (1963), 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.

When constant revised costs of production are too high to account for the prospective paybacks, this may sometimes cause limitations in investing in new capital stocks. This is the case especially when the factors influencing them is considered. Backup generation investments to mitigate the impact of power outage contains associated costs and consequently has to be taken prudently. Firms that experience power outages must evaluate and compare the additional benefit of investing in substitute electricity generation versus the additional cost of procuring and operating one more power backup generator in order to determine the optimality of either investment decisions. One, whether it would be optimal to make investment in substitute electric power supply source and therefore be in a position to sustain firm processes when outages occur, or instead, not to make any investment in backup generation and be obliged to shut down operations when power outages occur (Carmeli & Tishler, 2004).

According to Wray and Tymoigne (2008), a firm will opt to acquire backup generation equipment if the investment in a power generator aimed at sustaining a certain level of operations when power outages occur is considered a rational decision. Alternatively, some organizations would possibly consider non-investment in backup to be the most optimal choice, due to the associated costs of acquisition and running alternative power generation facility that may be cost prohibitive in comparison to ceasing operations when power outage occurs. However, these investment decisions are also guided by power outage characteristics for the firm as well as the resultant impact on the firms' performance, for example, frequent and long duration power outages may have huge negative impacts on firms that may clearly indicate a need for investment in backup generation.

The financial theory of investment can be critiqued in that it provides for the level of a firm's profitability as being determined by investment decisions made. The theory further provides that investments decisions are positive when marginal product of the investment is greater than the marginal cost. However, there exists numerous other factors that may affect investment decisions and investment outcomes such as the financial distress position of a firm, that would impact investment decisions whether or not investment opportunities are suitable or not.

2.2.2 Transformation Theory

Transformation theory was propagated by Shephard in 1970. The transformation theory is the principal theory related to production. The theory is centered on three aspects; input, process and output (IPO). The theory provides for breakdown of each process into distinct activities implemented by specialized persons. All actions are systematically ordered and coordinated; it is consistent with traditional cost accounting and scientific management. The theory advocates for the optimization of the whole production process by optimizing singular tasks, supposing that decreasing the costs for individual units results in the highest levels of performance. Production comprises the conversion of inputs into output of goods or services. Managers are focused on attainment of efficiency throughout the process of production for both technical and economic use of inputs. The efficiency goal provides the firm with adequate guidelines on how to optimize inputs to obtain the desired level of outputs for goods and services.

Transformation theory underpins this study since the context of the study is manufacturing firms, each of which manages a production process within the firm. In addition, electricity is a critical input to the production process and therefore any limitation in its supply affects the performance of firms. The critical role of energy in the production process is quantified in some studies based on losses to firms due to power outages. In some cases, the production function is used to analyze the contribution of electricity as a direct input to the production process or as an indirect determinant of the level of use of other direct inputs such as equipment (Adenikinju, 2005). The transformation theory has been subject to some criticism, one being that the production function is not formulated as a result of actual practice or observation. The argument is that most firms may not have an accurate functional quantification of the relation between their inputs and outputs based on production functions, however, this can be solved by use of linear programming.

2.2.3 Trade off Theory

The Trade-off theory proposed by Myers (1984) provides a hypothesis that a profit maximizing firm will endeavor to ensure that it maintains a balance between marginal benefits and marginal costs when a firm is maintaining some cash balances and investing in capital goods with an aim of avoiding cases of impairment between liquidity and profitability (Opler, Pinkowitz, Stulz and Williamson, 1999; Afza & Adnan, 2007). When a firm is planning to invest in a profitable opportunity, there are benefits and costs to that effect. The theory underscores an equilibrium between a reduction in bankruptcy, financial distress costs and agent costs, and tax saving arising from debt.

The trade-off theory is related to the Miller and Modigliani theory on capital structure that puts emphasis on optimal capital structure. The theory suggests just like the MM theory that the tax shield benefits are offset by the firm's costs of agency and financial distress (Danso & Adomako, 2014; Mostafa & Boregowda, 2014). The optimal leverage level is obtained by balancing the costs of debt issue and the benefits from interest payments. Sheikh & Wang (2010) proposed that trade off theory targeted to attain a capital structure that would maximize the value of the firm by lessening the costs of predominant market deficiencies. The theory assumes that the firm with greater tax advantage will integrate more debt to fund its business processes and the cost of financial distress and benefit from tax shield are balanced (Chen 2011).

For a capital structure of a firm, the tax shield benefit associated with borrowing is compared with finance distress costs of the firm. In this case, the marginal benefit and marginal cost should equal for an optimal capital structure policy to exist. This implies that the tradeoff theory also has an impact on the firm performance. Further, Kraus and Litzenberger, (1973) advocates that the ideal debt level is where the additional benefits of debt is equivalent to its additional cost. Therefore, by modifying their levels of long term liabilities and owners' equity, firms can obtain most preferred debt equity ratio hence striking a balance between the tax shield benefits and distress costs associated with borrowing. However, past studies portrayed dissimilar outcome on the same subject of benefits and costs by researchers. Fama and French (2002) contends that a capital structure considered to be ideal can be recognized from the paybacks accrued from debt interest which is termed as deductible allowance in taxation and cost associated to agency conflicts and bankruptcy respectively.

Tradeoff theorem is appropriate to this study for it covers the association amongst variables of focus such as electric power outage, investment in back up generation, firm characteristics (capital structure) and manufacturing firms' performance. Secondly, the assumption that there exists optimality state in investment and capital structure decisions whereby, a profit maximizing firm should have both marginal benefits and marginal cost being at par holds, hence this concept of optimality provides reference to argue the case for the electric power outage dynamics and firm performance and the extent to which this association is influenced by investment in back up generation and firm characteristics for manufacturing firms under KAM membership.

2.2.4 Pecking order Theory

The pecking order theory was authored by Myers and Majluf, (1984), with a proposition that firms will use the cheapest sources of finance before opting for the costly alternative. Therefore, an organization will utilize retained earnings first before borrowing externally and once these two options are exhausted, it will go for new issuance. According to the aforementioned philosophy, capital structure optimality state can be attained by firms that display preferences for utilizing internal funds or retained earnings over external capital.

The pecking order theory emanates from the asymmetric information notion, that arises when a party is in possession of more information than other parties which results in disproportionate power in transactions. Under normal circumstances, corporate managers hold significantly greater information than shareholders and creditors in regard to the performance, future prospects and risks that firms face. In order to balance this effect, external parties demand higher rates of return in order to cover the risks undertaken, therefore external financiers comprising creditors and shareholder demand higher rates of return to cover their risks.

Amongst many important suppositions in corporate finance, pecking order theory takes the lead on matters pertaining company leverage and goes against the firm's idea of having distinctive amalgamation of financing through equity and debt, which minimizes the corporation costs of funds. It proposes that firms ought to keep a clear order of primacy with respect to sources of financing in order to keep its agency conflict related costs at minimum levels, hence prioritizing ploughed back profits as the first choice of financing, then debt and finally new equity issuance is considered as the last option. It advocates for retained earnings to be used first in funding long-term projects since this is an internal source of financing that minimizes information asymmetry and when they are exhausted or not available, then debt is issued, as debt has lower cost of financing than equity; and when it is insufficient or not available, equity, considered the most expensive source is issued. The theory argues that, as firms become more profitable, they seek less external funds, since they would have enough internal funds to support their investment projects (Myers, 1984).

The current study is pegged on pecking order theory due to the fact that one of the objectives was to determine the extent to which firm characteristics affect the relationship between EPOD and firm performance, in this case, industry and capital structure were considered. Since the theory advocates on being economical when choosing sources of finance, the order of financing is critical for efficient management of financing costs for a firm. Practically, this should be the case as most firms prefer borrowing for investments. However, as per past studies, small and medium firms do not have financial power to facilitate their own investments, including power generation, this begs the question on whether the theory applies uniformly for all types and sizes of firms.

2.3 Empirical Literature Review

Past literature that empirically underpin this study on the relationship amongst electric power outage dynamics, investment in back up generation and firm characteristics on firm performance are considered in this section. The discussion is in an orderly manner where in each case, knowledge gaps have been highlighted to justify the need of the study.

2.3.1 Electric Power Outage Dynamics and Firm Performance

The aspect of power outage dynamics has become a matter of great concern to most of the users of electricity. Efforts to determine the economic implications by scholars resulted to diverse research findings. For instance, Siddiqui *et al.* (2012) explored the cost of energy not served in Pakistan that occurred due to power outages. The study utilized survey technique and was carried out for four major industrial cities whereby the definite aim of the aforementioned study was; to determine the extent to which energy not served influenced production output of firms in India; to assess the impact of energy not served on employment level; to examine the impact of energy not served on cost of production and to establish the impact of energy not served on supply of orders. To estimate the impact thereof, output loss was measured using two-dimensional methodologies, one, checking for changes in the duration of outages and in the hours of shifts.

To select the sample size, random sampling technique was utilized. Hence 339 firms which constituted almost 8 percent of the total population was considered. The survey data revealed that workers did not lose their jobs as the management sought alternative energy arrangements which ensured continuous production However, the additional source of energy apart from the mainstream one resulted to increased production cost of the firms. Further, energy shortages translated into delayed execution of orders placed for delivery. The study opined that the total industrial production loss fluctuated between 12 percent and 37 percent and that the most affected province was Punjab.

The study of Siddiqui *et al.* (2012) focused on the unused energy and the production cost implications it had. That is, researchers of the study aimed at establishing the forgone benefits for the firms due to the energy not served. In addition, power outage duration was the key inclusion of electric power outage dynamic discussed in this study. This was a narrow focus for there are other elements of power outage dynamics such as power outage frequency, power outage notification and time of power outage that will be included in the current study. In addition, these scholars ignored the performance perspective of the manufacturing firms, which is one of the main objectives of firm owners of all types of firms. Another shortcoming of this study was incorporation of macro-economic factors such as employment level which is uncontrollable by the management for it is externally determined. This calls for further investigation to assess the magnitude to which power outage duration affects performance and also scale down the study to focus on micro factors, which management would have control over.

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

The aforementioned study of Fisher-Vanden, Mansur and Wang (2015) concentrated on strategies of mitigating losses due to power outage. Again, the concern of the scholars was to establish whether the firms in question generated own power in events of power outage. The study did little in establishing whether power outages affected Chinese manufacturing firm level of performance and also whether the time of outage was a challenge in meeting the objectives of the firms. The methodology of measuring power shortage was electricity scarcity, this approach was not suitable for power outage has multidimensional aspects that for a study to empirically conclude that power outage has implication on other variables such as performance, both content and constructs validity are important for consideration (Mason and Bramble, 1989). Incorporation of other aspects of power outage dynamics can provide enhanced results for the association between power outage dynamics and performance.

Growitsch *et al.* (2013) investigated the values of lost load for data sets of industry and households in Germany in order to estimate the cost of power interruptions for various regions and sectors and for every hour of the year. The outcome of the study was that there existed a serious cost effect of electric power outages that varied significantly over time, between sectors and regions. That is, dynamic Values of Lost Load (VoLLs) varied significantly overtime, between sectors and regions. On average, total national outage costs amounted to approximately 430 Mio € per hour. Results further emphasized the southern and western part of Germany had the highest estimated VoLLs. The study also quantified the costs of outages through a macroeconomic approach that provided outage cost estimates in different regions and sectors in Germany. In summary, the study established that firms in varying regions and industries were impacted differently by the electric power outages. The study focused on outage costs and did not elaborate the aspects of power outage and the extent this shortfall impacted on performance.

In the study of Frederick and Selase, (2014), the aim was to analyze the influence of electric power variation on small and medium enterprises (SMEs) profitability and competitiveness in Ghana. The country had achieved middle-income status and needed to sustain this condition. The research paper utilized a case study approach with a main target group for the case study being SMEs with operations located within the Accra business district in Ghana. The study utilized cross-sectional survey and systematic sampling technique was considered most appropriate to select a sample size of 70 Ghanaian SMEs. The criteria that was used to select an SME firm was the location and dependence on the level of electricity as a major input for business processes. Structured questionnaires were utilized to collect data related to power fluctuations, firm profitability and firm competitiveness.

The study outcome was that unreliable power supply resulted in firm's inability to increase the quantity and quality of their products that further led to poor sales and profitability. Hence both Return on Investment (ROI) and Return on Assets (ROA) for the SMEs were adversely influenced by the low profitability levels experienced by the aforementioned firms. The study aimed at determining the extent to which power outage influenced SME operations. An investigation is necessary to establish whether similar results would be achieved in the case of larger manufacturing firms. Further, decomposition of power outage perspectives into various power outage dynamics could be considered as this would provide additional issues for evaluation of power unreliability. The study in question ignored the non-financial perspective as it only focused on the financial dimensions of firms. This inclusion would enhance the analysis of power unreliability analysis by use of a more comprehensive measure of performance.

Abotsi (2016) carried out a study to evaluate the effect of power outages on production efficiency of businesses in Africa that included manufacturing, services and retail sectors. The study was based on secondary data obtained from the data bank of the World Business Environment Survey directed by the World Bank. A two-tail Tobit and stochastic production frontier models were used to carry out the data analysis. The outcome of the study indicated that frequent electric outages impacted the production proficiency of African based firms in a negative manner.

Power outage has multiple dimensions and therefore, further investigation is necessary to ascertain the magnitude at which power outage influence performance of firms affiliated to manufacturing activities. This can be achieved through consideration of each component of power outage dynamics in isolation and the specific impact it has on performance. Proposed components are, namely; power outage frequency, power outage duration, power outage notification and time of power outage. This approach would enable an interrogation of the implication of each electric power outage dynamic, hence, provide a better interpretation of the impact.

In addition to the study of Abotsi (2016) which aimed at determining the influence of electric power blackouts on production proficiency of Africa based firms, Cole, Elliott, Occhiali and Strobl (2018) assessed the scope to which power outages impact the turnover for organizations in the African continent. Using World Bank Enterprise Surveys data for 14 countries, it was evident that firms that did not own a generator were more negatively affected in sales due to unreliable power supply. It was established that a downsizing of the expected outage levels to those achieved by the South Africa economy during the study time span would result to the organization's overall turnover up rise by 85.1%. This would lead to 117.4 per cent for the persons without generator facility.

The studies of Abotsi (2016) and Cole *et al.* (2018) had dissimilar conceptual gaps. The latter focused on influence of power outage and sales implication whereas the former (ie Abotsi, 2016) was concerned with how power outage affected production efficiency. None of the two studies considered the performance perspective. Again, it is worth noting that if productivity efficiency and sales levels were adversely influenced by power outage, it is necessary to further investigate the extent to which the same predictor variable has on performance, especially on non-financial, financial and overall performance perspective.

According to the past studies (Siddiqui *et al.* 2012; Fisher-Vanden, Mansur and Wang 2015; Growitsch *et al.* 2013 and Frederick and Selase, 2014), it is clearly depicted that power outage had mostly negative influence on the dependent variable in question. Although power outage was a common concern by all authors in the aforementioned studies, conceptual gaps existed as some authors focused on the strategy, while other firms adopted mechanisms to counter power outage challenges by acquisition of generators. Still, other studies considered productivity efficiency as the dependent variable. In other cases, changes in cost of production was the major concern.

Past studies did little in considering the diverse perspectives of power outage dynamics in order to determine the extent to which they impact performance. Therefore, the current study sought to establish the level of influence caused by electric power outage dynamics on firm performance. To achieve this, the study decomposed the electric power outage aspect into four sub-variables, namely; power outage frequency, power outage duration, power outage notification and time of power outage and further analyzed the extent that these perspectives influenced manufacturing firms' performance in Kenya. Furthermore performance was not taken as a composite score but it was similarly delineated into financial, non-financial and the overall performance perspectives so as to enable generation of new information for effective managerial decision making. Past studies further portrayed methodological gaps especially in data analysis where by simple regression was common. This study adopted multiple regression to test the first hypothesis to assess the predictive power of every additional sub-variable.

Quarshie, Agyeman, and Bonn, (2017) conducted a study on manufacturing firms listed on the Ghana stock exchange. The study sought to establish whether diverse outcomes were realized in relation to power outage impacts on firm performance. The population used was all the manufacturing companies listed at the Ghana Stock Exchange (GSE) for the period 2007-2013. Quantitative data analysis was utilized through descriptive statistics, averages and variances to make conclusions. It was discovered that the difference in Return on Equity (ROE) for power outage and non-power outage years, were not significant and that power outage does not affect ROE of manufacturing firms. On the other hand, power outage had effect on asset management ratio or asset turnover ratio of manufacturing firms. Return on Asset ratio (ROA) of manufacturing firms was higher in non-power outage periods than during power outage periods. The paper concluded that power outages in the short run, do not explain much of the gap in productivity and that manufacturing firms in the long run maybe affected by power outages.

2.3.2 Electric Power Outage Dynamics, Investment in Back up Generation and Performance

Most of the past studies were bivariate for they strictly considered the influence of the predictor variables, namely power outage on other proposed criterion variables. 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 this 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.

Mensah (2016) study focused on power outage and the dependent variables thereof. The assessment of implication of self-generation to correct the negative effect of power outage had a methodological shortcoming. That is, the methodology used to carry out analysis consisted three parts: first, analysis of the effects of outages on firm revenue and productivity and then further estimation of the effects on labor demand and firm size. In the final part, evaluation of the impact of electricity self-generation on firm revenue and productivity was done. This represented a methodological gap for the self-generation variable was treated as an independent variable. It was necessary to consider self-generation as an intervening variable and test its effect in the link between power outage and revenue and productivity. This way, the methodology would provide better information for decision making. This calls for further classification of some of the variables as intervening and not pure predictors of the dependent variables as done in past studies.

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 aforementioned study of Ado and Josiah (2015) followed bivariate model to estimate cost variations in production. Self-generation was assumed to play the role of another predictor variable in addition to power outage. In addition, the study considered three levels of firms, namely; manufacturing, service provision and trading organizations. This classification was not appropriate in comparing the economic or cost implications of the firms and it would be hard to generalize the impact power outage had on those Nigerian firms. The differences in input-output structure for firms in varying businesses would sufficiently infer a high degree of differences in electricity dependability as an input factor for firms in various businesses. Therefore, further investigation would be necessary to delineate the firms and consider each in isolation to determine the in-depth effect of power outage. In addition, self-generation could be considered as an intervener of the relationship between power outage and production cost.

In the study of Reinikka and Stevesson (2002), the aim was to evaluate 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) was 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.

The study of Reinikka and Stevesson (2002) portrayed that most firms had laid down strategy to cushion power blackout due to poor public power supply through acquisition of generators. The independent variable was the unreliable and inadequate electric power supply and self-generation whereas the dependent variable was sales, costs and profits. The empirical results would provide greater detail if the study utilized delineated power outage indicators in order to assess the effect of each outage characteristic on cost variations and other dependent variables such as sales and profitability.

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 in the duration of the 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.

From the past studies reviewed, (Mensah, 2016; Ado and Josiah, 2015; Reinikka and Stevesson, 2002) the focus of most of the researchers was to determine the extent to which power outage affected other variables (dependent variables). That is the studies relied on bivariate models in analyzing data such as simple regression analysis. In addition, there exist conceptual gap for most authors had dissimilar research findings yet they had considered power outage as a common predictor variable. Some investigated the effect of power outage on diverse outcome variables such as sales, production cost and production efficiency. While others categorized power outage as the dependent variable especially in the case of studies that investigated the causes of power outages. Also, there existed methodological gap for past studies used diverse indicators to estimate variables such as power outage. This calls for a more appropriate approach to measure variables which should be universally accepted.

Electric power outage was classified as the predictor variable in the current study and firm performance as the criterion variable. It further classified self-generation as an intervening variable hence delineating it from the past classification of being a predictor variable in past literature. This study endeavored to eliminate the conceptual gap of self-generation being treated as independent variable by testing its proposed intervening effect in the relationship between electric power outage dynamics and firm performance. The study adopted stepwise regression models instead of simple regression approach used in past literature.

2.3.3 Power Outage Dynamics, Firm Characteristics and Firm Performance.

The characteristics of a firm are dominated by the demographic and decision-making qualities that make a distinction between one firm and another. Firm characteristics describe elements of its internal environment. Hence, organizations are demarcated by variables such as firm size, capital structure, liquidity, age of the firm, access to capital markets and growth opportunities (Zou & Stan, 1998). Most studies incorporate those firm characteristics as predictors of the dependent variable chosen, be it financial performance, productivity efficiency or production cost.

The study of Oseni and Pollitt (2013) investigated the effect of firm characteristics in creation of incentives for backup generation leading to reduced unmitigated outage costs. The study was conducted in 12 African countries and involved 6854 firms. The study evaluated the effect of firm characteristics as the independent variable towards motivating firms to self-generate power and investigated whether these motivations led to lesser unmitigated outage costs. The study used cross-sectional data and applied incomplete backup, marginal cost and individual assessment methodology. The study conclusions were as follows; that firms which concentrated on export transactions, big firms, and those that required the internet for operations suffered greater outage costs that were not mitigated notwithstanding their greater inclination to venturing in self-generation of electricity. Unmitigated costs of power outage accounted for the bigger share of total costs of outage notwithstanding the high levels of backup power generation investments, and indication of a low level of backup investment as a result of small capacity of back up capacity accessed by firms. Regression analysis outcome also portrayed that ignorance of an organization's attributes such as the size of the firm and its way of operations may amount to underrating of outage deficiencies.

The study of Oseni and Pollitt (2013) classified firm characteristic of the African based firms as a predictor variable and further sought the influence it had on power outage. The approach in this study represented a conceptual research gap for the model was bivariate considering only independent and dependent variable. Also, the study classified power outage as the outcome variable contrary to past studies of (Mensah, 2016; Ado and Josiah, 2015; Siddiqui *et al.* 2012; Fisher-Vanden, Mansur and Wang 2015). The study did not integrate any moderation in the analysis.

Alam (2014) conducted a study in India to evaluate the effect of power outage on firm size, productivity levels and profitability. The analysis adopted a model to generate comparative static predictions about input choices, output and changes in profits while increasing the occurrence of power outages. The conclusion of the study indicated that the effect of power outage differs across industries. In some power-intensive industries, increased frequency of outages was found to lower production and profits, while some industries were less affected due to availability of greater adaptation mechanisms. For instance, a rise in the occurrence of power outages lowered the yield and returns of only some electricity-intensive industries. In addition, the study found that short-run changes in power outages do not induce firms to install back up power generators. This study was bivariate as it was in many past studies, only considering the link between power outage and profitability, firm size and productivity. The study portrayed a methodological gap for measurement of power outage was based on power outage frequency dynamics.

The study by Alam (2014) was an appropriate one in estimating profitability of the firms in India. However, the author overlooked the content validity of the variable he intended to measure for he only used power outage frequency. Use of additional power outage dynamics would provide greater impetus in evaluation of firm performance. In addition, the study only considered firm size which is one of the firm characteristics recognized in corporate finance scope. It would be more rewarding if further consideration of additional firm characteristics were factored to assess any element of moderation, as all factors may not be necessarily pure predictors of performance. Hence an advancement on the study was necessary to establish the impact of power outage on firm performance in a more comprehensive manner by incorporating additional firm characteristics as moderating variables.

In another study by Bawuah and Anaman, (2018), the aim was to establish whether power outages in Ghana had an effect on performance of firms listed at the Ghana Stock Exchange. Explanatory research design was adopted and quantitative methods employed, that made it possible to carry out trend analysis of six years of firm performance, 'before' and 'during' power outage periods. The sample size selected entailed 25 firms from a population of 35 firms using purposive sampling technique. Key performance indicators measured were, profitability, revenue and growth rate. The research conclusions were contrary to the past studies as power outages did not have an adverse outcome on revenues of listed firms. In this study, the firms attained greater maximum revenues for periods when power outage was experienced. An average growth rate of 122.26 percent was achieved for periods of power outages against 79.0 percent mean rate of growth for periods with consistent power supply. The study therefore concluded that power outages had no effect on the growth rate of listed firms in Ghana. However, power outages had an influence on profitability of listed firms' and more so, were responsible for increases in operation expenses. The study concluded that power outage effects on financial performance of Ghana's listed firms is mixed.

Most of the past studies (Frederick & Selase, 2014 & Mensah, 2016) revealed that power outage had declining influence on performance of firms, including profitability, revenue and productivity efficiency. According to Singh and Mangat, (2012), this scenario could be justified by the fact that power outage may assume two dimensions, namely; planned and unplanned power outage. When unplanned power outages occurred, customers would be caught unawares, hence they would not be in a position to plan for such eventualities. In instances when firms experienced planned outages and where notification of outage was provided in advance, increased profitability was noted. Therefore, notification is noted as an important determinant of the level of impact of power outage on industrial firm performance and thus has been incorporated as a power outage dynamic in the current study.

In a similar study by Moyo (2012), the aim was to evaluate the impact of power supply interruptions on productivity of firms in the manufacturing sector of Nigeria. Tobit and OLS models were utilized. Productivity variables that were used as outcome factors were estimated using plant and machinery replacement costs. Output was measured using sales total value, while material inputs were measured using total expenses of direct materials and transitional things utilized in production. The age of the firm was computed by determining the change in duration between the year the organization was incorporated and the year the study was undertaken. Firm size was computed based on the number of workers engaged; all firms with less than twenty workers were categorized as small and the large one had more than 20 employees. The aim of using this methodology was to assess whether power outages affected firms arbitrarily or whether the impact depended on the firm's size. Power outage was estimated by the number of days' firms experienced power outage per month, the number of hours a firm went without power per day, and the percentage of yield lost due to power outages in any given year. The research finding revealed that power outage variables had adverse and significant consequence on productivity, more so for small firms. It was further depicted that, inadequate electric supply had an inverse impact on growth rate of small and medium businesses, and operational costs increased significantly during periods that power outages were experienced. The cost of backup power source also pushed up the cost of business operations significantly.

The study by Moyo (2012) focused on the extent to which power outage influenced productivity of manufacturing firms in Nigeria. The model used was bivariate and considered some firm characteristics namely firm age and firm size. Other firm characteristics such as capital structure needed to be incorporated in the model and assessed for the moderation effect it could have on the link between power outage and productivity of manufacturing firms in Nigeria. Further, the study of Moyo (2012) considered power outage in days and hourly basis. There was need to factor in power outage notification and frequency to determine the magnitude of influence on productivity.

Oladele, Omotunde and Adeniyi (2017) also conducted a study which classified capital structure as an independent variable. The study assessed the influence of capital structure on performance of listed organizations at the Nigeria Stock Exchange from 2004-2013. The study set to establish the general impact of capital structure on corporate performance of the quoted organizations by ascertaining the linkage between determination of capital structure of Nigerian firms and their ROE, ROA, EPS and turnover growth rate, whereby those factors were used as proxies to measure corporate performance. Multiple regression was used to carry out the data analysis. The study outcome was that capital structure did not have substantial impact on ROE but had significant impact on ROA, Earning per Share (EPS) and sales growth of listed manufacturing firms in Nigeria. The study advocated for the listed firms critical need to ensure optimization of capital structure so as to increase the returns on equity, assets and earnings per share.

Saeedi and Mahmoodi (2011) carried out a study to determine the linkage between the capital structure and the performance of firms listed at the Tehran exchange bourse. The outcome of the study was that there was a direct association between market related measures of performance and capital structure. ROE and capital structure did not have significant association, while ROA had a positive link to capital structure. Hence, the study concluded that financial leverage impacted on the various measures of performance in distinct ways.

Kisengo and Kombo (2014) carried out a study in Nakuru, Kenya to assess the impact of characteristics of firms on the microfinance sector performance. Both primary and secondary data was gathered by use of questionnaires. Using census approach, analysis was conducted for the 48 registered microfinance institutions. Firm characteristics and organizational performance were analyzed using descriptive statistics. Relationship between firm characteristics and performance was interrogated using correlation analysis and further, the impact of firm characteristics on performance of microfinance institutions was done using regression analysis approach. It was established that firm characteristics had statistically significant direct effect on performance of MFIs. Features that were capital related had the least effect on performance of microfinances, whereas those that were structure related had the greatest impact.

2.3.4 Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Performance

Several past studies portrayed that power outage was the key variable that researchers focused on. In other cases, the power outage was modeled as a dependent variable and the results obtained were dissimilar. For instance, Adewuyi and Emmanuel (2018) investigated whether corruption played any role in easing the consequence of power outages on performance of firms within some selected zones in Nigeria.

Comparisons were made to determine which options between self-generation of electricity during outage periods or bribing of electricity officials was more profitable for firms in attempting to lessen the effect of power outages on performance. The secondary data used was sourced from the World Bank Enterprise Survey (WBES). Predictor variables for the study were percentage of skilled labor, power outage intensity, capital intensity, firms that self-generated, cost of material inputs and bribery paid for electricity connection. The dependent variable was firm performance. The study also classified foreign ownership, difficulty in accessing finance (ie capital structure), the size of the firm, private ownership, generator ownership, security cost, research and development, annual sales competition levels and the proportion of export a firm has as the control variables. Two-Stage Least Squares (2SLS) and Cross Sectional Ordinary Least Squares (OLS) techniques were employed in the study.

Adewuyi and Emmanuel (2018) research findings portrayed that consequence of electricity outages on the firms were not lessened by bribery. The study also concluded that although power holidays improved firm performance, some geo-political zones recorded increased cost of production due to self-generation which was termed as a form of indirect tax whose effect on firm performance was negative. This study classified self-generation as a control variable whereas in other studies (Reinikka and Stevesson, 2002; Ado and Josiah, 2015 and Mensah, 2016) it was classified as predictor of profitability of the firm hence a conceptual gap existed. Similarly, the study categorized sales turnover as control variable while in other studies (Abotsi, 2016 and Mensah, 2016) was assumed to be the criterion variable. These approaches by different researchers represented a variety of research findings and no universally accepted classification of these variables exists. Further investigation was therefore valuable to establish the multiple regression outcome where by power outage (assuming independent variable), investment in back up generation commonly referred to as self-generation (assuming intervening variable) and capital structure and industry as moderating variable jointly influence performance of manufacturing firms, as conducted in the current study.

Amadi, Ephraim, Okafor and Izuegbunam, (2016) investigated the impact of power outages in Nigeria's industries for the year 2014 through the simulation of statistical data collected from two hundred and fifty (250) electricity intensive industries drawn from the nation's three major industrial cities. The sample was determined using the technique of stratified random sampling. Analysis in the study was done using Statistical Package for the Social Sciences (SPSS) Version 16.0. The research outcomes concluded that in 2014, Nigeria industries under investigation spent a significant amount of money as a consequence of power outages. The results further showed that Nigerian industries suffered low capacity utilization, significant reduction in productivity, low marginal profit and lack of competitiveness in the international market due to perennial shortages in energy supply resulting from high distribution losses.

Power outage is a common phenomenon in both developed and emerging economies and from past literature, it is evident that this challenge adversely affects cost of production and sales turnover among other perspectives. For instance, Amadi *et al.* (2016) study considered power outage as the predictor variable and cost of production, production capacity utilization, profitability and competitiveness as the dependent variable. The study provided a recommendation about the need for immediate upgrading of the power transmission lines and also highlighted the need for power utilities to provide consumers prior notice of power outages. A variation of this study could consider the inclusion of moderating and intervening variables to introduce a multiple regression model to determine the joint effect of the aforementioned variables on Nigeria's industrial firms' performance.

A study by Adenikinju (2005) was carried out to evaluate the cost of failures of infrastructure on performance of the manufacturing sector in Nigeria. The study evaluated firm's behaviors in adaptation to the business environment upon experiencing power outage. The study adopted survey technique and revealed preference methodology. The study established that inefficient supply of power to industry had inflicted substantial costs to the business sector in Nigeria mainly from investment in expensive power back-up. The study further revealed that outage costs varied with scale of production, the costs had wide variations across various classifications of manufacturing firms as reflected by a high standard deviation. A similar study to that of Adenikinju (2005) was undertaken by Allcott, Allan & Stephen (2014) to evaluate the effects of power outages on manufacturing firms in India. Using a Cobb-Douglas production function model, the researchers sought to evaluate the effect of outages on firm productivity and revenues. The study conclusions reflected that outages impacted firm revenues on the order of 5 percent and that the effect of the outages affected productivity much less than revenue. There was heterogeneity in effect of firms with versus those without generators and amongst firms with high versus low electricity intensity.

The two studies of Adenikinju (2005) and Allcott, Allan & Stephen (2014) portray that the matter of power outage in developing countries is a challenge. This is because, the two authors established that power outage effects were negative although the studies dependent variables were dissimilar. The two studies used bivariate models that could benefit from inclusion of additional moderating and intervening variables in order to determine the joint effects of various variables. This would provide greater impetus in the cause effect relationships of power outage and other variables.

In summary, most of the past studies considered the influence of power outage on diverse dimensions of the firms such as profitability, productivity efficiency, cost of production, firm growth rate and sales revenue just to mention but a few. The aspect of self-generation was considered where by firms especially the large ones invested in acquisitions of back up generation. Also, other studies incorporated some firm characteristics as predictor variables. However, most of those studies were bivariate and used simple regression models to establish the link between the dependent and independent variables. Little focus was observed on multiple perspective where the influence of independent, intervening and moderating factors are considered jointly to establish the influence they have on the outcome variable. Therefore, there was need to come up with a multivariate regression model to achieve this object.

2.4 Summary of Previous Studies and Research Gaps

From review of previous literature, electric power outage dynamics and the correlational perspective it has with firm performance resulted in diverse and controversial results

(Adenikinju, 2005; Allcott, Allan & Stephen (2014); Amadi *et al.* 2016 and Alam, 2014). Past studies endeavored to determine the extent of effect which power outage had on manufacturing firms, whether small or large and provided dissimilar views for both similar and dissimilar criterion variables. Hence no well-established studies on the subject and cause effect relationship amongst the aforementioned variables were conclusive. As per the past literature, a number of conceptual, theoretical, contextual and methodological knowledge gaps arose from the analysis of the issues in chapter two.

This study identified some conceptual gaps due to the fact that past studies did not incorporate intervening and moderating factors to the predictor-criterion linkage between electric power outage dynamics and performance. In fact, many of the variables were common in most studies reviewed but they were treated as either independent or dependent variables or the vice versa. This was conflicting, hence there was no universally accepted cause-effect association that was clearly established.

The introduction of investment in back up generation as intervening variable and firm characteristic as moderating variables provided a better insight of power outage and firm performance association. This study introduced investment in back up generation as an intervening variable and firm characteristics as a moderating variable in an attempt to functionally elaborate the connotation that exists between power outage and performance association of manufacturing firms under membership of Kenya Manufacturers Association. A key short coming of past empirical studies is that they were bivariate (independent and dependent) hence this approach necessitated consideration of the four variables taken together. Therefore, this study analyzed electric power outage dynamics, IBUG and firm characteristics against firm performance using data of firms that are members of Kenya Manufacturers Association.

The conceptual gaps were as a result of lack of scholarly logical relationship between power outage and firm performance. That is, most of past empirical studies utilized power outage as the predictor of other variables such as sale revenue, profitability, cost of production and firm growth rate. In other cases, although not very common, power outage was treated as the dependent variable as scholars endeavored to establish factors that cause such occurrences. Other studies considered self-generation as an independent variable and hence focused on determining the extent it influenced the identified dependent variable(s). No much emphasis on intervening effect was put on this variable by many scholars. Such studies ignored some critical influences some of those factors had in the relationship between electric power outage dynamics and firm performance. This study provided more elaborate regression model especially in the Kenyan context by introducing both investment in back up generation and firm characteristics as intervening and moderating variables respectively which conclusively explained the relationship between power outage dynamics and firm performance.

Another critical issue this study aimed at resolving was to bridge the methodological gap that existed in the past studies. Past studies used dissimilar indicators to measure the same variable. For example, use of only one proxy: power outage frequency in Alam (2014) to estimate electric power outage dynamics was limiting. The current study introduced the aspect of sub-variables that define electric power outage dynamics such as frequency, duration, notification and time of power outage. Further, composite score perspective was introduced to meet some of the specific goals of this study. For the perspective of firm performance, the study delineated construct in to three, namely; non-financial, financial and the overall performance so as to comprehensively establish the correlational link between the predictor and outcome variable used in the study.

The concept of electric power outage and firm performance was anchored on several theoretical foundations where by some theoretical gaps were highlighted in this study. This was as a result of the hypothetical argument inconsistencies that were noted during the review of the literature. The practices and policies followed by the manufacturing firms as pertains electric power outage dynamics and what the theories advocate seem to be misaligned hence a puzzle to many scholars. The current study has interrogated the applicability of financial theory of investment, transformation theory, trade-off theory and the pecking order theory which are linked to the association between electric power outage dynamics and firm performance. The aim of interrogating those theories was to affirm, disapprove or bring out novelty in past theoretical knowledge.

The study of electric power outage dynamics and firm performance portrayed some contextual gaps based on the reviewed literature. From the past literature, it was observed that most of the research findings were from the developed economies and few of the developing ones, thus similar studies were lacking in most of the emerging economies such as Kenya. The research findings of the developed economies did not directly apply to developing economies like Kenya due to differences in the level and structure of economies as well as significant variations in the firms that operate in those economies.

Past literature was dominated by diversity of methodologies used in measuring variables, sampling approaches and data analysis, even when the studies were similar in objectives to be achieved and the way they were conceptualized. This revealed some methodological gaps on the joint effect of electric power outage dynamics, investment in back up generation, firm characteristics and firm performance. Some of the studies used OLS estimation equation to achieve their study objective such as Mensah (2016). Other similar studies to that of Mensah (2016) utilized OLS methodology, whereas others used both OLS and Tobit models such as Moyo (2012). Other researchers on the effect of power outage on dependent variables used cross sectional Ordinary Least Squares (OLS) and Two-Stage Least Squares (2SLS) techniques such as Adewuyi and Emmanuel (2018).

In addition, the proxies used as indicators of similar variables in either similar or diverse studies were also controversial. For instance, in some studies power outage was measured using different approaches. For instance, Moyo (2012), used the average monthly power outages, the number of hours firms experienced outage per day, and the proportion of lost output due to the outages in a year while Siddiqui *et al.* (2012) used energy not served connotation to refer to power outage. For dependent variable, most researchers in the past literature used dissimilar measures. Some measured firm performance using sales revenue, others profitability and others used ROA and ROE. The current study has comprehensively considered more appropriate methodologies on data collection and analysis by first adopting descriptive analysis to determine the general trend of the study variables, to access their normal distribution and their level of dispersion from the expected values, then further carried out correlation analysis using Pearson product moment before testing the null hypotheses where by stepwise and multiple regressions analysis was utilized.

Therefore, a summary of the past literature on the study variables, namely; electric power outage, IBUG, firm characteristics and firm performance has been highlighted as shown in Table 2.1 below. For each study, it is further outlined how the results and the research gaps are addressed.

Table 2.1: A Summary of Previous Studies on the Research Variables

Study	Study Focus	Research Methodology	Findings	Knowledge Gaps	Focus of the Current Study
Bernard and Anaman (2018)	Assessment of effect of power outages on financial performance of listed firms	*Comparative analysis	*Effect of power outages on financial performance of listed firms in Ghana is mixed. *Power outages did not have an effect on revenue generation of listed firms *Power outages had an effect on listed firms' profitability and accounted for increases in operational expenditure.	*Firm performance was measured by revenue, profitability and growth rate. *Power outage was represented by presence or absence of power outage in two periods; one period with consistent power (no outage), while in the second period, the firms experienced power outages. *Study was a three-year comparative trend analysis of two periods.	* Firm performance was measured through six indices based on SBSC *Study used robust power outage characteristics (frequency, duration, notification and time of outage) * Study was based on cross sectional design *To analyze the data, stepwise and multiple regression was utilized
Mensah (2016)	Investigation of the impact of electricity shortages on the performance of firms.	*Cross sectional analysis *Ordinary Least Squares (OLS)	* Existence of significant and negative impact of electric power outages on firm revenue and productivity * Self-generation of electricity to mitigate outage may have long run negative impact on firm productivity due to the high marginal cost associated with self-generation	* Firm performance measured based on productivity and revenue * Electric power outage characteristics evaluated was only frequency * Longitudinal research design based on variant years for different countries	* Firm performance was measured through six indices based on SBSC *Study incorporate four outage characteristics; (frequency and duration) and in addition, notification and time of outage * Study was based on cross sectional design
Ado and Josiah (2015)	Influence of deficient electricity supply on small scale businesses in Nigeria	*Cross sectional design *Analysis of Variance (ANOVA)	*Unreliable supply of electricity imposes costs to businesses in many ways *Investment in back up denies businesses use of scarce resources for other investments *Study measured willingness to pay of improved electricity supply	*Impacts of electric power outage only measured by cost of power back up investment *Firm performance measurement was not a factor in the study	*Impacts of electric power outage was measured on various firm performance perspectives *Study examined intervening effect of backup power on the impact of electric power outage on firm performance * Study used the contemporary SBSC to measure performance.
Amadi and Okafor (2015)	Derivation of mathematical models for estimation of economic costs of power outages among selected industries in Nigeria	*Cross sectional study *Direct assessment and captive costs	*It is crucial to incorporate certain factors that have a major bearing on magnitude of costs of power outage, *The use of a combination of direct costs and captive costs assessment techniques is critical in order to incorporate	*Study focus is on cost of power outage impact on the firm without consideration of other non-monetary impacts *'Industry' was the only firm differentiating characteristic in the study	* The study measured impacts of electric power outage on various firm performance measures *study incorporated two firm characteristics as indicators of moderating variable; industry and capital structure

		methodologies	all aspects of costs of a power outage for industrial firms		
Fisher-Vanden *et al.* (2015)	Examination of response to severe power shortages of firms in China, whose production processes are energy intensive	*Cross sectional design *Regression modeling	* Replacing materials for energy - a change from "make" to "buy" of intermediate inputs to production led to firms re-optimizing among inputs to production * No expansion of backup generation from power outages	*Study focus was on response of firms to power shortages and resultant effect on productivity *Capacity factors of regional grid used as measure of electric power reliability	*study focused on impacts of power shortages to various performance measures *Study utilized four outage characteristics as measures of electricity scarcity
Alam (2014)	Results of inter-industry heterogeneity in adaptation to insufficient electricity on a firm's output and profits	*Longitudinal study *Regression modeling	* Effect of electric power outages differs by type of industry * Some businesses have the capacity to modify their means of production to manage power shortages.	* Only one electric power outage characteristic is considered; frequency of outage * Study focus is on evaluation of electric power outage and adaptation in 3 industries; brick, rice and steel industries	* Current study considered four characteristics of electric power outage namely; frequency, duration, notification, and time of outage * Study evaluated the impact of electric power outage on performance of firms in three main categories of business
Allcott *et al.* (2014)	Analysis of the response of Indian textile plants to weekly power holidays	*Cross sectional design *Leontief/Cobb-Douglas production function model	*Power shortages reduce outputs of companies by about 5% *Plants without generators have much larger losses *Shortages affects small plants more severely	*study focus was on effect of power outages on productivity and revenues *Study incorporated only two power outage dynamics; notification of outage and frequency in analysis of power outage on firm productivity *Firm size and electricity intensity firm characteristics were incorporated	*Current study evaluated the impact of power outages on various performance measures * Study incorporated four outage characteristics; (frequency and duration) and in addition, notification, and time of outage * the study incorporated industry and capital structure as indicators of moderating variable (firm characteristics)
Cissokho and Seck (2013)	Assessment of impact of electric power outages on firm productivity (cost efficiency, technical efficiency, and scale efficiency) in Senegal	*Cross sectional design *Econometric analysis	*Unreliable Electricity is a major constraint to business activities * Electric power outages, typically a limitation to production, resulted in a trigger of best management actions from businesses, which lessens the negative effects of electric power outages	* Study provided only three outage dynamics; frequency, duration and severity *Wider array of performance measures for the firms are feasible	*Additional indicators of outage dynamics were incorporated in the study; notification, and time of outage * Study had a wider scope of performance measurement through the use of SBSC.

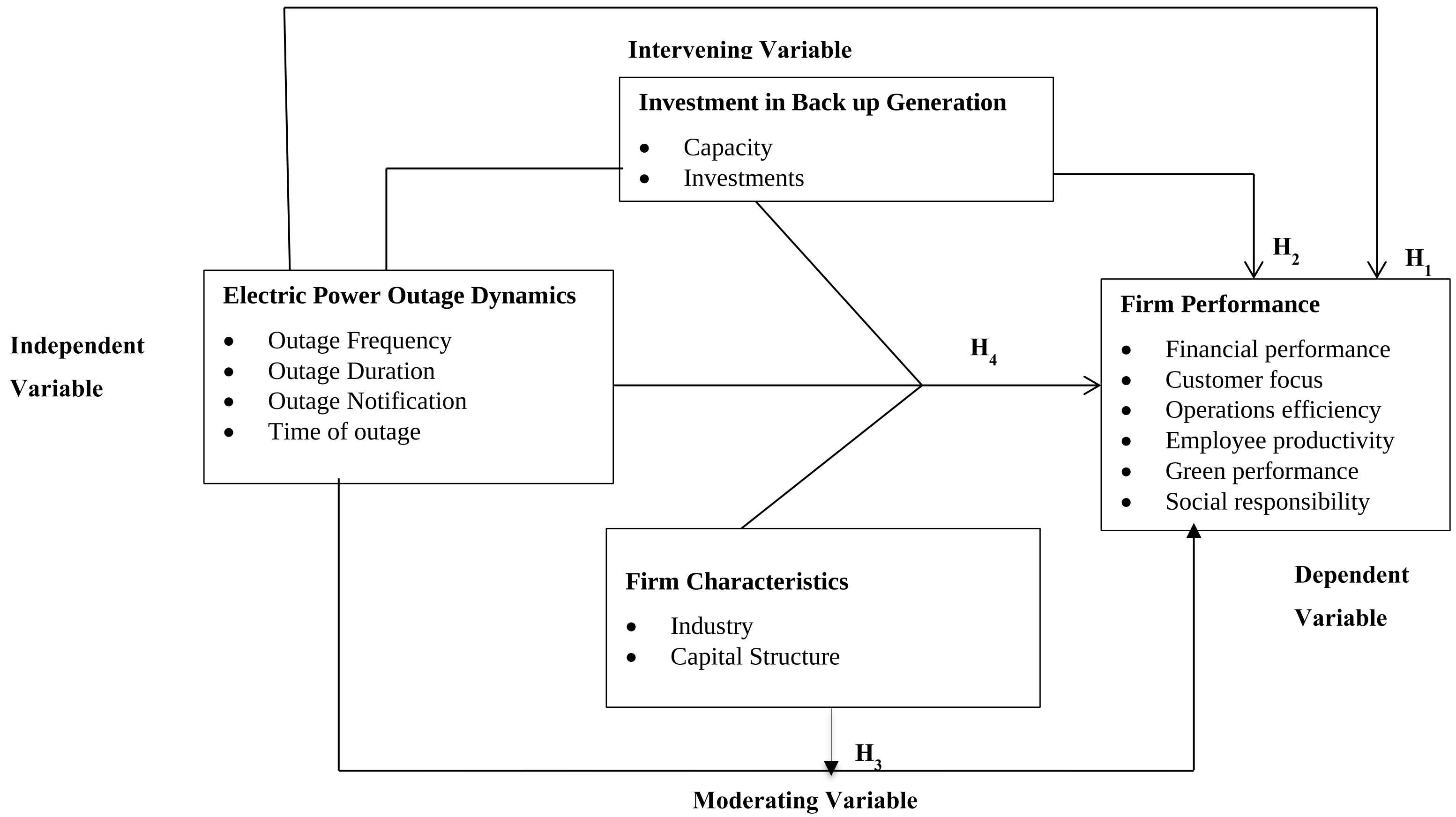
Oseni and Pollit (2013)	Effect of firm characteristics on impact of electric power outage costs and how this may create incentive to invest in back up generation	*Cross sectional design *Marginal cost, incomplete backup and subjective evaluation techniques.	* The need for investment in alternative backup generation is influenced by occurrences of power outage, size of the firm, experience of managers. *The largest portion of power outage costs is derived from unmanaged outage costs, which occur despite significant ownership of back up generation equipment.	* Electric power outage dynamics effects were not analyzed * Outage cost is the main focus of the study – how these are impacted by firm characteristics and the effect of back up investment in mitigating the costs	*Study analyzed the impact of outage dynamics on overall firm performance *Study analyzed the intervening role of investment in back up generation and the effect of moderation by firm characteristics on the relationship between electric power outage dynamics and firm performance *Study focused on the overall firm performance using the SBSC.
Siddiqui *et al.* (2012)	Estimation of the cost of energy not served in selected industrial cities of Pakistan	*Cross sectional design *Two-dimensional analysis	* There was increase in the production cost of the firms due to electric power outage * The loss from industrial output ranged between 12 and 37 percent.	* The impact of alternative generation sources was not analysed * Outage characteristics were modeled using duration and shift hours. * The study analysed the cost of outage based on only the idle factor of production	* The impact of alternative power source in reduction of negative impact to businesses was examined * Current study incorporated four outage characteristics * The study analyzed effect of electric power outage dynamics such as outage frequency, duration, time, notification of outage and time of outage (or lack thereof) on performance
Steinbuks and Foster (2010)	Identifying fundamental sources, benefits and costs of self-generation in Africa	*Cross sectional design *Regression modeling	*Costs of self-generation are about 3 times the cost of power from the grid *Significant value is drawn from ownership of generators due to reduced value of lost load *Firm characteristics namely size, age, industrial sector and export orientation have significant influence on firm ownership of own-generation capability	*Methodology of assessment of effect of self-generation was based on costs versus benefits to determine net effect *Outcome was characterized by size, age, industry and export orientation of firms under consideration	*Self-generation was the intervening variable in relationship between power outage dynamics and performance *Firm characteristics industry and capital structure were incorporated as moderating variables
Adenikinju (2005)	Analysis of the cost of electric power outages to the businesses in Nigeria	*OLS Regression *Survey technique and revealed preference approach	*The characteristics of the power outage namely; frequency and duration impact the value incurred from outage * Backup generators have a decreasing influence on outage costs	*Only two electric power outage dynamics were considered in the study; electric power outage frequency and duration. Additional characteristics can be analysed for analysis of further impact on the operations of the firm	*Study incorporated additional electric power outage dynamics (characteristics) to analyze their effect on firm performance – notification of outage, day and time of outage * Investment in back up generation incorporated into the study as an intervening variable

2.5 Conceptual Framework

The framework provides a representation of the relationships amongst four study variables namely; Electric power outage dynamics, investment in back up generation, firm characteristics and performance representing independent, intervening, moderating and dependent variables respectively.

Electricity functions as a critical input to business enterprises. In addition to its critical role in powering industrial equipment, its significance in contributing to human capital productivity cannot be taken for granted since most of the firms' manufacturing activities require continuous flow of electricity. Electric power outages therefore, affect businesses activities, which eventually lead to negative effects on firm performance. The impacts of the outages are defined by the characteristics or dynamics of each outage. In order to insulate against perverse effects of power outages on business processes, many firms invest in backup power generation. Firm characteristics are considered to be significant drivers to varying categories of firm performance, in addition, the impact of outage on performance is largely influenced by firm characteristics including industry and capital structure.

The conceptual framework is represented in figure 2.1



Source: Researcher 2021

Figure 2.1: Conceptual Framework

2.6 Research Hypotheses

The hypotheses that have guided this study are;

H_{01}: The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significant.

H_{02}: The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in back up generation.

H_{03}: The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly moderated by firm characteristics.

H_{04}: The joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance of manufacturing firms in Kenya is not significant.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This section captures the research methodology that was adopted for the study and includes a discussion on research design, research philosophy and population. The section also features discussions on the methodology adopted for data collection, validity and reliability tests and techniques of data analysis adopted for the study.

3.2 Research Philosophy

Social science research is mainly dominated by two research paradigms, namely positivism and phenomenology. Positivist approach is founded on knowledge obtained from 'positive' confirmation of visible experience rather than introspection or perception, (Cohen & Crabtree, 2006). Phenomenology approach on the other hand, assesses human experiences through the descriptions provided by involved persons.

This study adopted positivist philosophy, a methodology that seeks to establish facts based on objective measures and methodologies through the use of statistical techniques. Positivist approaches depend profoundly on investigative methods. The methods confirm differences between the prejudiced opinions of the person(s) undertaking the research and the unbiased real experience of their analysis. Cohen & Crabtree 2006 postulate that this research methodology comprises the generation of study hypothesis and subsequent testing of the hypothesis. Positivist paradigm is anchored on existing theories and results in a scientific, systematic approach to research and as such lends itself to the application of quantitative approaches (Mukherji & Albon, 2010). Adoption of this philosophy facilitated use of statistical approaches for analysis of data to deduce relationships amongst electric power outage dynamics, investment in backup generation, firm characteristics and performance of manufacturing firms in Kenya.

3.3 Research Design

Research design is a strategy of how a researcher aims at conducting their investigation (Burns & Grove, 2003). The selection of the approach depends on what the researcher would like to investigate, as well as the type of method that the researcher finds appropriate for the research. Kerlinger (1992) defines research design as the strategy and organization of analysis envisioned in order to attain responses to research questions.

The study adopted descriptive survey design. Bryman (2004) contends that a descriptive research design is valuable in studies that involve data collection (qualitative or quantitative) for greater than one case and at a specific time and involves the use of two or more variables so as to assess patterns of association. The design involved data collection at a point in time in relation to relationships between variables in an effort to determine associations between them.

3.3.1 Population and Sample

In research, study population is an accumulation or totality of all the items, subjects or participants that conform to a set of specifications, (Polit & Hungler, 1999). The study focused on 447 firms in Kenya that are engaged in manufacturing of different goods. The firms are distributed in different regions and counties across the country. All the firms in the study were members of the Kenya Association of Manufacturers (KAM), attached in (Appendix I). KAM classifies member firms into fourteen (14) categories based on goods and services the firm is engaged in. The study focused on twelve (12) of these categories, represented in Table 3.1. The two categories excluded from the study are services and consultancy and the agriculture sector. The exclusions of the two categories of firms was due to the fact that the operations of firms within these categories are not dependent on electricity, which was a main subject in this study. Therefore, evaluation of the effects of power outages on performance of firms as depicted in this study was not expected to be effective.

Stanley & Gregory, (2001) contend that for sample selection in cross sectional surveys, values of not less than 10 percent population sample should be viewed as a suitable proportion of sample selection. In a population of 447 firms, ten percent is roughly forty-five (45) firms, which is above thirty making 10% an adequate prevalence for the population of medium and large scale firms engaged in manufacturing in Kenya. This is an adequate size but not sufficient, hence the need to determine appropriate sample size. Kate (2006) postulates that a suitable sample size determination for a survey based on the population may be selected based on the following three aspects: (i) the desired level of confidence, (ii) the acceptable margin of error and (iii) the projected fraction share of frequency of the population of interest – 10% in this case based on the above prevalence by Stanley and Gregory (2001)

Kate (2006) formula for computation of desired size of sample for a design of survey established for a simple random sample. A sample of 138 firms was used. The sample computation was based on 95% confidence level and (±5%) precision.

$$\mathbf{n = \frac{t^2 \times p(1-p)}{m^2} = 138}$$

Where, n is desired size of sample, t is the level of confidence at 95%, p = projected percentage occurrence of the population of interest – 10%, m = margin of error at 5% (standard value of 0.05). Sub-sample sizes were determined across the 12 categories (strata) based on the proportionate size relative to the population. Within the strata, firms for the sample were selected by random sampling, while putting into consideration the location of the firms.

Table 3.1: Sample Frame

Category	Population	Sample Size Proportion	%
Leather and Footwear	5	1.54	2
Pharmaceutical & Medical Equipment Sector	14	4.32	4
Timber, Wood & Furniture Sector	15	4.63	5
Building, Mining & Construction Sector	17	5.25	5
Motor Vehicle Assemblers & Accessories Sector	26	8.03	8
Energy, Electrical and Electronics Sector	30	9.26	9
Paper & Board Sector	36	11.11	11
Textile & Apparels Sector	39	12.04	12
Chemical & Allied Sector	47	14.51	15
Plastics & Rubber Sector	49	15.13	15
Metal and Allied Sector	50	15.44	15
Food & Beverages Sector	119	36.74	37
TOTAL	**447**	**138**	**100**

Source: Researcher (2021)

3.4 Data Collection

Primary and secondary data was used for the study. A questionnaire attached in (Appendix II) was used to collect the primary data. The questionnaires were distributed to each of the 138 firms to collect information on indicators of electric power outage dynamics which entails power outage frequency, power outage duration, power outage notification and time of power outage as well as for non-financial performance proxies. For investment in back up generation (ie capacity and investment), firm characteristics which was measured using industry and capital structure and financial performance, both primary and secondary data was availed to the researcher for the compilation of the overall data.

The participants in the study were managers in charge of finance, operations or both, whichever was identified as the most appropriate to obtain accurate information in the various firms. The respondents had a good understanding of operational and performance aspects of their firms and the impacts of electric power outage.

3.5 Operationalization of Research Variables

The research variables under study are represented in the study as captured in table 3.2 in order to measure their relationships quantitatively. The independent variable for the study is electric power outage dynamics, while firm performance is the dependent variable. Investment in back up generation takes the intervening role in the relationship between electric power outage dynamics and firm performance, while firm characteristics take the moderating role of the relationship between electric power outage dynamics and firm performance. Organizational performance was captured by SBSC.

Table 3.2: Summary of Research Variables and their Operationalization

Variable	Indicator	Operational Definition	Supporting Literature	Questionnaire/Data Sheet Section
Electric Power Outage Dynamics ***(Independent Variable)***	Outage frequency	Regularity of power loss incidences	Mensah (2016), Amadi and Okafor (2015), Eto *et al.* (2001)	(B) 1
	Outage duration	Length of time of power loss	Mensah (2016), Moyo (2012), Eto *et al.* (2001)	(B) 2
	Outage notification	Advance communication to firm by power company before power loss occurs	Allcott *et al.* (2014), Eto *et al.* (2001)	(B) 3&4
	Time of outage	Time of day an outage occurs (day, evening or night)	Foster & (2009), Amadi and Okafor (2015), Eto *et al.* (2001)	(B) 5
Investment in Back up generation ***(Intervening Variable)***	Capacity	Size of backup power relative to full demand	Moyo (2012), Steinbuks and Foster 2010	(C) 1&2
	Investment	Amount invested in power backup in relation to firm's total assets (as per the balance sheet)	Allcott *et al.* (2014), Adenikinju (2005)	(C) 3
Firm Characteristics ***(Moderating Variable)***	Industry	Dummy Variable-with value of one (1) if a firm belong to a particular industry. Otherwise assign zero value (0)	Steinbuks and Foster (2010)	(D) 1
	Capital structure (Gearing ratio)	Debt/Total Capital	Xiaodong & Birge, (2008)	Data Sheet (A) 1
Firm Performance ***(Dependent Variable)***	**Financial performance**	ROA (Net Income/Total Assets)	Magutu (2013) Kinuu (2014)	Questionnaire (E) Data Sheet (B)
	Non-Financial performance ✓ Customer satisfaction ✓ Operations efficiency ✓ Employee productivity ✓ Green performance ✓ Social responsibility	✓ Meeting customer requirements ✓ Internal processes adopted to improve efficiency ✓ Mechanisms to improve employee productivity ✓ Protection of environment in all processes ✓ Corporate social responsibility		

Source: Researcher (2021)

3.6 Data Analysis

Various types of analysis were carried out to test diverse properties on the study variables. Multiple and step wise regression analysis were applied to the study variables to assess various relationships amongst them. Coefficient of variation and standard deviation were applied to analyze the variability of association amongst the variables. The strength of fit was assessed using the coefficient of multiple determination. Measures of dispersion were applied to investigate the fundamental qualities of the data collected for the study.

3.7 Diagnostic Tests

The study variables were subjected to various diagnostic tests. Namely; normality test; multicollinearity and homoscedasticity test. Normality tests was carried out to determine whether the data collected for the study was normally distributed or not. For test of compliance to normal, linear and homogeneity by the data collected, histogram, normality and scatter plot of residuals which were standardized against predicted dependent values were used. Hence the Kolmogorov-Smirnov and Shapiro Wilk and histogram tests were utilized.

For results to be valid and reliable, the empirical model developed should demonstrate orthogonality of the independent variables. This is an issue which arises between independent variables which imply high correlation between the said variables. This problem creates difficulties when trying to draw interpretations about the diagnostic's relative influence on each independent variable to the success of the model (Ambula, 2015). Variance Inflation Factor (VIF) was used to test for multicollinearity.

Test for homoscedasticity state was also undertaken. Homoscedasticity describes a situation in which the error term, in the relationship between the independent variables and the dependent variable is the same across all values of the independent variables. The absence of this state is a case of heteroscedasticity (Hair, William, Barry & Anderson, 2006). Heteroscedasticity therefore arises when the variation of the dependent variable differs across the data. Homoscedasticity arises when the variance of the dependent variable is similar for all the data (Ghasemi & Zahediasl, 2012). This aspect was also tested using Breusch-Pagan test approach.

3.8 Empirical Models

The diverse relationships of the variables are summarized in four empirical models outlined in section 3.81 to 3.84

3.8.1 Electric Power Outage Dynamics and Firm Performance

Multiple regression model was adopted to test the first hypothesis (H_1) which states that; the effect of electric power outage dynamics on manufacturing firms' performance in Kenya is not significant.

To determine the association between EPOD and firm performance, electric power outage dynamics (EPOD) was not taken as a composite variable hence all the four proxies, namely; power outage frequency (OF), power outage duration (OD), power outage notification (ON), and time of power outage (TO) were considered exclusively. Similarly, firm performance was decomposed in to the three main perspectives, namely; non-financial, financial and total performance. This was presented in summary using the following empirical expression;

$PER = \beta_{10} + \beta_{11}OF + \beta_{12}OD + \beta_{13}ON + \beta_{14}TO + \varepsilon_i$……………………………………(1)

Where:

PER is Firm Performance which entails three perspectives aforementioned

Electric Power Outage Dynamics (EPOD) which is measured using diversified indicators, namely;

Power Outage Frequency (OF)

Power Outage Duration (OD)

Power Outage Notification (ON) and

Time of Power outage (TO)

β_{10} is the regression constant or y intercept

β_{11-14} are regression coefficients of OF, OD, ON, and TO respectively.

ε_i is the random error term

NB: Hypothesis testing was done in three levels so as to robustly determine the extent to which electric power outage dynamics influenced the three aspects of firm performance.

3.8.2 Electric Power Outage Dynamics, Investment in Back up Generation and Firm Performance

The second null hypothesis (H_2) which was tested states 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. To test the association (ie intervening effect) that exists for the three variables, namely; EPOD, Investment in Back up Generation and firm performance, Baron and Kenny (1986) preliminary intermediation condition has to prevail. The condition is that the predictor and the criterion variable used must portray a significant causality relationship.

To achieve this objective, stepwise regression model was used. It should further be noted that electric power outage dynamics (EPOD) was not taken as a composite variable hence all the four proxies, namely; power outage frequency (OF), power outage duration (OD), power outage notification (ON), and time of power outage (TO) were subjected to intermediation test. The intermediating effect of investment in back up generation (IBUG), composed of capacity and investment was tested by adopting a three step procedure advocated by Baron and Kenny (1986) as depicted below:-

(a) Non-Financial Performance Perspective

i) Power outage frequency (OF)

1. *Investment in back up generation (IBUG)-Capacity*

Step one: Intermediation between OF and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$……………………………………………………………… (2)

Step two: Intermediation between OF and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………………….………...… (3)

Step three: Intermediation amongst NFIN, CAPA and OF as follows;

$NFIN_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (4)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

NFIN is non-financial performance of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

2. *Investment in back up generation (IBUG)-Investment*

Step one: Intermediation between OF and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………………………… (5)

Step two: Intermediation between OF and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………….…………..… (6)

Step three: Intermediation amongst NFIN, INVEST and OF as follows;

$NFIN_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$……………………………………...………… (7)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

NFIN is non-financial aspect of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

ii) Power outage Duration(OD)

3. *Investment in back up generation (IBUG)-Capacity*

Step one: Intermediation between OD and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$…………………………………………………………… (8)

Step two: Intermediation between OD and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$…………………………………………….…………..… (9)

Step three: Intermediation amongst NFIN, CAPA and OD as follows;

$NFIN_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$…………………………………………...………… (10)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

NFIN is non-financial performance of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

4. *Investment in back up generation (IBUG)-Investment*

Step one: Intermediation between OD and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$……………………………………………………………… (11)

Step two: Intermediation between OD and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$……………………………………….…………..… (12)

Step three: Intermediation amongst NFIN, INVEST and OD as follows;

$NFIN_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (13)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

NFIN is non-financial aspect of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

iii) Power outage notification (ON)

5. *Investment in back up generation (IBUG)-Capacity*

Step one: Intermediation between ON and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$…………………………………………………………… (14)

Step two: Intermediation between ON and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$………………………………………….…………..… (15)

Step three: Intermediation amongst NFIN, CAPA and ON as follows;

$NFIN_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (16)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

NFIN is non-financial performance of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

6. *Investment in back up generation (IBUG)-Investment*

Step one: Intermediation between ON and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$…………………………………………………………… (17)

Step two: Intermediation between ON and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$………………………………………….…………..… (18)

Step three: Intermediation amongst NFIN, INVEST and ON as follows;

$NFIN_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (19)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

NFIN is non-financial aspect of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

iv) Time of power outage (TO)

7. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between TO and Non-Financial Performance (NFIN)

$$NFIN_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it} \quad (20)$$

Step two: Intermediation between TO and Capacity (CAPA).

$$CAPA_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it} \quad (21)$$

Step three: Intermediation amongst NFIN, CAPA and TO as follows;

$$NFIN_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 CAPA_{it} + \varepsilon_{it} \quad (22)$$

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

NFIN is non-financial performance of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

8. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between TO and Non-Financial Performance (NFIN)

$NFIN_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$………………………………………………………………… (23)

Step two: Intermediation between TO and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$………………………………………….…………..… (24)

Step three: Intermediation amongst NFIN, INVEST and TO as follows;

$NFIN_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$……………………………………...………… (25)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

NFIN is non-financial aspect of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

(b) Financial Performance Perspective

v) Power outage frequency (OF)

9. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between OF and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$………………………………………………………………… (26)

Step two: Intermediation between OF and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$………………………………………….…………..… (27)

Step three: Intermediation amongst FIN, CAPA and OF as follows;

$FIN_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………………...………… (28)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

FIN is financial performance of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

10. *Investment in back up generation (IBUG)-Investment*

Step one: Intermediation between OF and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………………………… (29)

Step two: Intermediation between OF and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………….…………..… (30)

Step three: Intermediation amongst FIN, INVEST and OF as follows;

$FIN_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (31)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

FIN is financial aspect of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

vi) Power outage Duration (OD)

11. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between OD and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$………………………………………………………… (32)

Step two: Intermediation between OD and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$……………………………………….…………..… (33)

Step three: Intermediation amongst FIN, CAPA and OD as follows;

$FIN_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (34)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

FIN is financial performance of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

12. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between OD and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$………………………………………………………… (35)

Step two: Intermediation between OD and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$……………………………………….…………..… (36)

Step three: Intermediation amongst FIN, INVEST and OD as follows;

$FIN_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (37)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

FIN is financial performance of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

vii) Power outage notification (ON)

13. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between ON and Financial Performance (FIN)

$$FIN_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it} \quad (38)$$

Step two: Intermediation between ON and Capacity (CAPA).

$$CAPA_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it} \quad (39)$$

Step three: Intermediation amongst FIN, CAPA and ON as follows;

$$FIN_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 CAPA_{it} + \varepsilon_{it} \quad (40)$$

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

FIN is non-financial performance of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

14. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between ON and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$………………………………………………………………… (41)

Step two: Intermediation between ON and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$……………………………………………….…………..… (42)

Step three: Intermediation amongst FIN, INVEST and ON as follows;

$FIN_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$……………………………………...………… (43)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

FIN is financial performance aspect of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

viii) Time of power outage (TO)

15. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between TO and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$………………………………………………………………… (44)

Step two: Intermediation between TO and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$……………………………………………….…………..… (45)

Step three: Intermediation amongst FIN, CAPA and TO as follows;

$FIN_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (46)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

FIN is financial performance of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

16. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between TO and Financial Performance (FIN)

$FIN_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$…………………………………………………………… (47)

Step two: Intermediation between TO and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$……………………………………………….…………..… (48)

Step three: Intermediation amongst FIN, INVEST and TO as follows;

$FIN_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (49)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

FIN is financial performance of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

(c) Total Performance Perspective

ix) Power outage frequency (OF)

17. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between OF and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$………………………………………………………………… (50)

Step two: Intermediation between OF and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………….…………..… (51)

Step three: Intermediation amongst PER, CAPA and OF as follows;

$PER_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (52)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

PER is performance of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

18. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between OF and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$………………………………………………………………… (53)

Step two: Intermediation between OF and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OF_{it} + \varepsilon_{it}$…………………………………………….…………..… (54)

Step three: Intermediation amongst PER, INVEST and OF as follows;

$PER_{it} = \beta_0 + \beta_1 OF_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$……………………………………...………… (55)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

PER is performance of firm i in time t

OF is power outage frequency of firm i in time t

ε_{it} are as defined in model (1)

x) Power outage Duration(OD)

19. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between OD and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$………………………………………………………………… (56)

Step two: Intermediation between OD and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$………………………………………………….…………..… (57)

Step three: Intermediation amongst PER, CAPA and OD as follows;

$PER_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (58)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

PER is performance of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

20. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between OD and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$………………………………………………………………… (59)

Step two: Intermediation between OD and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 OD_{it} + \varepsilon_{it}$ ……………………………………………….…………..… (60)

Step three: Intermediation amongst PER, INVEST and OD as follows;

$PER_{it} = \beta_0 + \beta_1 OD_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$ …………………………………...………… (61)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

PER is performance of firm i in time t

OD is power outage duration of firm i in time t

ε_{it} are as defined in model (1)

xi) Power outage notification (ON)

21. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between ON and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$ ………………………………………………………………… (62)

Step two: Intermediation between ON and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$ ……………………………………………….…………..… (63)

Step three: Intermediation amongst PER, CAPA and ON as follows;

$PER_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$ …………………………………...………… (64)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

PER is performance of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

22. *Investment in back up generation (IBUG)-Investment*

Step one: Intermediation between ON and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$………………………………………………………… (65)

Step two: Intermediation between ON and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 ON_{it} + \varepsilon_{it}$…………………………………………….…………..… (66)

Step three: Intermediation amongst PER, INVEST and ON as follows;

$PER_{it} = \beta_0 + \beta_1 ON_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$…………………………………...………… (67)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

PER is performance of firm i in time t

ON is power outage notification of firm i in time t

ε_{it} are as defined in model (1)

xii) Time of power outage (TO)

23. Investment in back up generation (IBUG)-Capacity

Step one: Intermediation between TO and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$…………………………………………………………… (68)

Step two: Intermediation between TO and Capacity (CAPA).

$CAPA_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$…………………………………………….…………..… (69)

Step three: Intermediation amongst, CAPA and TO as follows;

$PER_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 CAPA_{it} + \varepsilon_{it}$……………………………………...………… (70)

Where:

$CAPA_{it}$ is Capacity of back up generation of firm i in time t

PER is performance of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

24. Investment in back up generation (IBUG)-Investment

Step one: Intermediation between TO and Performance (PER)

$PER_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$…………………………………………………………… (71)

Step two: Intermediation between TO and Investment (INVEST).

$INVEST_{it} = \beta_0 + \beta_1 TO_{it} + \varepsilon_{it}$…………………………………………….…………..… (72)

Step three: Intermediation amongst PER, INVEST and TO as follows;

$PER_{it} = \beta_0 + \beta_1 TO_{it} + \beta_2 INVEST_{it} + \varepsilon_{it}$ …………………………………..………… (73)

Where:

$INVEST_{it}$ is Investment in back up generation of firm i in time t

PER is PER of firm i in time t

TO is time of power outage of firm i in time t

ε_{it} are as defined in model (1)

Mediation occurs when all the Baron and Kenny (1986) three step conditions are met; hence mediation has taken place in the relationship between the predictor and the dependent variable. In this study, mediation (intervention) occurs if a predictor variable (OF, OD, ON and TO) significantly predicts the response variable (firm performance) and intervening variable (IBUG-capacity and investment) but not significant any more in the presence of intervening variable (IBUG) (Baron & Kenny, 1986).

3.8.3 Electric Power Outage Dynamics, Firm Characteristics and Firm Performance

Stepwise multiple regression was used to determine the relationships amongst the three variables. The models below were used to test hypothesis three. The test was conducted in two levels to assess whether each firm characteristics component moderated the relationship between Electric Power Outage Dynamics and Firm Performance. EPOD was considered as a composite score to test moderation effect. While debt equity ratio was used to measure capital structure, dummy variables of (1 and 0) were used to measure industry. That is, the study assigned a value of one (1) to all firms belonging to a particular industry and a value of zero (0) if otherwise. Also, test for moderation effect considered each category of industry at a time under the three aspects of performance, namely; financial performance, non-financial performance and total performance in that order.

Case (a) Industry

Non-financial Perspective (NFIN)

$$NFIN = \beta_0+\alpha_1 EPOD_{it} + \alpha_2 INDU_{it} + \alpha_3 (INDU_{it})*(EPOD)_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(74)$$

Financial Performance Perspective (FIN)

$$FIN = \beta_0+\alpha_1 EPOD_{it} + \alpha_2 INDU_{it} + \alpha_3 (INDU_{it})*(EPOD)_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(75)$$

Performance Perspective (PER)

$$PER = \beta_0+\alpha_1 EPOD_{it} + \alpha_2 INDU_{it} + \alpha_3 (INDU_{it})*(EPOD)_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(76)$$

Where

NFIN, FIN, PER and EPOD are as defined in model (1)

EPOD is Electric Power Outage Dynamics

INDU is the i^{th} Industry in time t,

$\alpha_1 \ldots \alpha_3$ are Regression coefficients,

β_0= Intercept or Regression constant,

and ε_i is the random error term.

Case (b) Capital structure

Non-financial Perspective (NFIN

$$NFIN = \beta_0+\alpha_1 EPOD_{it} + \alpha_2 CS_{it} + \alpha_3 (CS_{it})*(EPOD)_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(77)$$

Financial Performance Perspective (FIN

$FIN = \beta_0 + \alpha_1 EPOD_{it} + \alpha_2 CS_{it} + \alpha_3 (CS_{it})*(EPOD)_{it} + \varepsilon_i$……………………………..….(78)

Performance Perspective (PER)

$PER = \beta_0 + \alpha_1 EPOD_{it} + \alpha_2 CS_{it} + \alpha_3 (CS_{it})*(EPOD)_{it} + \varepsilon_i$……………………………..….(79)

Where

NFIN, FIN, PER and EPOD are as defined in model (1, 26-49)

EPOD is Electric Power Outage Dynamics of firm i in time t

CS is capital structure of firm i in time t,

$\alpha_1 \ldots \alpha_3$ are Regression coefficients,

β_0= Intercept or Regression constant,

and ε_i is the random error term.

In the equations 3.8.3 above, the two variables, namely; $INDU_i$ and CS_i in parenthesis are related to coefficients α_2 through α_3 in the parenthesis above and were included to quantify the effect of moderation in the model. The effect of moderation variables (industry, and capital structure) is statistically characterized as an interaction that affects the strength and/or direction of the relation between dependent (firm performance) and the independent (electric power outage dynamics) variables (Baron & Kenny, 1986). Firm characteristics are non-additive and will therefore be included in the models one at a time. The term * in the model implies moderation, it does not signify multiplication.

To establish the moderating effect of firm characteristics, Baron and Kenny (1986) and Aiken and West (1991) approach was used. The guideline entails first, fitting a regression model (model 1) to test the main effects of the predictor variable and the proposed moderator. Step two of Baron and Kenny (1986) involves entering of the interaction term in the previous model (model 1) so as to generate a second model (model 2).

Stage one, involved fitting an empirical model with the predictor and the moderator to predict change in response variable (performance). The main effects from predictor and the moderator variables as well as the model in general (adjusted R^2) should have a $p<0.05$ values (should be significant). Stage two involved addition of an interaction term to the preceding model (stage one) and tested for a significant adjusted R^2 change as well as a significant influence by the new interaction term. In summary if either of the following moderation conditions is realized, then moderation will have occurred. That is;

If both change in adjusted R^2 and new interaction term are significant, then it should be concluded that moderation occurred

If both the predictor and the moderator are insignificant, then it means moderation has occurred (full moderation);

If both the predictor and the moderator are significant, then it means moderation has occurred. Nevertheless, main effects are still significant (partial moderation).

It should be noted that the interaction term is developed by determining the product of the predictor and the moderator. As a result of multiplying those two variables, multicollinearity may occur. To eliminate such a limitation, both the predictor and the moderator variables are converted to standardized (Z) scores, centered whereby the product of the two variables is determined (interaction term variable). A stepwise regression process was carried out to predict performance of manufacturing firms in Kenya.

3.8.4 Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Firm Performance

To determine the relationship among Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Firm Performance, multiple regression analysis was used. The model was as follows:

$$PER = \beta_0 + \beta_1 \mathbf{OF} + \beta_2 \mathbf{OD} + \beta_3 \mathbf{ON} + \beta_4 \mathbf{TO} + \beta_5 \mathbf{CAPA} + \beta_6 \mathbf{INVEST} + \boldsymbol{\beta_7} \mathbf{CS} + \boldsymbol{\beta_8} \mathbf{INDU} + \boldsymbol{\varepsilon_i} \quad \ldots\ldots (80)$$

Where;

PER represents the three aspects of performance of firm i in time t

OF, OD, ON and TO is EPOD of firm i in time t

CAPA is the Size of backup power relative to full demand of firm i in time t

INVEST is the amount invested in power backup in relation to investment in total assets of firm i in time t

CS is the capital structure of firm i in time t

INDU is the dummy variable of industry i in time t (NB that the industry dummy variable is a composite score determined from the 12 industries).

CHAPTER FOUR: DESCRIPTIVE DATA ANALYSIS AND PRESENTATION

4.1 Introduction

The study aimed at investigating the relationship amongst electric power outage dynamics, investment in back up generation, firm characteristics and performance of firms operating in the manufacturing segment in Kenya. This chapter highlights data analysis of the variables used in this study. The chapter considered the two perspectives of pre-estimation and post-estimation diagnostic tests and also utilized Pearson Product-Moment approach to carry out correlation analysis of the variables used in the study. Results of analysis were presented in terms of descriptive statistics, percentages and frequencies for variables. Tables were used to portray these statistics. In addition, reliability test of cronbach's alpha coefficient results were also reported

4.2 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 4.1.

Table 4.1: Questionnaire Return Rate

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

Source: Researcher (2021)

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.

4.3. Electric Power Outage Dynamics

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

4.3.1 Power Outage Frequency

The issue of the rate at which power supply is on and off is paramount to manufacturing firms. This is because the more frequent the power outage, the more unreliable it is. Therefore, each firm's officials were requested to give their opinion pertaining the extent to which power outage occurred (frequency) in a month and responses were obtained as represented in Table 4.2

Table 4.2: Power Outage Frequency

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

Source: Researcher (2021)

Power outage frequency was not high for the majority of the firms (88%) reported up to 10 cases of blackout occurrences in a month. Whereas, 12% of the manufacturing firms experienced over 10 outages in a month.

4.3.2 Power Outage Duration

The time span within which the firm experiences power outage is of great concern to most of the players in the manufacturing industry. Responses obtained from firms on the average outage duration in a month is shown in Table 4.3

Table 4.3: Power Outage Duration

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

Source: Research Data (2019)

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

4.3.3 Power Outage Notification

Making users of electric power aware of power outage is valuable. This is because early alerts enable the users to make alternative arrangements to avoid production stoppages. This study endeavored to establish the extent to which manufacturers were notified of an envisaged power outage before it occurred. Using a likert scale of three, the respondents were requested to portray the number of times firms they were working in were notified of power outages in advance. The responses were as per Table 4.4

Table 4.4: Incidence of Outage Notification

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

Source: Research Data (2019)

From Table 4.4, 42% of respondents were always notified of foreseeable power outages before they occurred. Notification of outage for 42% of the firms was not consistent, with outage only being communicated some of the time. The result of timely communication of outage provided firms opportunity to put in place coping mechanisms in order to mitigate negative impact of power outages on operations. The remaining 16% of the electric power users did not receive any communication of outages before they occurred.

4.3.4 Average Notification Duration

A further clarification was necessary to know on average the timing of the notifications made by the power suppliers for firms that gave a positive response on notification of outage. Therefore, the current study sought the average time within which the manufacturing firms were notified that there was to be power interruption. The outcomes were presented in Table 4.5

Table 4.5: Power outage Notification

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

Source: Research Data (2019)

From Table 4.5 it was depicted that 73% of firms are informed of an outage over 24 hours prior to the outage, while 21% are informed between 1 hour and 12 hours to the outage. 6% of the firms depicted that they got notification of power outage between 5-60 minutes before the outage. This implies that most manufacturing firms were notified of power outages in fairly good time, hence were in a position to make alternative power arrangements or discontinue operations in a timely manner to prevent damage of equipment and spoilage of raw materials among other negative effects. This action would assist in ensuring that there were minimal operations interruptions that would adversely affect performance.

4.3.5 Time of Power Outage

The time of outage was also a focus of the current study. The aim was to establish the implications power outage had on performance depending on when the outage occurred.

Manufacturing firms in Kenya have varying operating times. Some firms operate over 24 hours a day, 7 days a week, others have operations between 8 and 12 hours or more. This study sought to capture the time of occurrence of outages in order to capture the various operation schedules of the various firms.

The response pertaining to time of outage is presented in Table 4.6

Table 4.6: Time of Power Outage

Rate of occurrence	Daytime		Evening		Night		Total	
	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	%
	27	20.3	57.0	43.0	87.0	66.7	171	43.07
1-5 times	103	77.4	74.0	56.0	44.0	33.3	121	55.66
5-10 times	2	1.5	1.0	1.0	1.0	0.0	4	0.010
10-15 times	1	0.8	0.0	0.0	0.0	0.0	1	0.0025
Total	133	100	132	100	132	100	397	

Source: Researcher (2021)

The outcome as per Table 4.6 depicted power outage less than 5 times in a month was experienced by 98.73% of the respondent firms, majority of which was experienced in the day and night time. For all categories of time, that is day, evening and night, there were very low incidents of power outage depicted by the fact that power outage hardly exceeded 5 times in a month. This provided sufficient opportunity for firms to carry on production shifts in the day, night or both.

4.4 Investment in Backup Generation (IBUG)

The study further aimed at investigating the plans adopted by firms engaging in manufacturing activities in Kenya so as to mitigate the power outage disruptions. Investment was computed as a ratio of investment in back-up generation in relation to total assets of the firm.

4.4.1 Access to Backup-Generator

The power used for manufacturing could be either from the main grid or private generators. This study was informed on the fact that all firms under this category were connected to the main national electricity system. Further interrogation was done to assess the availability of alternative source of power as regards backup power generation in the event of power outage. As pertains this perspective, respondents were asked to indicate their position on access to back-up generator, whether by ownership, leasing or any form of agreement. The outcome is as per Table 4.7

Table 4.7: Access to backup Generator

Response	Frequency	Percent (%)	Cumulative (%)
No	5	7	7
Yes	62	93	100
Total	67	100.00	

Source: Research (2019)

As per Table 4.7, it was revealed that 93% of firms had access to back-up generator implying that most firms had plans in advance to mitigate the adverse effects of power blackout. Majority of the firms had access to a substitute source of power whenever there was power outage. Only 7% of the respondents did not have an alternative source of power when outage was experienced.

4.4.2: Capacity in Backup Generation

A further interrogation was undertaken to establish the capacity of backup generation in relation to total capacity requirement by firms. The respondents were asked to indicate capacity range within which their self-generation power facilities were capable of producing. The responses are presented in Table 4.8

Table 4.8: Capacity in Backup Generation

Back-generator capacity	Frequency	Percent (%)	Cumulative (%)
0-5 %	3	5	5
10-20%	1	2	7
Over 30%	58	93	100
Total	62	100	

Source: Research (2019)

As per Table 4.8 it was portrayed that back-up generators mostly accounted for over 30% of power requirement by firms implying that sufficiency of backup capacity was critical for the firms and had led to substantive investment in adequate capacity of power requirement.

4.4.3: Investment in Backup Generation

Another concern of this study was the proportion of capital outlay required to finance the self-generation power infrastructure as compared to the overall investment as per the balance sheet records. The outcome is presented in Table 4.9

Table 4.9: Investment in Backup Generation (in Kshs.)

Variable	N	Mean	SD	CV	Min	Max
Back-up investment (Million, Kshs)	62	33.85	197.29	5.83	0.06	1,400
Back-up investment (% of total assets)	62	4.01	6.07	1.51	0.11	26.32

Source: Researcher (2021)

Table 4.9 revealed that the amount of capital invested in acquisition of generators by the manufacturing firms in Kenya was an average of Kshs. 33.85 million, indicating a significant capital outlay by firms. Investment variability was wide for it was 583%. This may imply a variation in the scale of operations between firms that also translated to differences in investment requirements for backup generation facilities. The firm with the least investment operated in the metal and allied sector while that with the highest investment operates in the food and beverages sector. Significant investment of back up capacity in the food and beverage category may be a reflection of the sensitive nature of product - fast moving goods, hence a concern of investing heavily in self-generation to ensure continuous production to meet the wide demand in the market and prevent shift to competitor products due to unreliability. Further analysis on the proportion of investment on back-up investment as compared to total investment of the firm was undertaken which portrayed that on average, investment in back-up generation was 4.01% of total assets of manufacturing firms with a variability of 151% which showed that the least investment was 0.11% of total assets while the highest investment is 26.32%.

4.5 Firm Characteristics

Firm characteristics is the managerial and demographic features that differentiate one organization from others even when operating in the same industry and also describes the unique internal factors surrounding the firm. Firm characteristics was measured using industry and capital structure.

4.5.1 Industry Distribution

The firms were categorized into twelve classes based on the classification of industries by KAM. The distribution pattern is presented in Table 4.10

Table 4.10: Industry Distribution

Industry	Frequency	(%)	Cumm(%)
Building, Mining and Construction	7	10	10
Chemical and Allied	7	10	20
Energy, Electricals and Electronics	1	02	22
Food and Beverages	18	27	49
Leather and Footwear	1	01	50
Metal and Allied	8	12	62
Motor Vehicle Assemblers and Accessories	4	06	68
Paper and Board	4	06	74
Pharmaceutical and Medical Equipment	2	3	77
Plastics and Rubber	8	13	90
Textiles and Apparel	6	09	99
Timber, Wood and Furniture	1	01	100
Total	67	100	

Source: Research (2019)

For the industry perspective, most firms in the database were in the food and beverages sector (27%). This could be explained by the fact that Kenya is an agro-based economy. Hence most industries concentrate on manufacture of products whose inputs are locally available and cheap, that are mainly agricultural in nature. The rest of the firms are distributed in the other 11 categories with a large capacity in plastic and rubber sector (14%) and Chemical and Allied (10%) respectively.

4.5.2: Capital Structure

On the other hand, capital structure was explained using descriptive analysis which comprised of debt, equity and a computed gearing ratio as shown in Table 4.11

Table 4.11: Capital Structure

Variable	N	Mean	SD	CV	Min	Max	Sk	Kurt
Debt (Millions, Kshs)	67	1,363.07	5066.9	3.71727	0.26	22,611 .	3.883	16.24
Equity (Millions, Kshs)	67	1,503.92	4362.7	2.90086	0.11	18,495.2	3.1	10.801
Gearing ratio (%)	67	40.18	23.050	0.57371	1.00	96.96	0.504	3.186

Source: Research (2019)

The average debt was Kshs. 1.36 billion while the average equity of firms was approximately Kshs. 1.5 billion. This shows that manufacturing firms did not over rely on external financing which could threaten their operation through financial distress costs, which could lead to being put under receivership.

4.6 Firm Performance

Performance of manufacturing firms is categorized in financial and non-financial perspectives (Neely, 1999). Firms operating in the manufacturing segment in Kenya has a notable contribution towards economic growth of most of the economies through creation of employment opportunities to many people.

4.6.1 Non-Financial Perspective

To determine the trend in non-financial performance, views on customer focus, operations efficiency, employee productivity, green performance and social responsibility were collected by asking the respondents to indicate the perceived performance of their institutions on the various perspectives. The outcome was as per Table 4.12

Table 4.12: Non-Financial performance indicators

Variable	N	Mean	SD	CV	Min	Max	Skew	Kurto
Customer Focus	67	70.500	15.749	0.223	0	90	-1.986	8.448
Operations Efficiency	67	67.604	15.922	0.236	25	90	-0.906	2.979
Employee Productivity	67	81.738	14.699	0.180	0	100	-3.066	16.726
Green Performance	67	62.006	20.239	0.326	0	100	-0.952	4.044
Social Responsibility	67	61.741	27.723	0.450	0	100	-1.144	3.404

Source: Research (2019)

It was established that on average, firms rate performance on the customer perspective at 70%. This attainment was based on indicators of customer satisfaction and level of resolution of customer complaints and was considered critical for attainment of good performance for all organizations. Operations efficiency had an average attainment of 67% measured against rate of automation of processes in the firm and capacity utilization of existing infrastructure. Employee productivity rate had an average score of 81% for 67 firms. This measure was based on employee satisfaction, employee retention and competency and development budget in relation to firm's total budget. Green performance attained an average of 62% for implementation of environmental protection policy in the firm's operations and level of adoption of green technologies in the operations. Finally, the social responsibility score was 61% for rate of implementation of social responsibility policy and the budgetary allocation for social responsibility programmes in relation to firm's total budget. of firms attribute their non-financial performance to customer focus as shown in Table 4.12. This is because customer focus aid the management in many strategic perspectives such as the adoption of customer satisfaction programs could foster customer royalty and increase of competitive edge which will in the long run be reflected in the financial performance perspective.

On variability perspective, social responsibility had the highest value of coefficient of variation (45%). This indicates that priority of executing social responsibility policies varies within firms with some firms paying significant attention on this aspect while others did not give the matter a valuable consideration. Employee productivity had the least variation (17.9%), indicating that firms are cautious about satisfaction and retention of employees across board. Variation in customer focus was also low (22.3%), meaning that firms pay close attention to their customers in their operations to avoid loss of market share to their competitors. All variables are negatively skewed implying lack of asymmetry. Both skewness and kurtosis values indicate that operations efficiency, green performance and social responsibility are normally distributed. Their skewness values are close to zero while their kurtosis values are approximately three.

4.6.2 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 4.13

Table 4.13: Financial performance

Variable	n.	Mean	SD	CV	Min	Max	Sk	Kurt
Profit Before Tax	67	576.2377	1862.276	3.232	-363	9837.4	4.003	18.668
Return on Assets	67	13.98597	14.358	1.027	-21.85	56.67	0.142	4.554

Source: Research (2021)

In the case of financial performance, data from the firms depicted that financial performance was presented by Profit Before Tax and Return on Assets. The latter is a quotient of Earnings Before Taxation and Total Assets which is made up of both fixed and current assets. The average Profit Before Tax for manufacturing firms is approximately Kshs. 576 million with the most profitable firm making a profit of about Kshs. 9.8 billion (see Table 4.13). The least profitable firm made a loss of about Kshs. 363 million. The average return on assets among manufacturing firms was about 13.98%. The firm which made least profits had a negative return of about 22% while the highest firm had a positive return of over 57%. Profit Before Tax had the highest variation while Return on Assets had the least variation. Only 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 unlike Profit Before Tax and Total Assets whose skewness and kurtosis value are far from zero and three respectively.

4.7 Descriptive Statistics of the Composite Variables

Further descriptive analysis on the variables used in conceptualization of this study was done for the manufacturing firms in Kenya covering a period of 5 years, between 2014 and 2018. The statistics utilized in this study for descriptive analysis were, namely; lowest and highest values of the variables used in the study; both central tendency and dispersion measurements were incorporated whereby average and standard deviation perspectives amongst others were used in that order. In addition, skewness and kurtosis measures were included. The variables used in this study were; EPOD (power outage frequency; power outage duration; power outage notification; time of power outage); investment in back up generation (capacity and investment); firm characteristics (industry and capital structure) and firm performance which was looked at from the perspective of non-financial, financial and total performance. The outcome was indicated in Table 4.14

Table 4.14: Descriptive Statistics

	n.	Min	Max	Mean	SD	Sk		Ku	
	Stat	Stat	Stat	Stat	Stat	Stat	SE	Stat	SE
NFIN	67	.16	.88	.6472	.15099	-1.584	.293	2.823	.578
FIN	67	-.22	.57	.1464	.10692	.106	.293	6.134	.578
PER	67	.10	.59	.3960	.09727	-.901	.293	1.150	.578
OF	67	1.0	5.0	1.851	.9415	1.767	.293	3.965	.578
OD	67	1.0	5.0	2.746	.8228	.003	.293	.173	.578
ON	67	1.0	3.0	2.239	.7404	-.417	.293	-1.057	.578
TO	67	1.00	2.50	1.5796	.34735	.318	.293	-.631	.578
CAPA	67	1.0	5.0	4.552	1.2466	-2.517	.293	4.573	.578
INV	67	.00	.28	.0632	.05470	1.787	.293	5.260	.578
INDU	67	1.00	12.00	5.8806	3.28229	.228	.293	-1.186	.578
CS	67	.00	1.00	.4537	.20612	.715	.293	1.958	.578

Source: Research (2021)

As indicated in Table 4.14, non-financial performance had minimum and maximum values of .160 and .880 correspondingly implying that the manufacturing firms almost had the same level of non-financial performance. The overall mean score for non-financial performance was .6472 with standard deviation of .15099 which implies that all the manufacturing firms considered achievement of customer requirements, internal processes adopted to improve efficiency, mechanisms to improve employee productivity, protection of environment in all processes, and corporate social responsibility within similar patterns during the period of the study and it was therefore possible to predict the future outcome of non-financial aspects of manufacturing firms in Kenya. For financial performance, the minimum and maximum values were -.220 and .570 in that order. That is, the lowest financially performing firm was quite low although the expected profitability was more and stable for the standard deviation was .143, which was small implying stability of financial performance levels for manufacturing firms in Kenya between 2014 and 2018. In addition, variations of overall performance which was a combination of financial and non-financial viewpoints had a minimum of .100 and a maximum of .59 values. 0.396 was the average score with .09727 as the standard deviance implying that the overall performance was also stable and predictable.

On the other hand, power outage frequency revealed a minimum score of 1.00 and a maximum score of 5.00. This was a wide range. Also, the corresponding standard deviation was of .9415 which was small. That is, with a mean of 1.851, it implies that power outage frequency was almost all the time predictable by the manufacturing firms. Further, power outage duration had a mean value of 2.746 with a corresponding standard deviancy of .8228 implying that between 2014 and 2018, there was almost an assured pattern of the time duration of power outage that was experienced by manufacturing firms. This is evident in the records for minimum and maximum values which were 1.00 and 5.00 correspondingly which was also fairly small.

For the case of power outage notification, the average score was .2.239 with a standard deviation of .7404 implying that between 2014 and 2018, there was consistency of alerting manufacturing firms of power black outs. This is evident in the records for minimum and maximum values which were 1.00 and 3.00 correspondingly which was also small. Power supplying utilities had a good communication flow of ensuring that they alerted the manufacturing firms of any forthcoming power outage. This action could be of much help to the firms to make prior arrangement to access alternative power to avoid productivity interruptions. The time of power outage had an average score of 1.580 whereby the standard deviance of .34735 was realized which was low implying that the aforementioned electric power outage dynamics was stable and was predictable by the manufacturers in the future times not covered by the time period of 2014 to 2018. On the other hand, investment in back up generation was based on two indicators, namely capacity and investment level in back up generation by firms in the manufacturing subsector in Kenya. Capacity had a normal score of 4.552 and a minimum and maximum values of 1.00 and 5.00 in that order. In addition, the standard deviation was 1.2466 which implies that variations of the level of the expected capacity of back up generation was minimal hence this aspect was predictable in the near future.

Investment depicted an average score of .0632 whereby the corresponding standard deviancy was .05470. In addition, minimal and maximum values were .000 and .028 which was consistent with the standard deviation which implies that investment in back up generation was stable and all manufacturing firms were spending on this aspect to ensure continuity in productivity. The aspect of industry had an expected score of 5.8806 where by the corresponding standard deviation was 3.28229 meaning that variability was fairly wide due to a variety in the industrial category of the various firms. In addition, the average value of capital structure was .4537 and a standard deviancy of .20612 which was also low. This implies that the trend of accessing debt was stable amongst the manufacturing firms.

Skewness and kurtosis were also considered for the study variables. For skewness, it was portrayed that all the variables were symmetrical for the lowest value was -2.517 and the highest was 1.787 which was within the range of a symmetrical distribution for according to the general rule of the thumb, a symmetrical data distribution should be between -0.5 and 0.5. For kurtosis, the range used to measure sharpness is between -3.00 and 3.00. In this study, the values of kurtosis depicted that the highest value was .6.134 and the lowest was -1.186. Hence the distribution of data was normal for most of the variables.

4.7.1 Reliability Test for Study Variables

Reliability test is useful in certifying that the research instrument used provides results which are consistent. The test provides the degree of correctness to which the research instrument yields dependable outcomes when subjected to several estimations (Mugenda & Mugenda, 2003). To achieve this objective, the study relied on Cronbach's Alpha score in assessing the level of reliability. If the score is .5, it is assumed to be appropriate for research and if the Cronbach's Alpha score is above the aforementioned value, it was purported to be more appropriate. This test was undertaken and the outcomes was presented in Table 4.15

Table 4.15: Cronbach's Alpha Test Results for the Study Variables

	Scale Mean if Item Erased	Scale Variance if Item Erased	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
NFIN	95.7435142	504.315	.644	.	.401
FIN	151.6565911	376.304	.467	.	.562
PER	105.0623603	451.401	.869	.	.294
OF	164.7473603	887.364	-.043	.	.592
OD	163.9396680	886.766	-.033	.	.591
ON	162.1319757	873.197	.191	.	.584
TO	164.9204373	886.489	-.040	.	.590
CAPA	161.8627449	870.968	.278	.	.582
INVEST	166.5925733	886.592	-.227	.	.590
CS	163.0305563	884.840	.056	.	.589
INDU	162.8432834	866.453	.564		.566

Source: Researcher (2021)

In Table 4.9, entire alpha coefficients are above 0.5 while the overall alpha coefficient was .583. Therefore, data for most of the variables was reliable. It shows that all the study variables were reliable except two which had values less than .5. The rest of the study variables had a Cronbach alpha scores which were above 0.5 which were considered adequate in a study.

4.8 Diagnostic Tests

Diagnostic tests are pre-estimation tests that are conducted to ensure that results meet the Ordinary Least Squares assumptions. In this section, the following diagnostic tests were undertaken, namely: normality, multicollinearity and homoscedasticity.

4.8.1 Normality test

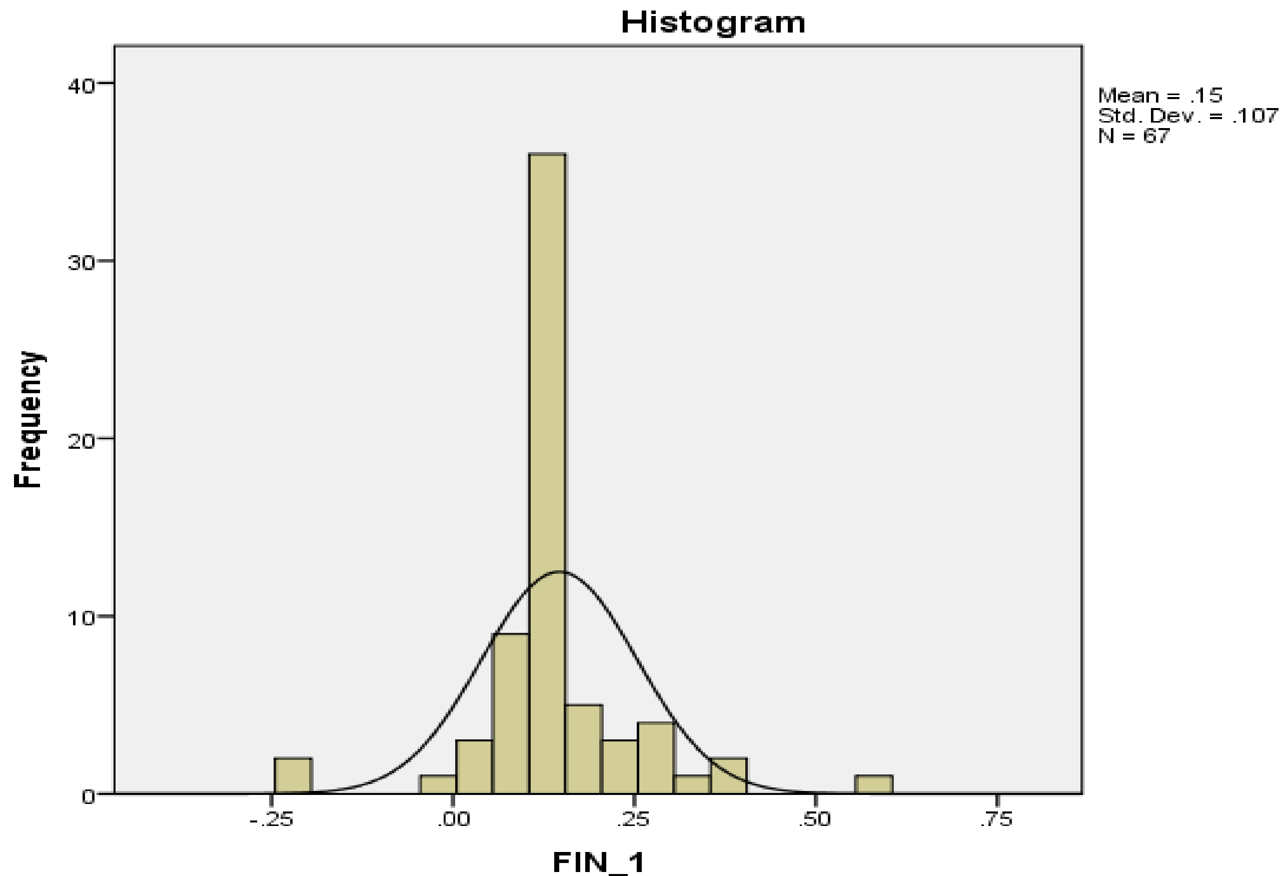
Normality test was carried out to confirm whether the error term represented distribution which was normal. Therefore, both graphical (histogram), plot of residuals which where standardized against predicted dependent values (non-financial, financial and overall performance perspective) where used. In addition, a scatter plot was used according to details provided in Table 4.16 and Figure 4.1 respectively.

Table 4.16: Kolmogorov-Smirnov and Shapiro-Wilk Normality Test

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df.	Sig.	Statistic	Df	Sig.
FIN	.101	40	.200*	.957	40	.131
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df.	Sig.	Statistic	Df	Sig.
PER	.129	35	.150	.915	35	.010
a. Lilliefors Significance Correction						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df.	Sig.	Statistic	Df	Sig.
NFIN	.115	62	.040	.886	62	.000

a. Lilliefors Significance Correction
Source: Research (2021)

From Table 4.10, it was demonstrated that fiscal performance perspective of Kenyan based firms engaged in manufacturing activities was normally distributed whereas for the case of non-financial and overall performance, was not. The corresponding Figure 4.1 to 4.3 it was depicted that normality assumption was fulfilled by the three aspects of performance.



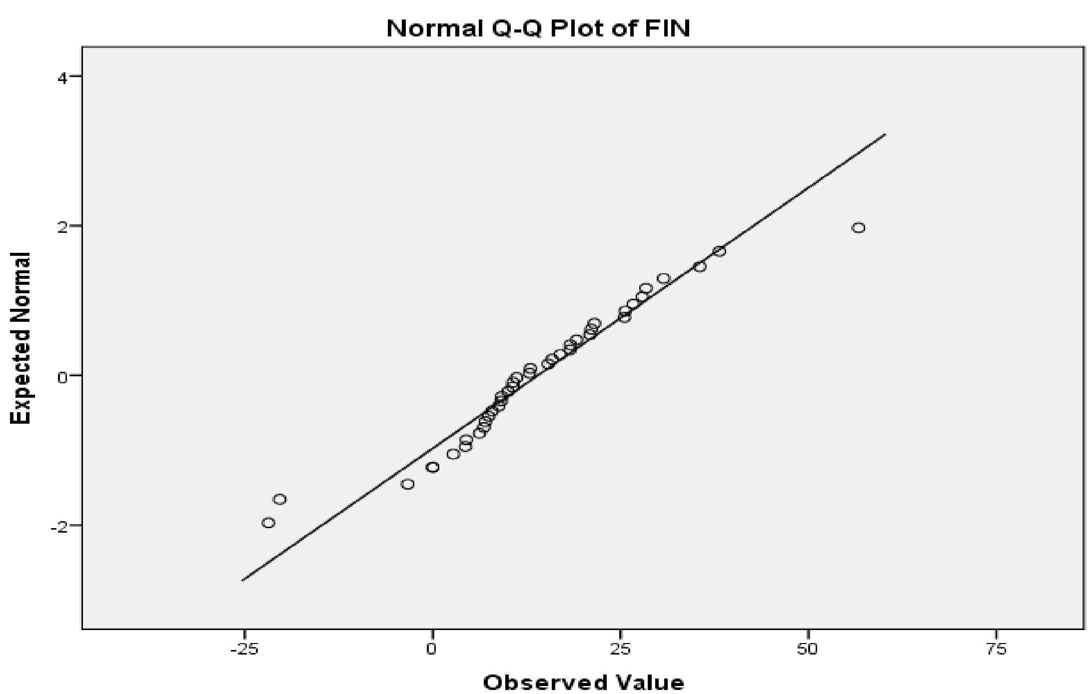
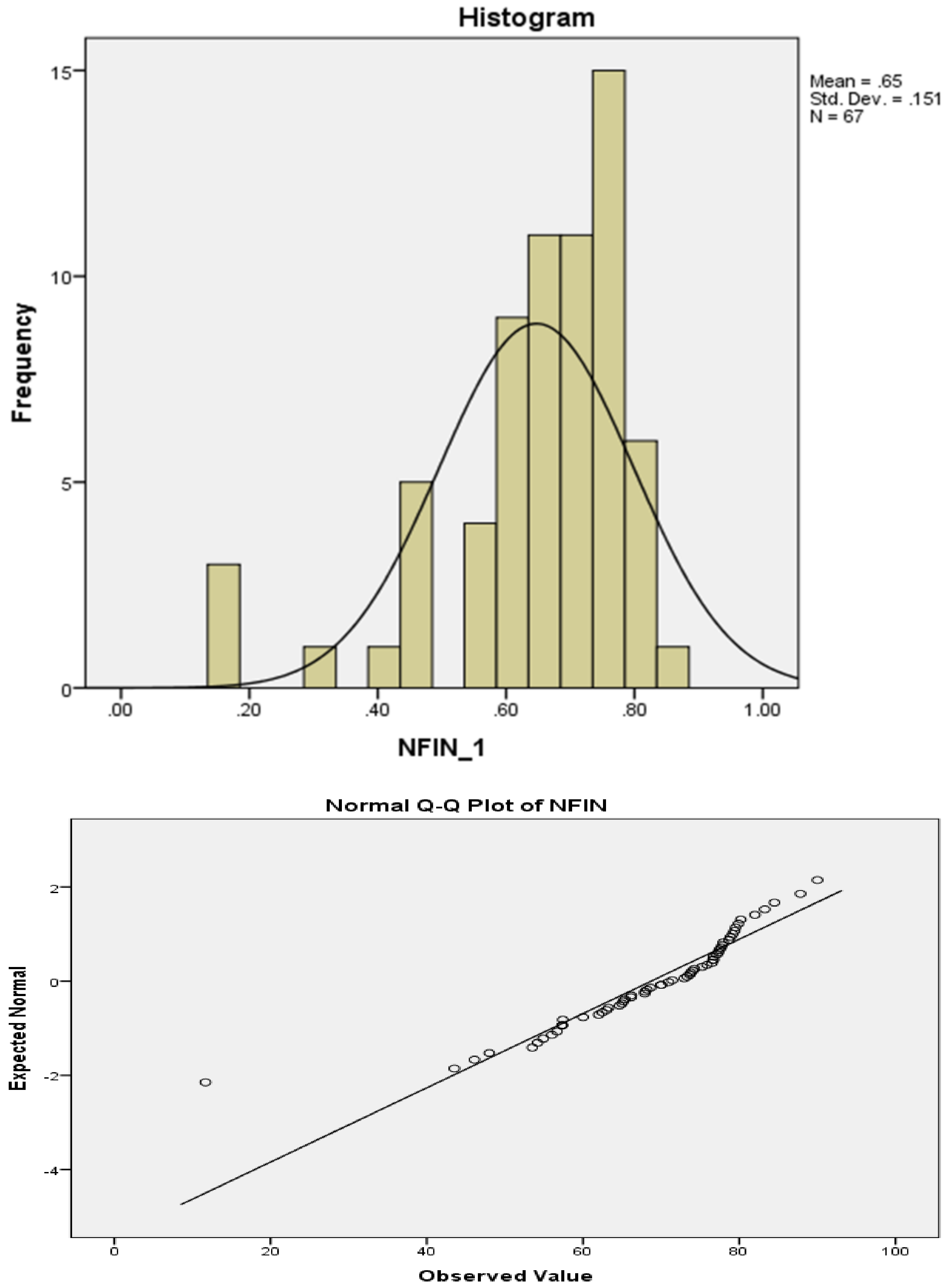
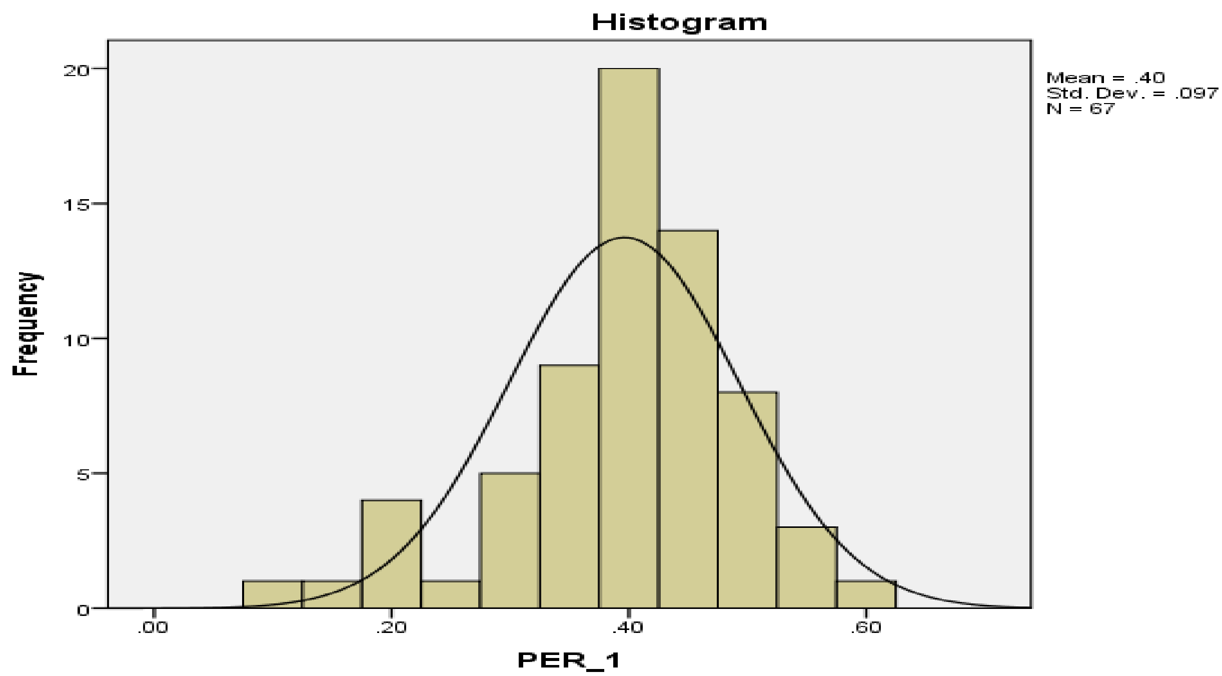


Figure 4.1: Financial Performance



1.1.1.1.1 Figure 4.2: Non-Financial Performance



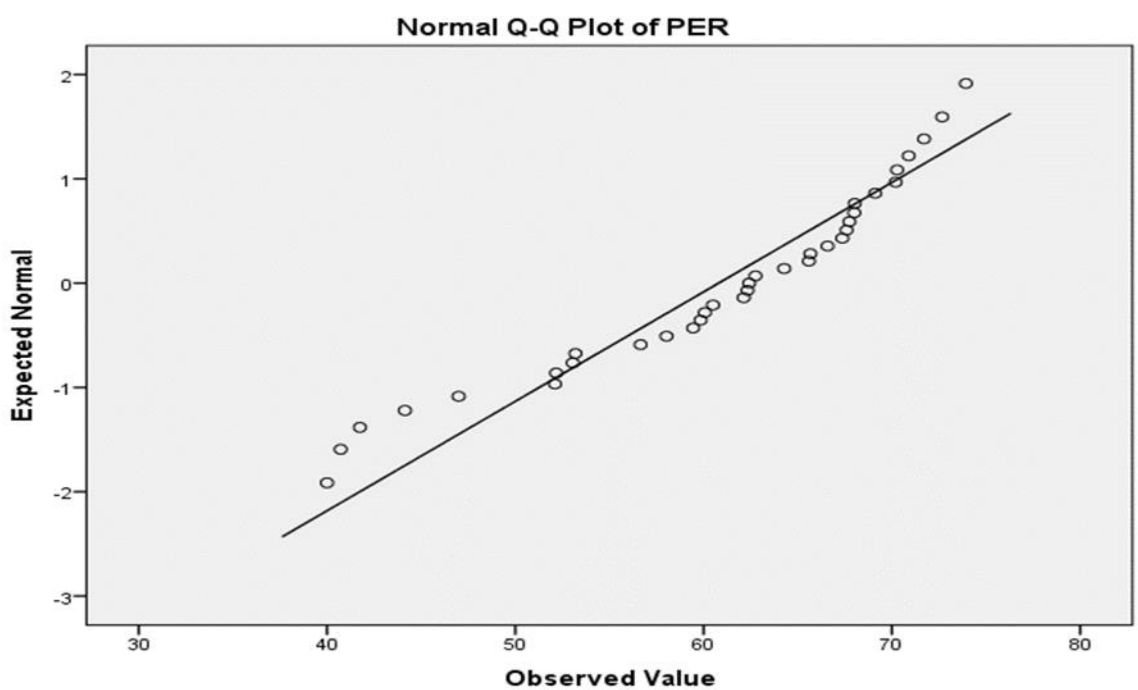


Figure 4.3: Overall Performance

4.8.2 Test for Multicollinearity

Multicollinearity occurs when independent variables have an almost perfect relationship. Failure to control for this problem leads to inefficient estimators which hampers credibility of results. The variance inflation factor (VIF) is used in this study. A VIF value of at most 10 indicates that the problem of multicollinearity is absent. Table 4.17 represents the respective outcomes

Table 4.17: Multicollinearity test results Coefficients

	Collinearity Statistics	
	Tolerance	VIF
OF	.807	1.240
OD	.801	1.249
ON	.846	1.182
TO	.844	1.185
CAPA	.838	1.193
INV	.954	1.048
INDU	.782	1.279
CS	.926	1.080

a. Dependent Variable: NFIN, FIN AND PER

Source: Research (2021)

From Table 4.17, all VIF results for respective independent variables are below 10 whether non-financial performance, financial performance or aggregate performance.

4.8.3 Homoscedasticity Test

Heteroscedasticity assumes that the discrepancy of the error term is not constant for all the identified observations. It is a problem because it makes the variance to be inefficient and in turn makes estimators unbiased. In this study, the Breusch-Pagan test was used to establish presence/absence of heteroscedasticity. Results are shown in Table 4.18

Table 4.18: Heteroscedasticity Test results

Model	Chi-square	P-Value	Conclusion
Firm performance= Non-financial performance	3.66	0.0556	Homoscedasticity present
Firm performance= Total performance	2.37	0.1236	Homoscedasticity present

Source: Researcher (2021)

The null hypothesis of the Breusch-Pagan test is that the variance is constant (homoscedasticity present) while the alternative assumes that heteroscedasticity is present. To make an inference, a comparison between computed p-value and critical p-value (0.05) was made. In case the calculated p-value is more than 0.05, a conclusion is made that homoscedasticity is present. As per Table 4.18, the p-values have a higher value than 0.05. Hence, the variance is homoscedastic and forthcoming regression results will be reliable.

4.9 Correlation Analysis

Pearson Product-Moment correlation coefficient to assess strength and direction of the various variables used in this study. The linearity connection between any two variables under this methodology was symbolized by *r*. To determine the correlation aforementioned, the study incorporated electric power outage dynamics (EPOD) which represented the predictor variable and was designated by outage frequency (OF), outage duration (OD), outage notification (ON) and time of outage (TO). Intervening variables were investment (INVEST) and capacity (CAPA) in back up generation (IBUG) whereas firm characteristics was estimated using (INDU) and capital structure (CS).

The dependent variable was performance which was decomposed in to non-financial (NONFIN), financial (FIN) and total performance (PER). The correlation outcome was reported at a significant level of 0.05 which was also successfully used by Magutu (2013). The study developed a correlation matrix to summarize the correlational association that was established. The results were presented as per Table 4.19, 4.20 and 4.21

Table 4.19: Correlation Matrix results for non-financial performance

V		NFIN	OF	OD	ON	TO_	CAPA	INV	NDU	CS
NFIN	Pearson Correlation	1.000	-.030	-.006	-.079	-.093	-.092	-.239	.049	.097
	Sig. (2-tailed)		.812	.962	.524	.452	.458	.052	.693	.433
OF	Pearson Correlation		1.000	.244*	-.035	.284*	-.084	-.040	.136	.043
	Sig. (2-tailed)			.047	.778	.020	.501	.745	.271	.731
OD	Pearson Correlation			1.000	-.322**	.028	.094	-.066	.000	-.150
	Sig. (2-tailed)				.008	.825	.448	.593	.999	.226
ON	Pearson Correlation				1.000	.102	.118	-.032	-.156	.142
	Sig. (2-tailed)					.412	.343	.794	.206	.252
TO	Pearson Correlation					1.000	.119	-.083	-.211	.015
	Sig. (2-tailed)						.339	.503	.087	.901
CAPA	Pearson Correlation						1.000	-.050	-.369**	.007
	Sig. (2-tailed)							.690	.002	.958
INV	Pearson Correlation							1.000	.107	.148
	Sig. (2-tailed)								.387	.232
INDU	Pearson Correlation								1.000	-.101
	Sig. (2-tailed)									.415
CS	Pearson Correlation									1.000
	Sig. (2-tailed)									

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

From Table 4.19 above, the aspect of non-financial performance had an inverse insignificant link with outage frequency ($p > .01$ and .05). Such that, a unit modification in power outage frequency, non-financial performance perspective of the manufacturing firms transformed by .030 units in the opposite direction and the variation was not statistically significant with (r=-.030 and p=.812). This implies that if power outage frequency increased, this slowed down non-financial performance such as operations efficiency and employee productivity that would be affected by frequent power outages. Further, a unit alteration in power outage duration led to a -.006 unit adjustment in non-financial performance with (r=-.006 and $p > .01$ and .05). That is, the longer the time it took for power to be restored, the more adverse non-financial performance perspectives were influenced such as customer focus would decrease due to reduced ability to meet customer requirements.

Further, the link between outage notification and non-financial performance was inverse and not statistically significant with (r=-.079, p=.524). This implies that a unit alteration of outage notification resulted to .079 unit variation in non-financial performance perspective which was adverse. This implies that, although the power providers would notify the manufacturing firms, that act made some non-financial related activities such as employee productivity to decline due to adjustment in production schedules in accordance to the notified power outages. It was further established that the association between the perspective of non-financial performance and time of power outage was negative and not statistically significant. In addition, a unit modification in time of outage resulted to -.093 unit variation in non-financial performance with (r=-.093 and $p > .01$ and .05). That is, regardless of the time blackout occurred, whether during the day, evening or at night, it adversely influenced some or all the non-financial performance aspects such as employee productivity and operations efficiency. For capacity in power backup generation, it was established that its linkage with non-financial performance aspect for the manufacturing firms was inverse and not statistically significant with (r=-.092 and p=.458). Whereby a unit change in capacity in backup generation used to substitute main power grid resulted to .092 unit variation in non-financial performance. This means that an increase in capacity of backup in a firm would utilize resources with a resultant impact of reduced budgetary allocation to some aspects such as corporate social responsibility activities with resultant impact of reduced implementation of the firms' corporate social responsibility policy.

On the other hand, the connection between investment in backup generation and performance (ie non-financial) was not statistically significant also it was inverse with entity variation in investment in backup generation leading to -.239 unit transformation in non-financial performance with (r=-.239 and p=.052). Therefore, the inference that is noted in the aforementioned linkage is that due to the firm budget being re-directed towards acquisition of self-generation power equipment, it then implies that the investment turns out to be a competitor of the financial resources that could be allocated on other non-financial activities such as programs related to customer care, green performance and employee productivity improvement. Hence such activities possibly slowed down.

In addition, this study classified firms in to diverse industries based on their nature of their operations. This is because for firms to be assumed to be in the same industry, they must have similar characteristics such as products they produce or the raw materials they use in production such as the intensity of electric power required. In this case, the twelve industries identified represent firms which utilize electric power as a major input to their production process and are also affected by similar macroeconomic factors. As per the correlation analysis which was undertaken, it was portrayed that there is direct link between industry classification and performance of firms in the manufacturing sector in Kenya which was not statistically significant with (r=.049 and p=.693). This implies that a unit change in industry resulted to .049 unit variation in non-financial performance. Therefore, firms in dissimilar industries had varying effects on their respective non-financial performance, a differentiation caused by industry related factors. Additionally, the link between capital structure and non-financial performance was direct and insignificant. Such that, a unit adjustment in capital structure translated to .097 unit variation in non-financial performance with (r=.097 and p>.01 and .05). This means that the more a firm was levered the more the non-financial performance activities were undertaken especially if the external borrowing was for direct facilitation of the non-financial activities such as customer satisfaction, improvement of operations efficiency and green performance among others.

On the side of power outage frequency and power outage duration linkage, the relationship was positive and statistically significant with (r=.244 and p=.0.047). Such that a unit alteration of power outage duration resulted to .244 unit change in power outage frequency. That is the longer the length of interval of time experienced in state of blackout by the manufacturing firms, the more frequent power outages are likely to be. Also, since both power outage frequency and power outage duration are aspects of electric power outage dynamics, the direct significant link implies that they equally influence firm performance. Contrary, power outage notification had an inverse link with power outage frequency which was not statistically significant with (r=-.035 and p>.01 and .05). This means that the more the number of times suppliers of electricity alerted manufacturing firms on forthcoming blackouts, the less the likelihood of power outage occurrence, thus lower frequency of power outages for the aspect of signaling the users of power showed that the suppliers were aiming at minimizing the number of such occurrences.

In addition, there existed significant correlation between time of outage and outage frequency with (r=.284 and p=.020) which was positive. Such that a unit modification in time of outage resulted to .284 unit transformation in outage frequency. Further, capacity in backup generation and power outage frequency depicted a negative relationship which was not statistically significant with (r=-.084 and p=.501). Therefore, a unit alteration of capacity in backup generation led to inverse .501 unit change in outage frequency which was not statistically significant. This shows that increased frequency of power outages necessitated acquisition of higher capacity of backup generators to sustain the firms' operations.

In the case of investment in backup generation as the predictor variable, it did not depict statistically significant relationship with power outage frequency for a unit transformation of investment in backup generation resulted to .040 unit variation in power outage frequency with (r=-.040 and p=.745) which was inverse. This displays that purchase of more generators was a sure way of continuous supply of electric power even when there were cases of power blackouts. Hence availing of generators meant reduction of power outage frequency. On the other hand, industry and power outage frequency had a direct link which was not statistically significant with (*r*=.136 and p>.01 and .05). Such that, for every unit variance of industry variable, power outage frequency varied by .136 units in the same direction. This shows that varying categories of industry experienced more frequent power outages than others, thus there was an industry differentiation in frequency of outages experienced by various firms. Lastly, there existed a direct association between capital structure and power outage frequency which was not statistically significant with (*r*=.043 and p=.651). This implies that a unit alteration in capital structure amounted to .043 unit modification in power outage frequency. This link implies that the additional external debt accessed by the manufacturing firms was not substantially utilized to reduce power outage frequency. That is most likely it was utilized to finance other projects other than back up generation.

Power outage notification and outage duration depicted statistically significant indirect association with (r=-.322 and p=.008). That is, for a unit modification in outage notification, there was a corresponding .322 unit variation which was inverse and statistically significant for (r=-.322 and p<.01). This implies that the endeavors of the power suppliers to communicate in advance on issues of power blackout resulted to reduced power outage duration for this aspect is indirectly controlled by the supplier. So the shorter the power outage duration was experienced by the manufacturing firms. Dissimilar results were established between outage duration and time of outage for the association was weak although positive with (r=.028 and p=.825). This implies that a unit variation in time of outage resulted to a direct transformation in outage duration by .028 units which was small and was not statistically significant. This means that the time a power outage occurred had very minimal differentiation in the duration of power outage experienced. Outages in the daytime, evening and night experienced nearly similar durations of power outage.

Capacity in backup generation and outage duration portrayed a direct linkage which was not statistically significant with (r=.094 and p=.448). Such that a unit modification in capacity in backup generation resulted to .094 unit variation in outage duration. For the case of investment in backup generation to power outage duration connection, it was inverse and not statistically significant with (r=-.066 and p=.593). Therefore, a unit variation in investment in backup generation resulted to negative .066 unit conversion in power outage duration which was not statistically significant. This is because increased backup generators aided in reduction of duration of power outage experienced. Further, industry did not portray any relationship with power outage duration with (r=.000 and p=.999). This means that the industry affiliated to the firm in question did not dictate the extent to which blackout duration would be experienced . The reason being that duration of outage is not differentiated by type of industry. Lastly, for capital structure and power outage duration, an inverse negative link was established which was not statistically significant for a unit adjustment in capital structure resulted to .150 unit transformation of power outage duration in the opposite direction with (*r*=-.150 and p=.226). Therefore, it shows that if management of the manufacturing firms utilized additional external debt to facilitate activities associated with reducing power outage effects such as purchase of generators, outage duration would be decreased.

The study also aimed at establishing the degree to which power outage notification as the dependent variable related with time of power outage, capacity in backup generation, investment in backup generation, industry and capital structure. For time of power outage, there was a direct association with power outage notification which was not statistically significant with (*r*=.102 and p=.412). That is, regardless of when time of power outage occurred, whether during the day, evening and or at night the suppliers of electric power were consistent in communication of outage notifications to the electric power users.

On the other hand, capacity in backup generation and power outage notification showed a direct link although it was not statistically significant with (*r*=.118 and p=.343). Whereby a unit modification in capacity in backup generation resulted to .118 unit variation in power outage notification which was direct. Further, there was inverse linkage between investment in backup generation and power outage notification with (*r*=-.032 and p=.794). Such that a unit transformation in investment resulted in to .032 unit adjustment in outage notification which was not statistically significant (p>.01 and .05). This could be due to the fact that most manufacturing firms invested heavily on power generation and needed no notification for the alerts would not play a major role in planning for power supply amongst them especially in the long run.

Similarly, the relationship between industry and power outage notification was inverse although not statistically significant with (*r*=-.156 and p=.206) such that a unit modification of industry resulted to .156 unit modification in outage notification which was not significant. This association implies that the more the number of industry, the less the number of notifications that were required to be sent to the users of electric power. For the majority of the firms could not be in need of such notifications based on their category they are in. It was also established that capital structure had a direct linkage with power outage notification although it was not statistically significant with (*r*=.142 and p=.252). Therefore, a unit adjustment in capital structure resulted into .252 unit change in power outage notification which was positive. It shows that the providers of electric power continued to notify their clients on power outage instances regardless of whether the manufacturing firms accessed more external debt to finance electricity power generators or not. The positive connection could be possible for the decision to notify and the decision to access external debt to finance acquisition of generators are discrete.

Time of outage and capacity showed positive linkage which was not statistically significant with (*r*=.119 and p=.339). Such that a unit variation in capacity in backup generation resulted to .119 unit variation in time of outage in the same direction This implies that as capacity in backup generation increased, time of outage increased for there could be other external factors which power suppliers cannot control which could be causing the number of outages to increase either during the day, evening or at night such as earthquakes, errors at power stations, electricity transmission line breakdown or short-circuiting. Also, investment in backup generation and industry portrayed an indirect linkage with time of outage which was not statistically significant with (*r*=-.083 and p=.503) and (*r*=-.211 and p=.087) respectively. Such that a unit modification in investment in backup generation translated into .083 unit alteration in time of power outage which was not statistically significant and again, a unit modification in industry resulted to .211unit change in time of outage. In both cases, the transformation was inverse, meaning that both investment in backup generation and industry caused time of outage to reduce in number. This could be due to increased investment in backup generation using generators by most firms across all the industries. Further, capital structure portrayed a positive relationship with time of power outage which was not statistically significant with (*r*=.015 and p=.901). This implies that a unit alteration in capital structure translated in to .015 unit variation in time of outage with (p>.01 and .05). The aforementioned linkage is justified by the fact that although capital structure may be positively changing, time of outage could coincidentally increase either during the day, evening and or night due to external factors such as short-circuiting and mistakes occurring on the transmission lines.

In addition, capacity in backup generation and investment in backup generation had an association which was inverse with (*r*=-.050 and p=.690) which was not statistically significant. In this case, a unit alteration in investment in backup generation resulted to .050 unit adjustment in capacity in backup generation with ($P>.01$ and .05). This shows that as firms invest more on power generation facilities, capacity reduced may be due to low quality generators acquired. For industry, there was an inverse link with capacity in backup generation which was statistically significant with (r=-.369 and p=.002). Hence a unit variation in industry resulted to .369 unit variation in capacity in backup generation in the opposite direction which implied that collectively, manufacturing firms in all industries decreased self-generation capacity as they aimed at strategizing for power outage through acquisition of generators. This contrary results could be due to use of generators whose capacity is lower due to diseconomies of scale associated with large purchases from suppliers who can compromise the capacity quality especially if there are no purchase regulations. Lastly, capital structure and capacity in backup generation demonstrated a positive link which was not statistically significant with (r=.007 and p=.958). This means that a unit transformation in capital structure resulted to .007 unit variation in capacity in backup generation with ($p>.01$ and .05). Although the coefficient was very small, this shows that some of the finance resources obtained from the external borrowing was used to finance acquisition of self-generation facilities resulting to increased capacity in backup generation.

Industry and investment in backup generation showed a direct association although it was not statistically significant with (r=.107 and p=.387). Such that a unit variation in industry resulted to .107 unit adjustment in investment in backup generation. This portrays that variations in industries contributed to the increased level of investment in backup generation for some firm demand more electric power supply as compared to others. Whereas, capital structure and investment in backup generation demonstrated an inverse connection. Such that whenever capital structure changes by one unit, the investment level varied by .148 units in the same direction. Therefore, most likely the external debt was used in financing acquisition of self-generation facilities in addition to use of owners capital. Lastly, the correlation between capital structure and industry was indirect although it was not statistically significant with (*r*=-.101 and p=.415). This implies that, for a unit modification in capital structure, industry altered by .101 in the opposite direction. The reason of such an inverse link occurring is that external debt always threatens closure of firms due to financial distress associated with level of gearing. The correlation of the variables based on the financial performance perspective was demonstrated using Table 4.20

Table 4.20: Correlation Matrix Results for Financial Performance

		FIN	OF	OD	ON	TO	CAPA	INV	INDU	CS
FIN	Pearson Correlation	1.000	-.315**	-.029	.024	-.081	.281*	-.150	-.145	-.145
	Sig. (2-tailed)		.009	.813	.845	.513	.021	.224	.240	.240
OF	Pearson Correlation		1.000	.244*	-.035	.284*	-.084	-.040	.136	.043
	Sig. (2-tailed)			.047	.778	.020	.501	.745	.271	.731
OD	Pearson Correlation			1.000	-.322**	.028	.094	-.066	.000	-.150
	Sig. (2-tailed)				.008	.825	.448	.593	.999	.226
ON1	Pearson Correlation				1.000	.102	.118	-.032	-.156	.142
	Sig. (2-tailed)					.412	.343	.794	.206	.252
TO	Pearson Correlation					1.000	.119	-.083	-.211	.015
	Sig. (2-tailed)						.339	.503	.087	.901
CAPA	Pearson Correlation						1.000	-.050	-.369**	.007
	Sig. (2-tailed)							.690	.002	.958
INV	Pearson Correlation							1.000	.107	.148
	Sig. (2-tailed)								.387	.232
INDU	Pearson Correlation								1.000	-.101
	Sig. (2-tailed)									.415
CS	Pearson Correlation									1.000
	Sig. (2-tailed)									

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

From Table 4.20 above, financial performance had an inverse significant link with outage frequency with (*r*=-.315 and p<.01). Such that, a unit alteration in power outage frequency resulted to .315 unit alteration in financial performance of firms operating in the manufacturing segment in the opposite direction which was statistically significant. The implication is that when power outage frequency increased, level of earnings before interest and taxation declined for productivity slowed down further affecting the market share and the level of the manufacturing firm profitability in an adverse manner. Further, a unit variation in power outage duration led to a -.029 unit variation in financial performance with (r=.029 and p>.01 and .05).This indirect link implies that return on assets was negatively affected by the length of duration within which electric power was missing for during this time production was low. Furthermore, outage notification-financial performance connection was direct although it was not statistically significant with (*r*=.024, p=.845). This implies that a unit alteration of outage notification resulted to .024 unit transformation in financial performance. This means that the efforts made by electric power suppliers to alert manufacturing firms on power blackouts assists the management of the manufacturing firms in adopting of strategies in advance to prevent power outage interruptions. As a result, ROA and/or EBIT is retained or increased. Hence the positive association between power outage notification and financial performance.

Further, the association between financial performance and time of power outage was negative and not statistically significant with (*r*=-.081 and p=.513). Therefore, when time of power outage changed by one unit, the financial performance declined by .081 units for whether the time of power outage was during the day, evening or night, production decreased hence affecting profitability. Further, capacity in backup generation had statistically significant positive linkage with financial performance with (*r*=.281 and $p<.05$). Such that a unit alteration in capacity resulted to .281 unit conversion in financial performance. An increase in the level of capacity in backup generation provided an assurance of continuous production by the manufacturing firms which implied that it was hard for them to lose their market share hence profitability was guaranteed.

On the other hand, the relationship between investment in backup generation and financial performance was inverse and not statistically significant with (*r*=-.150 and p=.224) and therefore a unit modification in investment in backup generation led to a decline of .150 units in financial performance for it means that a portion of profits of the current year or retained earnings was spend in acquisition of the physical facilities of backup generation. In the case of industry, the link to financial performance was negative and not statistically significant with (*r*=-.145 and p=.240). This implies that a unit alteration in industry resulted to .145 unit alteration in financial performance in an inverse manner. This is because some underlying external factors could have impacted on the various industries in different ways which may in turn impact of financial performance decline. For debt equity ratio, the link between financial performance and capital structure was indirect and insignificant with (*r*=-.145 and p=.240). Therefore, a unit change in capital structure translated in to -.145 unit change in financial performance for it shows that probably the cost of borrowing was high hence taking away a big percentage of the firm profitability.

Further, power outage frequency and power outage duration linkage, the relationship was positive and statistically significant with (*r*=.244 and p=.0.047). Such that a unit alteration of power outage duration resulted to .244 unit change in power outage frequency. That is the longer the length of interval of time experienced in state of blackout by the manufacturing firms, the more the frequency of power outage. Also, since both power outage frequency and power outage duration are aspects of electric power outage dynamics, the direct significant link implies that they equally influence firm performance. Contrary, power outage notification had an inverse link with power outage frequency which was not statistically significant with (*r*=-.035 and p>.01 and .05). This means that the more the number of times suppliers of electricity alerted manufacturing firms on forthcoming blackouts, the less the number of power outage frequencies for the aspect of signaling the users of power showed that the suppliers were aiming at minimizing the number of such occurrences.

In addition, there existed statistically significant connection between time of outage and outage frequency with (*r*=.284 and p=.020) which was positive. Such that a unit modification in time of outage resulted to .284 unit transformation in outage frequency. The aforementioned association portrays that whether the blackout occurred during the day, evening or at night cumulatively represented the magnitude of power outage frequencies. Further, capacity in backup generation and power outage frequency depicted a negative relationship which was not statistically significant with (*r*=-.084 and p=.501). Therefore, a unit amendment in capacity in backup generation resulted to an inverse .501 unit change in outage frequency which was not statistically significant. This shows that if the voltage capacity of the generator improves, the level of power outage should portray a decline trend for the manufacturing firm is indifferent on the source of power, whether from the main grid or from generators.

In the case of investment in backup generation as the predictor variable, it did not depict statistically significant relationship with power outage frequency for a unit transformation of investment in backup generation resulted to .040 unit variation in power outage frequency with (r=-.040 and p=.745) which was inverse. This displays that purchase of more generators was a sure way of continuous supply of electric power even when there were cases of power blackouts. Hence availing of generators meant reduction of power outage frequency. On the other hand, industry and power outage frequency had a direct link which was not statistically significant with (r=.136 and $p>.01$ and .05). Such that, for every unit variance of industry variable, power outage frequency varied by .136 units in the same direction. This shows that the more the number of industry categories being considered, the more the number of power outage frequencies are experienced at the same time. This is because, regardless of the category selected at a time, the overall results will be increased power outage frequency for all firms use power. Hence power outage frequency increased. Lastly, there existed a direct association between capital structure and power outage frequency which was not statistically significant with (r=.043 and p=.651). This implies that a unit alteration in capital structure amounted to .043 unit modification in power outage frequency. This link implies that the additional external debt accessed by the manufacturing firms was not substantially utilized to reduce power outage frequency. This means that most likely it was utilized to finance other projects other than backup generation.

Power outage notification and outage duration depicted statistically significant indirect association with (*r*=-.322 and p=.008). That is, for a unit modification in outage notification, there was a corresponding .322 unit variation which was inverse and statistically significant for (*r*=-.322 and p<.01). This implies that the endeavors of the power suppliers to communicate in advance on issues of power blackout resulted to reduced power outage duration for this aspect is indirectly controlled by the supplier. So the shorter the power outage duration was experienced by the manufacturing firms. Dissimilar results were established between outage duration and time of outage for the association was weak although positive with (*r*=.028 and p=.825). This implies that a unit variation in time of outage resulted to a direct transformation in outage duration by .028 units which was small and was not statistically significant. This means that all power outages taken together, resulted to increased durations of power outage.

Capacity in backup generation and outage duration portrayed a direct linkage which was not statistically significant with (*r*=.094 and p=.448). Such that a unit modification in capacity in backup generation resulted to .094 unit variation in outage duration which changed in the opposite direction. This nature of association could be affiliated to the fact that increase of capacity in backup generation did not boost electric power supply as supposedly due to lack of power generation efficiencies. For the case of investment in backup generation to power outage duration connection, it was inverse and not statistically significant with (*r*=-.066 and p=.593). Therefore, a unit variation in investment in backup generation resulted to negative.066 unit conversion in power outage duration which was not statistically significant. For the more generators were bought, the more they aided in reduction of power outage duration. Further, industry did not portray any relationship with power outage duration with (*r*=.000 and p=.999). This means that the industry affiliated to the firm in question did not dictate the extent to which blackout duration would take. The reason being that duration of blackout would be the same for all firms regardless of the type of industry. Lastly, for capital structure and power outage duration, an inverse negative link was established which was not statistically significant for a unit adjustment in capital structure resulted to .150 unit transformation of power outage duration in the opposite direction with (*r*=-.150 and p=.226). Therefore, it shows that the management of the manufacturing firms utilized the additional debt to facilitate activities such as purchase of generators.

A further interrogation was performed to establish the magnitude power outage notification as the dependent variable impacted on time of power outage, capacity in backup generation, investment in backup generation, industry and capital structure. For time of power outage, there was a direct association with power outage notification which was not statistically significant with (*r*=.102 and p=.412). That is, regardless of when time of power outage occurred, whether during the day, evening and or at night the suppliers of electric power kept on sending notifications to the electric power users. Hence, the number of times notifications were made kept on rising for this guaranteed full coverage of alerting the concerned parties.

On the other hand, capacity in backup generation and power outage notification showed a direct link although it was not statistically significant with (*r*=.118 and p=.343). Whereby a unit modification in capacity in backup generation resulted to .118 unit variation in power outage notification which was direct. Coincidentally, the direct association could be due to the already set notification policies by the power suppliers of notifying customers of power blackout instances whether the customers had planned for power outages in advance through acquisition of generators or not. Also, the apparent direct link of capacity in backup generation and power outage notification could be due to the fact that not all manufacturing firms had increased capacity in backup generation due to acquisition of generators hence providers of power could not ignore to alert them even if the majority of the firms had blackout preparedness. Further, there was inverse linkage between investment in backup generation and power outage notification with (r=-.032 and p=.794). Such that a unit transformation in investment resulted in to .032 unit adjustment in outage notification which was not statistically significant (p>.01 and .05). This could be due to the fact that most firms invested heavily on power generation and needed no notification for the alerts would not play a major role in planning for power supply amongst them especially in the long run.

Similarly, the relationship between industry and power outage notification was inverse although not statistically significant with (r=-.156 and p=.206) such that a unit modification of industry resulted to .156 unit modification in outage notification which was not significant. This association implies that the more the number of industry, the less the number of notifications that were required to be sent to the users of electric power. For the majority of the firms could not be in need of such notifications based on their category they are in. It was also established that capital structure had a direct linkage with power outage notification although it was not statistically significant with (r=.142 and p=.252). Therefore, a unit adjustment in capital structure resulted into .252 unit change in power outage notification which was positive. It shows that the providers of electric power continued to notify their clients on power outage instances regardless of whether the manufacturing firms accessed more external debt to finance electricity power generators or not. The positive connection could be possible for the decision to notify and the decision to access external debt to finance acquisition of generators are discrete.

Time of outage and capacity showed positive linkage which was not statistically significant with (*r*=.119 and p=.339). Such that a unit variation in capacity in backup generation resulted to .119 unit variation in time of outage in the same direction This implies that as capacity in backup generation increased, time of outage increased for there could be other external factors which power suppliers cannot control which could be causing the number of outages to increase either during the day, evening or at night such as earthquakes, errors at power stations, electricity transmission line breakdown or short-circuiting. Also, investment in backup generation and industry portrayed an indirect linkage with time of outage which was not statistically significant with (*r*=-.083 and p=.503) and (*r*=-.211 and p=.087) respectively. Such that a unit modification in investment in backup generation translated into .083 unit alteration in time of power outage which was not statistically significant and again, a unit modification in industry resulted to .211unit change in time of outage. In both cases, the transformation was inverse, meaning that both investment in backup generation and industry caused time of outage to reduce in number. This could be due to increased investment in backup generation using generators by most firms across all the industries.

Further, capital structure portrayed a positive relationship with time of power outage which was not statistically significant with (*r*=.015 and p=.901). This implies that a unit alteration in capital structure translated in to .015 unit variation in time of outage with ($p>.01$ and .05). The aforementioned linkage is justified by the fact that although capital structure may be positively changing, time of outage could coincidentally increase either during the day, evening and or night due to external factors such as short-circuiting and transmission faults

In addition, capacity in backup generation and investment in backup generation had an association which was inverse with (r=-.050 and p=.690) which was not statistically significant. In this case, a unit alteration in investment in backup generation resulted to .050 unit adjustment in capacity in backup generation with ($P>.01$ and .05). This shows that as firms invest more on power generation facilities, capacity reduced may be due to low quality generators acquired. For industry, there was an inverse link with capacity in backup generation which was statistically significant with (r=-.369 and p=.002). Hence a unit variation in industry resulted to .369 unit variation in capacity in backup generation in the opposite direction which implied that collectively, manufacturing firms in all industries decreased self-generation capacity as they aimed at strategizing for power outage through acquisition of generators. This contrary results could be due to use of generators whose capacity is lower due to diseconomies of scale associated with large purchases from suppliers who can compromise the capacity quality especially if there are no purchase regulations.

Lastly, capital structure and capacity in backup generation demonstrated a positive link which was not statistically significant with (r=.007 and p=.958). This means that a unit transformation in capital structure resulted to .007 unit variation in capacity in backup generation with ($p>.01$ and .05). Although the coefficient was very small, this shows that some of the finance resources obtained from the external borrowing was used to finance acquisition of self-generation facilities resulting to increased capacity in backup generation.

Industry and investment in backup generation showed a direct association although it was not statistically significant with (*r*=.107 and p=.387). Such that a unit variation in industry resulted to .107 unit adjustment in investment in backup generation. This portrays that variations in industries contributed to the increased level of investment in backup generation for some firm demand more electric power supply as compared to others. Whereas, capital structure and investment in backup generation demonstrated an inverse connection. Such that whenever capital structure changes by one unit, the investment level varied by .148 units in the same direction. Therefore, most likely the external debt was used in financing acquisition of self-generation facilities in addition to use of owners capital. Lastly, the correlation between capital structure and industry was indirect although it was not statistically significant with (*r*=-.101 and p=.415). This implies that, for a unit modification in capital structure, industry altered by .101 in the opposite direction. The reason of such an inverse link occurring is that external debt always threatens closure of firms due to financial distress associated with level of gearing.

Table 4.21: Correlation Matrix Results for Performance

		PER	OF	OD	ON	TO	CAPA	INV	INDU	CS
PER	Pearson Correlation	1.000	-.199	-.022	-.050	-.117	.077	-.266*	-.042	-.009
	Sig. (2-tailed)		.107	.857	.690	.347	.534	.030	.734	.945
OF	Pearson Correlation		1.000	.244*	-.035	.284*	-.084	-.040	.136	.043
	Sig. (2-tailed)			.047	.778	.020	.501	.745	.271	.731
OD	Pearson Correlation			1.000	-.322**	.028	.094	-.066	.000	-.150
	Sig. (2-tailed)				.008	.825	.448	.593	.999	.226
ON	Pearson Correlation				1.000	.102	.118	-.032	-.156	.142
	Sig. (2-tailed)					.412	.343	.794	.206	.252
TO	Pearson Correlation					1.000	.119	-.083	-.211	.015
	Sig. (2-tailed)						.339	.503	.087	.901

CAPA	Pearson Correlation	1.000	-.050	-.369**	.007
	Sig. (2-tailed)		.690	.002	.958
INV	Pearson Correlation		1.000	.107	.148
	Sig. (2-tailed)			.387	.232
INDU	Pearson Correlation			1.000	-.101
	Sig. (2-tailed)				.415
CS	Pearson Correlation				1.000
	Sig. (2-tailed)				

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

From Table 4.21, the aspect of performance had an inverse insignificant link with outage frequency with (r=-.199 and p> .01 and .05). Such that, a unit transformation in power outage frequency, performance of the firms undertaking manufacturing activities changed by .199 units in the opposite direction and the alteration was not statistically significant. This implies that if power outage frequency increased, this decelerated the overall performance perspective. Further, a unit change in power outage duration led to a .022 unit change in performance with (*r*=-.022 and p>.01 and .05) which was inverse and not statistically significant. That is, the longer the time it took for power to be restored, the more adverse performance was influenced such as customer focus would be lost due to less concentration in meeting their requirements and ROA could be declining in the long run.

The relationship between outage notification and the overall performance of the manufacturing firms was inverse and not statistically significant with (*r*=-.050, p=.690). This implies that a unit modification of outage notification resulted to .050 unit variation in performance (both financial and non-financial performance perspective) which was adverse. Although the power providers would notify the manufacturing firms, that act made some non-financial related activities such as employee productivity to decline which could further influence financial performance in an adverse way. Further, the association between overall performance and time of power outage was negative and not statistically significant with (*r*=-.117 and p>.01 and .05). Such that for a unit variation in time of outage resulted to .117 unit variation in performance in the opposite direction. That is, regardless of the time blackout occurs, whether during the day, evening or at night it adversely influenced some or all the performance aspects such as employee productivity and operations efficiency and earnings before interest and taxation. Capacity in backup generation had a direct linkage with overall performance which was not statistically significant with (*r*=.077 and p=.534). Such that a unit variation in capacity in backup generation resulted to .077 unit alteration in performance such as both ROA and corporate social responsibility activities which could have declined for the capacity in backup generation may be only sufficient for catering of the main activities of the organization such as production.

Further, the connection between investment in backup generation and performance was negative and statistically significant with (*r*=-.266 and p=.030). Whereby a unit modification in investment in backup generation led to .266 unit conversion in performance. The argument being that in the aforementioned linkage could be negative due to the firm budget being re-allocated towards acquisition of self-generation power facilities, which then implies that the investment shared the financial resources with other performance affiliated activities such as sales promotion, customer care affiliated activities, green performance and employee productivity improvement. Hence such activities probably declined. Hence disadvantaging the overall performance. In the case of industry, it was portrayed that there is indirect link between industry classification and performance. This implies that a unit change in industry resulted to .042 unit change in performance which was not statistically significant with (*r*=.042 and p=.734). For capital structure, the link with performance was indirect and not statistically significant with (*r*=-.009 and p>.01 and .05). That is a unit change in capital structure translated in to .009 unit change in performance. This means that most likely the more a firm was financed using external debt as compared with own financing the more the performance activities were undertaken especially if the external borrowing was for direct facilitation of the income generating activities such as customer satisfaction, improvement of operations efficiency and green performance just to mention but a few.

On the side of power outage frequency and power outage duration linkage, the relationship was positive and statistically significant with (*r*=.244 and p=.0.047). Such that a unit alteration of power outage duration resulted to .244 unit modification in power outage frequency. That is the longer the dimension of interval of time experienced in state of blackout by the firms, the more the frequency of power outage. Also, since both power outage frequency and power outage duration are aspects of electric power outage dynamics, the direct significant link implies that they equally influence firm performance. Contrary, power outage notification had an inverse link with power outage frequency which was not statistically significant with (*r*=-.035 and p>.01 and .05). This means that the more the number of times suppliers of electricity alerted manufacturing firms on forthcoming blackouts, the less the number of power outage frequencies for the aspect of signaling the users of power showed that the suppliers were aiming at minimizing the number of such occurrences.

In addition, there existed statistically significant relationship between time of outage and outage frequency with (r=.284 and p=.020) which was positive. Such that a unit modification in time of outage resulted to .284 unit transformation in outage frequency. The aforementioned association portrays that whether the blackout occurred during the day, evening or at night cumulatively represented the magnitude of power outage frequencies. Further, capacity in backup generation and power outage frequency depicted a negative relationship which was not statistically significant with (r=-.084 and p=.501). Therefore, a unit amendment in capacity in backup generation resulted to an inverse .501 unit change in outage frequency which was not statistically significant. This shows that if the voltage capacity of the generator improves, the level of power outage should portray a decline trend for the manufacturing firm is indifferent on the source of power, whether from the main grid or from generators.

In the case of investment in backup generation as the predictor variable, it did not depicted statistically significant relationship with power outage frequency for a unit transformation of investment in backup generation resulted to .040 unit variation in power outage frequency with (r=-.040 and p=.745) which was inverse. This displays that purchase of more generators was a sure way of continuous supply of electric power even when there were cases of power blackouts. Hence availing of generators meant reduction of power outage frequency. On the other hand, industry and power outage frequency had a direct link which was not statistically significant with (r=.136 and p>.01 and .05). Such that, for every unit variance of industry variable, power outage frequency varied by .136 units in the same direction. This shows that the more the number of industry categories being considered, the more the number of power outage frequencies are experienced at the same time. This is because, regardless of the category selected at a time, the overall results will be increased power outage frequency for all firms use power. Hence power outage frequency increased. Lastly, there existed a direct association between capital structure and power outage frequency which was not statistically significant with (*r*=.043 and p=.651). This implies that a unit alteration in capital structure amounted to .043 unit modification in power outage frequency. This link implies that the additional external debt accessed by the manufacturing firms was not substantially utilized to reduce power outage frequency. That is most likely it was utilized to finance other projects other than back up generation.

Power outage notification and outage duration depicted statistically significant indirect association with (*r*=-.322 and p=.008). That is, for a unit modification in outage notification, there was a corresponding .322 unit variation which was inverse and statistically significant for (*r*=-.322 and p<.01). This implies that the endeavors of the power suppliers to communicate in advance on issues of power blackout resulted to reduced power outage duration for this aspect is indirectly controlled by the supplier. So the shorter the power outage duration was experienced by the manufacturing firms. Dissimilar results were established between outage duration and time of outage for the association was weak although positive with (*r*=.028 and p=.825). This implies that a unit variation in time of outage resulted to a direct transformation in outage duration by .028 units which was small and was not statistically significant. This means that all power outages taken together, whether affiliated to daytime, evening or at night resulted to increased durations of power outage.

Capacity in backup generation and outage duration portrayed a direct linkage which was not statistically significant with (*r*=.094 and p=.448). Such that a unit modification in capacity in backup generation resulted to .094 unit variation in outage duration which changed in the opposite direction. This nature of association could be affiliated to the fact that increase of capacity in backup generation did not boost electric power supply as supposedly due to lack of power generation efficiencies. For the case of investment in backup generation to power outage duration connection, it was inverse and not statistically significant with (*r*=-.066 and p=.593). Therefore, a unit variation in investment in backup generation resulted to negative.066 unit conversion in power outage duration which was not statistically significant. For the more generators were bought, the more they aided in reduction of power outage duration. Further, industry did not portray any relationship with power outage duration with (*r*=.000 and p=.999). This means that the industry affiliated to the firm in question did not dictate the extent to which blackout duration would take. The reason being that duration of blackout would be the same for all firms regardless of the type of industry. Lastly, for capital structure and power outage duration, an inverse negative link was established which was not statistically significant for a unit adjustment in capital structure resulted to .150 unit transformation of power outage duration in the opposite direction with (*r*=-.150 and p=.226). Therefore, it shows that the management of the manufacturing firms utilized the additional external debt to facilitate activities associated with reducing power outage duration such as purchase of generators.

The study further sought to establish the extent to which power outage notification as the dependent variable related with time of power outage, capacity in backup generation, investment in backup generation, industry and capital structure. For time of power outage, there was a direct association with power outage notification which was not statistically significant with (*r*=.102 and p=.412). That is, regardless of when time of power outage occurred, whether during the day, evening and or at night the suppliers of electric power kept on sending notifications to the electric power users. Hence, the number of times notifications were made guaranteed full awareness to the concerned parties.

On the other hand, capacity in backup generation and power outage notification showed a direct link although it was not statistically significant with (*r*=.118 and p=.343). Whereby a unit modification in capacity in backup generation resulted to .118 unit variation in power outage notification which was direct. Coincidentally, the direct association could be due to the already set notification policies by the power suppliers of notifying customers of power blackout instances whether the customers had planned for power outages in advance through acquisition of generators or not. Also, the apparent direct link of capacity in backup generation and power outage notification could be due to the fact that not all manufacturing firms had increased capacity in backup generation due to acquisition of generators hence providers of power could not ignore to alert them even if the majority of the firms had blackout preparedness. Further, there was inverse linkage between investment in backup generation and power outage notification with (*r*=-.032 and p=.794). Such that a unit transformation in investment led to .032 unit adjustment in outage notification which was not statistically significant (p>.01 and .05). This could be due to most manufacturing firms investing heavily on power generation and needed no notification for the alerts would not play a major role in planning for power supply amongst them especially in the long run.

In a similar manner, the correlation between industry and power outage notification was inverse although not statistically significant with (*r*=-.156 and p=.206) such that a unit modification of industry resulted to .156 unit modification in outage notification which was not significant. This association implies that the more the number of industry, the less the number of notifications that were required to be sent to the users of electric power. For the majority of the firms could not be in need of such notifications based on their category they are in. It was also established that capital structure had a direct linkage with power outage notification although it was not statistically significant with (*r*=.142 and p=.252). Therefore, a unit adjustment in capital structure resulted into .252 unit change in power outage notification which was positive. It shows that the providers of electric power continued to notify their clients on power outage instances regardless of whether the manufacturing firms accessed more external debt to finance electricity power generators or not. The positive connection could be possible for the decision to notify and the decision to access external debt to finance acquisition of generators are discrete.

Time of outage and capacity showed positive linkage which was not statistically significant with (*r*=.119 and p=.339). Such that a unit variation in capacity in backup generation resulted to .119 unit variation in time of outage in the same direction This implies that as capacity in backup generation increased, time of outage increased for there could be other external factors which power suppliers cannot control which could be causing the number of outages to increase either during the day, evening or at night such as earthquakes, errors at power stations, electricity transmission line breakdown or short-circuiting. Also, investment in backup generation and industry portrayed an indirect linkage with time of outage which was not statistically significant with (*r*=-.083 and p=.503) and (*r*=-.211 and p=.087) respectively. Such that a unit modification in investment in backup generation translated into .083 unit alteration in time of power outage which was not statistically significant and again, a unit modification in industry resulted to .211unit change in time of outage. In both cases, the transformation was inverse, meaning that both investment in backup generation and industry caused time of outage to reduce in number. This could be due to increased investment in backup generation using generators by most firms across all the industries. Further, capital structure portrayed a positive relationship with time of power outage which was not statistically significant with (*r*=.015 and p=.901). This implies that a unit alteration in capital structure translated in to .015 unit variation in time of outage with (p>.01 and .05). The aforementioned linkage is justified by the fact that although capital structure may be positively changing, time of outage could coincidentally increase either during the day, evening and or night due to external factors such as short-circuiting and mistakes occurring on the transmission lines.

In addition, capacity in backup generation and investment in backup generation had an association which was inverse with (*r*=-.050 and p=.690) which was not statistically significant. In this case, a unit alteration in investment in backup generation resulted to .050 unit adjustment in capacity in backup generation with (P>.01 and .05). This shows that as firms invest more on power generating facilities, capacity reduced may be due to low quality generators acquired. For industry, there was an inverse link with capacity in backup generation which was statistically significant with (*r*=-.369 and p=.002). Hence a unit variation in industry resulted to .369 unit variation in capacity in backup generation in the opposite direction which implied that collectively, manufacturing firms in all industries decreased self-generation capacity as they aimed at strategizing for power outage through acquisition of generators. This contrary results could be due to use of generators whose capacity is lower due to diseconomies of scale associated with large purchases from suppliers who can compromise the capacity quality especially if there are no purchase regulations. Lastly, capital structure and capacity in backup generation demonstrated a positive link which was not statistically significant with (r=.007 and p=.958). This means that a unit transformation in capital structure resulted to .007 unit variation in capacity in backup generation with (p>.01 and .05). Although the coefficient was very small, this shows that some of the finance resources obtained from debts was used to finance acquisition of self-generation facilities resulting to increased capacity in backup generation.

Industry and investment in backup generation showed a direct association although it was not statistically significant with (r=.107 and p=.387). Such that a unit variation in industry resulted to .107 unit adjustment in investment in backup generation. This portrays that variations in industries contributed to the increased level of investment in backup generation for some firm demand more electric power supply as compared to others. Whereas, capital structure and investment in backup generation demonstrated an inverse connection. Such that whenever capital structure changes by one unit, the investment level varied by .148 units in the same direction. Therefore, most likely the external debt was used in financing acquisition of self-generation facilities in addition to use of owners capital. Lastly, the correlation between capital structure and industry was indirect although it was not statistically significant with (r=-.101 and p=.415). This implies that, for a unit modification in capital structure, industry altered by .101 in the opposite direction. The reason of such an inverse link occurring is that external debt always threatens closure of firms due to financial distress associated with debt to equity level.

CHAPTER FIVE: HYPOTHESES TESTING AND DISCUSSION OF FINDINGS

5.1 Introduction

The outcome of testing the four null hypotheses in this study using regression models and their interpretation is presented in this section. The first null hypothesis tested the direct relationship between performance (measured in three aspects, namely; non-financial, financial and total performance) and several predictors, namely; electric power outage dynamics (outage frequency, outage duration, outage notification, and time of outage). The second and third hypotheses, concern the mediating influence on the correlation between electric power outage dynamics and performance. The last and the fourth hypothesis was testing the joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance. Tests of goodness of fit including the adjusted coefficient of determination (R^2) were performed. The chapter is summarized with a discussion of findings on each of the hypothesis tested.

5.2 Electric Power Outage Dynamics and Performance of Manufacturing firms in Kenya

The study aimed at achieving its first specific objective by establishing the influence of electric power outage dynamics on Kenyan based manufacturing firm performance. The study considered non-financial, financial and overall performance aspects so as to develop a comprehensive study case. The corresponding null hypothesis stated that; ***H_{01}: The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significant.***

To determine whether outage frequency, outage duration, outage notification and time of outage (EPOD) significantly predicted Kenya based manufacturing firm performance, the study utilized multiple regression model. This was the test of the first null hypothesis as shown below:

a) Non-Financial performance perspective (NFIN)

The prediction equation as shown in chapter three was;

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

Note: The variables are as defined in models……………………………….. (1-7)

Table 5.1 represents the research findings of regression analysis of power outage frequency and non-financial performance

Table 5.1: Regression Analysis Results of OF, OD, ON, TO and Non-Financial Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.120[a]	.014	-.049	.15466

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

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.022	4	.005	.226	.923[b]
	Residual	1.483	62	.024		
	Total	1.505	66			

a. Dependent Variable: NFIN

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

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.756	.130		5.814	.000
	OF	.000	.022	-.002	-.012	.991
	OD	-.005	.025	-.029	-.211	.834
	ON	-.016	.027	-.080	-.597	.553
	TO	-.036	.058	-.084	-.634	.528

a. Dependent Variable: NFIN

The F statistic in Table 5.1 showed a value of .226 (p=.923). Therefore, the regression model was not significant at 95% confidence level for the (p>.05) hence it did not fit in estimating performance of non-financial nature of firms undertaking manufacturing activities in Kenya. Goodness of fit test was also performed which entailed coefficient of determination and test of the slope (β) whereby the outcome was as follows

The Adjusted R^2 was -.049 as per Table 5.1. This was the coefficient of determination for model in question and it depicted that outage frequency, outage duration, outage notification and time of outage taken together failed to explain the variations in performance of firms engaged in manufacturing undertakings in Kenya, especially in the non-financial performance perspective. This is because the Adjusted R^2 assumed a -4.9% value. That means that variations of performance (non-financial) were explained by other variables that were not captured in this model. For the test of the slope, a unit variation in power outage frequency resulted to .002 unit transformation in the same non-financial performance of Kenyan based manufacturing firms aforementioned which was inverse and not statistically significant with (p=.991). Further, a unit variation in power outage duration translated to .029 unit variation in performance (non-financial) which was inverse and not statistically significant with (p=.834). For power outage notification, a unit alteration in this variable resulted to .080 unit adjustment in manufacturing firm performance in Kenya which was inverse and had no statistical significance with (p=.553) and lastly, a unit alteration in time of power outage led to .084 unit alteration in performance of firms undertaking manufacturing activity which was indirect and had no statistical significance with (p=.811).

The study further considered the extent to which EPOD influenced financial performance perspective of the manufacturing firms in Kenya and the results were as follows;

b) Financial performance perspective (FIN)

The prediction equation as shown in chapter three was;

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

Note: The variables are as defined in model……………………………………..…. (1, 26-28)

The research findings of regression analysis of power outage frequency and non-financial performance is as per Table 5.2 as follows:

Table 5.2: Regression Analysis Results of OF, OD, ON, TO and Financial Performance

Model Summary

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

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

ANOVA

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

Coefficients

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

a. Dependent Variable: FIN

Further regression was conducted where by the four forecaster variables were considered. The results of Table 5.2, portrayed that F statistic was 1.778(p=.145). This implies that the model was not statistically significant at 95% confidence level, and hence it was inappropriate in estimating performance of the firms. The model was further subjected to other goodness of best fit tests namely (R^2) and test of the slope (β). The two tests were explained as follows;

Coefficient of determination as per Table 5.2 was (Adj.R^2= .045), which implies that power outage frequency, power outage duration, power outage notification and time of power outage taken together described 4.5% of variations in firm performance. That is 95.5% of variations of firm performance was described by extra aspects that were not incorporated in this model. In addition, test of the slope (the t-test) was undertaken and the results revealed that for every unit alteration in power outage frequency, financial performance varied by .332 units which was negative and statistically significant with ($p<05$). Whereas, a unit adjustment of power outage duration translated to .061 unit direct alteration of performance (financial) of firms in Kenya undertaking manufacturing activities which was not statistically significant with ($p>.05$). For power outage notification, a unit variation resulted to .032 unit alteration of financial performance of Kenyan based manufacturing firms which was positive and not statistically significant with ($p=.805$). Lastly, it was revealed that a unit alteration in time of power outage resulted to .008 unit variation which was not statistically significant with ($p=.950$). Therefore, the model developed from this analysis was presented as follows;

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

Where;

FIN is Financial Performance of organization i in time t

OF is power outage frequency of organization i in time t

OD is power outage duration of organization i in time t

ON is power outage notification of organization i in time t

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

On the other hand, the overall performance of the manufacturing firms was considered and the results were as follows;

c) Performance perspective (PER)

The prediction equation as shown in chapter three was;

$$\textbf{PER} = \beta_{10} + \beta_{11}\textbf{OF} + \beta_{12}\textbf{OD} + \beta_{13}\textbf{ON} + \beta_{14}\textbf{TO} + \varepsilon_{it},$$

Note: The variables are as defined in model……………………………………..…. (1, 50-73)

The research findings of regression analysis of power outage dynamics and non-financial performance was indicated in Table 5.3

Table 5.3: Regression Analysis Results of OF, OD, ON, TO and Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.214[a]	.046	-.016	.09802

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

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
	Regression	.029	4	.007	.746	.564[b]
1	Residual	.596	62	.010		
	Total	.624	66			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.469	.082		5.682	.000
	OF	-.019	.014	-.186	-1.390	.169
1	OD	.001	.016	.009	.069	.945
	ON	-.006	.017	-.047	-.356	.723
	TO	-.017	.036	-.059	-.456	.650

a. Dependent Variable: PER

The results of Table 5.3, portrayed that F statistic was .746(p=.564). That is, at 95% confidence level the model was not statistically significant, and therefore inappropriate to estimate the manufacturing firm overall performance in Kenya. The model was further subjected to other goodness of best fit tests of coefficient of determination (R^2) and test of the slope (β). The two tests were explained as follows;

Coefficient of determination as per Table 5.3 was (Adj. R^2= -.016), and it showed that power outage frequency, power outage duration, power outage notification and time of power outage taken together did not explain performance. This implies that variations of overall performance of firms undertaking manufacturing activities in Kenya was explained by other aspects that were not incorporated in this model. In addition, test of the slope (the t-test) was undertaken and the results revealed that for every unit alteration in power outage frequency, overall performance varied by .186 unit variation which was negative and not statistically significant with ($p>05$). Whereas, a unit variation of power outage duration translated to .009 unit alteration of the Kenyan based manufacturing firm total performance of which was very small, positive and not statistically significant with ($p>.05$). For power outage notification, a unit adjustment resulted to .047 unit alteration of aggregate performance of manufacturing firms which was negative and not statistically significant with ($p=.723$). Lastly, it was revealed that a unit alteration in time of power outage resulted to negative unit change of .059 which was small and also not statistically significant with ($p=.650$).

The F statistics values affiliated to the three performance perspective, namely; non-financial, financial and overall performance portrayed diverse outcomes. For the non-financial and overall performance, the values realized in all the models were statistically insignificant. Therefore, since at least one of the aspects of performance of manufacturing firms in Kenya was statistically significantly influenced by power outage frequency, the study failed to accept the first (H_{01}) null hypothesis which states that; ***H_{01}: the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significant.*** This implies that EPOD significantly influenced performance of Kenya based manufacturing organizations especially the perspective of power outage frequency which is a component of electric power outage dynamics.

5.3 Electric Power Outage Dynamics, Investment in Backup Generation and Performance of Manufacturing firms in Kenya.

The second objective of the study was to assess the effect of investment in backup generation on the relationship between electric power outage dynamics and performance of businesses undertaking manufacturing operations in Kenya. The study considered the predictor variables that estimated performance in a significant manner as per the previous empirical tests. In this case, it was power outage frequency for its influence on financial performance was statistically significant. The corresponding null hypothesis to the second specific objective was as stated below;

H_{02}: The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in back up generation.

The three steps of Baron and Kenny (1986) was utilized so as to assess mediation influence for each component of investment back up generation, namely; 1. Capacity and 2.

Investment. The three conditions for mediation have to be fulfilled for the test to be considered successful as explained below;

In step one, the regression outcome should depict that the predictor factor significantly impacts the response factor while putting the mediating factor aside; secondly, on incorporating the mediating factor as the current dependent variable in the regression model, the original predictor factor should significantly influence the mediator factor and thirdly, if the mediating factor is controlled, the consequence of the predictor factor on the dependent factor is no longer statistically significant in the presence of the intermediating variable.

1. Power Outage Frequency and Capacity as the Intervening Variable

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 5.4[a], 5.4[b]: and 5.4[c]:

Table 5.4[a]: Regression Results of Mediating Effect of Capacity on Outage Frequency and Financial Performance

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

To assess the intervening effect of capacity, the first step entailed regression analysis between financial performance (the response variable) and power outage frequency (independent factor) holding the mediating factor constant (capacity in backup generation). The outcome of the analysis portrayed statistically significant link as indicated by Table 5.4[a], for the model had (p-value<.05). The stepwise multiple regression model resulted to Adj. R^2 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 5.4[b]

Table 5.4[b]: Results of Regression between Power Outage Frequency and Capacity

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

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 5.4[b] 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 5.4[b], 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 5.4[c]

Table 5.4[c]: Results of Intervening Effect of Capacity between Power Outage Frequency, and Financial Performance

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.
	Regression	.123	2	.062	6.160	.004[b]
1	Residual	.630	63	.010		
	Total	.753	65			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	(Constant)	.108	.054		1.987	.051
1	OF	-.033	.013	-.293	-2.534	.014
	CAPA	.022	.010	.257	2.220	.030

a. Dependent Variable: FIN

As per Table 5.4[c], 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 variances in financial performance. That is, 86.3% of variations in financial performance was illuminated 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 5.4[c] 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). This outcome partially satisfied the third of 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 (ie power outage frequency) and manufacturing firm financial performance. 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

2. Power Outage Frequency and Investment as the Intervening Variable

The test for intervening effect was repeated using investment as the intermediating factor. In step one, the regression involved the power outage frequency and financial performance. Table 5.5[a] was utilized to present the outcome thereof

Table 5.5[a]: Regression Results of Mediating Effect of Investment on Power Outage Frequency and Financial Performance

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_1
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

To assess the intervening effect of investment, the first step entailed regression analysis between financial performance (the response variable) and power outage frequency (independent factor) holding the mediating factor constant (investment). The outcome of the analysis portrayed statistically significant link as indicated by Table 5.5[a], for the model had (p-value<.05). The stepwise multiple regression model resulted to Adj. R^2 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 investment as the response factor then regression analysis was carried out to establish the level of correlational significance between power outage frequency (predictor factor) and investment in backup generation (as the dependent factor). The results were presented in Table 5.5[b]

Table 5.5[b]: Results of Regression between Power Outage Frequency and Investment

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.040[a]	.002	-.014	.05508

a. Predictors: (Constant), OF

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.000	1	.000	.106	.745[b]
	Residual	.197	65	.003		
	Total	.197	66			

a. Dependent Variable: INV
b. Predictors: (Constant), OF

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.068	.015		4.525	.000
	OF	-.002	.007	-.040	-.326	.745

a. Dependent Variable: INV

The computed F statistics was .106(p=.745). Therefore, the model was inappropriate in predicting investment variations for at 95% confidence level, it was not statistically significant with (p>.05) as per Table 5.5[b] output. Further evidence was portrayed by the value of Adj. R^2 produced which was -.014 implying that power outage frequency did not statistically significantly predict investment. On undertaking t-test, (β) value of OF obtained was 0.040 which was negative and not statistically significant for (p=.745). The results implies that that OF did not significantly predict investment and a unit change in OF resulted to negative change of .040 which was small and not statistically significant with (p > .05). Hence, step two condition of intervening was not complied to as depicted in Table 5.5[b], 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, investment taking the position of intervening variable and financial performance was the response factor. The results were indicated in Table 5.5[c]

Table 5.5[c]: Results of intervening effect of Investment between Power Outage Frequency, and Financial Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.355[a]	.126	.099	.10150

a. Predictors: (Constant), INV, OF

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
	Regression	.095	2	.048	4.621	.013[b]
1	Residual	.659	64	.010		
	Total	.755	66			

a. Dependent Variable: FIN

b. Predictors: (Constant), INV, OF

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.234	.032		7.427	.000
1	OF	-.037	.013	-.322	-2.754	.008
	INV	-.320	.229	-.164	-1.398	.167

a. Dependent Variable: FIN

As per Table 5.5[c], F statistics was 4.62(p=.013). Hence the model was statistically significant (p<.05) and appropriate to predict financial performance at 95% confidence level. The stepwise multiple regression model produced Adj. R^2 of .099 which implies that power outage frequency and investment in backup generation taken together described 9.9% of variances in financial performance. That is, 90.1% of variations in financial performance was illuminated by other factors not incorporated in this model.

Further test of the slope depicts that a unit alteration in power outage frequency resulted to .322 unit transformation of financial performance which was negative and statistically significant with (p=.008). Whereas, a unit alteration of investment resulted to .164 unit modification in financial performance which was negative and not statistically significant with (p=.167).

The results as per Table 5.5[c] depicted that the effect of the intervening variable (investment) on the outcome variable (financial performance) was not statistically significant in the existence of the estimator factor (power outage frequency). This outcome did not satisfy the third Baron and Kenny (1986) approach for the independent factor statistically significantly predicted financial performance in the presence of the intervening factor. Therefore, investment did not mediate the correlation between electric power outage dynamics (ie power outage frequency) and financial performance of firms engaging in manufacturing activities in Kenya. The model developed was as follows;

FIN= .234-.322OF-.164INVEST

Where;

FIN is financial performance of organization i in time t

OF is power outage frequency

INVEST is investment in backup generation of organization i in time t

From Table 5.4[a] up to 5.5[c] the research findings demonstrated that capacity in backup generation had intervening effect on the relationship between power outage frequency which is a component of EPOD and financial performance. Investment had no intervening effect. In a nutshell, it was concluded that investment in backup generation (IBUG) intervened the relationship between EPOD (the aspect of power outage frequency) and firm performance.

Therefore, the study rejected the second null hypothesis (H_{02}) which states that; ***the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in backup generation.***

5.4 Electric Power Outage Dynamics, Firm Characteristics and Performance of Manufacturing firms in Kenya.

The third specific object was to determine the effect of firm characteristics (composed of industry and capital structure) on the relationship between electric power outage dynamics and performance of Kenya based firms in the manufacturing segmentation. The conforming null supposition (H_{03}) stated that the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly moderated by firm characteristics. A two-step stepwise multiple regression process was carried out to test the third null hypothesis. It should be noted that all the four EPOD components were used to determine the composite score for moderation purposes and the firm characteristics elements used were industry and capital structure.

To establish the moderating effect of industry, (Baron and Kenny, 1986; Aiken and West, 1991) approach was used. The guideline entailed first, fitting a regression model (model 1) to test the effects of the predictor and the proposed moderator factors which present the main effect. The effect for both the predictor and the moderator should be significant and also the model in general (R^2). Step two involved entering of the interaction term in the previous (model 1) to generate (model 2). In the case of industry, stepwise multiple regression was performed and the outcome for the three perspectives of firm performance for each of the twelve (12) industries were demonstrated as follows and as indicated in (Appendix iv)

Case (a): Industry

For the case of Building, Mining and Construction Industry, the main effect of Electric Power Outage Dynamics (EPOD), building mining and construction industry and the interaction term did not significantly influence the three performance perspectives of manufacturing firms in Kenya as per Table 5.6[a] Table 5.6[b], and Table 5.6[c] in (appendix iv). Hence there was no moderation

The study considered the extent to which Chemical and Allied industry moderated the link between EPOD and performance of manufacturing firms in Kenya as far as the three perspectives were concerned, namely; financial, non-financial and overall performance. The results portrayed that there was no moderation effect for the interaction term did not show any statistically significant effect as per Table 5.7[a] ,Table 5.7[b] and Table 5.7[c] in appendix iv.

The study further interrogated whether there was moderating effect of Energy, Electricals and Electronics industry on the relationship between EPOD and performance and the outcome for the three aspects of firm performance were as per Table 5.8[a], 5.8 [b] and 5.8 [c] in appendix iv which revealed that there was no moderation. It was further established that Leather and Footwear industry did not moderate the relationship between EPOD and the three perspectives of performance of manufacturing firms in Kenya as indicated in Table 5.9[a] to 5.9[c] in appendix iv

The study considered the Metal and Allied industry to test for moderation effect. The results for the three performance views were as indicated in Table 5.10[a] , 5.10[b] and 5.10[c] in (appendix iv). As per the aforementioned tables, it was concluded that Metal and Allied did not moderate the relationship between EPOD and performance of manufacturing firms in Kenya. Similarly, Motor vehicle assemblers and accessories industry was also considered as a moderator of the relationship between the three perspectives of performance and EPOD and the results were as indicated in Table 5.11[a], 5.11 [b] and 5.11[c] in (appendix iv) which revealed that moderation effect was missing.

The other focus by this study was on paper and board industry. Further investigation was performed to determine whether there was moderation effect. The results were presented as per Table 5.12[a], 5.12[b] and 5.12[c] as indicated in (Appendix iv). Again, it was concluded that there was no moderation effect.

The study also considered Pharmaceutical and Medical Equipment industry. An investigation to determine whether there was moderation effect was performed. The results were presented as per Table 5.13[a], 5.13[b] and 5.13[c] as indicated in (Appendix iv). The results portrayed that the non-financial performance perspective was moderated by Pharmaceutical and Medical Equipment industry unlike the case of financial and the overall performance perspective. Hence the empirical model for the non-financial perspective developed was as follows;

MODEL ONE: NFIN=80.887-.168EPOD-.356Pharmaceutical & Medical Equipment

MODEL ONE: NFIN=75.070-.083EPOD+1.138Pharmaceutical & Medical Equipment-1.552Pharmaceutical*Epod

Where;

NFIN, EPOD is as defined in model………………………………………………… (1)

EPOD is Electric Power Outage Dynamics

Pharmaceutical & Medical Equipment is the industry in time t

According to Baron and Kenny, 1986; Aiken and West, 1991) approach, the predictor and the moderator had significant outcome and also the model in general (R^2). The main effect and the interaction term in model two had significant influence. Hence it was established that Pharmaceutical & Medical Equipment moderated the relationship between EPOD and non-financial performance of manufacturing firms in Kenya.

The relationship between EPOD and financial, non-financial and overall performance was subjected to moderation test using plastic and rubber industry. Table 5.14[a], Table 5.14[b] and Table 5.14[c] in (Appendix iv) revealed that there was no moderation effect. In addition, the study also interrogated the extent to which Textile and Apparel industry moderated the EPOD to performance link. The results were presented as per Table 5.15[a], 5.15[b] and 5.15[c] as indicated in (Appendix iv). Again it was established that moderation did not occur.

Lastly, moderation effect analysis for Timber Wood and Furniture on the relationship between EPOD and the three perspectives of firm performance was undertaken. There was no moderation effect as per the results presented in Table 5.16[a], 5.16[b] and 5.16[c] as indicated in (Appendix iv).

Case (b); Capital structure

Moderation results for financial perspective was as follows;

Table 5.17: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Capital Structure

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.256[a]	.065	.036	.10497	.065	2.240	2	64	.115
2	.303[b]	.092	.049	.10429	.026	1.830	1	63	.181

a. Predictors: (Constant), CS, EPOD
b. Predictors: (Constant), CS, EPOD, CS*EPOD
c. Dependent Variable: FIN

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.049	2	.025	2.240	.115[b]
	Residual	.705	64	.011		
	Total	.755	66			
2	Regression	.069	3	.023	2.123	.106[c]
	Residual	.685	63	.011		
	Total	.755	66			

a. Dependent Variable: FIN
b. Predictors: (Constant), CS, EPOD
c. Predictors: (Constant), CS, EPOD, CS*EPOD

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.146	.013		11.418	.000
	EPOD	-.058	.033	-.210	-1.741	.087
	CS	-.074	.063	-.142	-1.173	.245
2	(Constant)	.147	.013		11.518	.000
	EPOD	-.056	.033	-.205	-1.704	.093
	CS	-.038	.068	-.074	-.564	.575
	CS*EPOD	-.264	.195	-.176	-1.353	.181

a. Dependent Variable: FIN

From Table 5.17 it was depicted that no moderation effect that was inferred. A further moderation effect test for non-financial performance perspective was undertaken as Table 5.18 as follows;

Table 5.18: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Capital Structure

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.127[a]	.016	-.015	.15210	.016	.523	2	64	.595
2	.130[b]	.017	-.030	.15325	.001	.045	1	63	.832

a. Predictors: (Constant), CS, EPOD

b. Predictors: (Constant), CS, EPOD, CS*EPOD

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.024	2	.012	.523	.595[b]
	Residual	1.481	64	.023		
	Total	1.505	66			
2	Regression	.025	3	.008	.359	.783[c]
	Residual	1.479	63	.023		
	Total	1.505	66			

a. Dependent Variable: NFIN

b. Predictors: (Constant), CS, EPOD

c. Predictors: (Constant), CS, EPOD, CS*EPOD

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.681	.110		6.177	.000
	EPOD	-.032	.048	-.081	-.656	.514
	CS	.072	.091	.099	.796	.429
2	(Constant)	.743	.314		2.364	.021
	EPOD	-.060	.140	-.154	-.425	.672
	CS_	-.064	.648	-.088	-.100	.921
	CS*EPOD	.061	.287	.203	.213	.832

a. Dependent Variable: NFIN

From Table 5.18 it was depicted that no moderation effect that was inferred for interaction term did not statistically significantly influence non-financial performance. Results for overall performance perspective as per Table 5.19 was as follows;

Table 5.19: Results of Hypothesis Testing of EPOD and Performance as Moderated by Capital Structure

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.182[a]	.033	.003	.09713	.033	1.092	2	64	.342
2	.194[b]	.038	-.008	.09767	.005	.295	1	63	.589

a. Predictors: (Constant), CS, EPOD
b. Predictors: (Constant), CS, EPOD, CS*EPOD
c. Dependent Variable: PER

ANOVA

Model		Sum of Squares	df.	Mean Square	F	Sig.
1	Regression	.021	2	.010	1.092	.342[b]
	Residual	.604	64	.009		
	Total	.624	66			
2	Regression	.023	3	.008	.818	.489[c]
	Residual	.601	63	.010		
	Total	.624	66			

a. Dependent Variable: PER
b. Predictors: (Constant), CS, EPOD
c. Predictors: (Constant), CS, EPOD, CS*EPOD

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.396	.012		33.369	.000
	EPOD	-.045	.031	-.181	-1.476	.145
	CS	-.003	.058	-.005	-.043	.966
2	(Constant)	.396	.012		33.188	.000
	EPOD	-.045	.031	-.179	-1.448	.153
	CS	.011	.063	.023	.171	.865
	CS*EPOD	-.099	.183	-.073	-.543	.589

a. Dependent Variable: PER

From Table 5.19 it was depicted that no moderation effect that was inferred. Therefore, the empirical results obtained from Table 5.6 to Table 5.19 portrays that both industry and capital structure did not moderate the association between electric power outage dynamics and performance of the firms engaging in manufacturing activities in Kenya and therefore the study failed to throwaway the null hypothesis which states that; the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly moderated by firm characteristics.

5.5 Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Firm Performance

The fourth specific objective was to assess the joint relationship amongst electric power outage dynamics, investment in back up generation and firm characteristics on the performance of manufacturing firms in Kenya. The corresponding null hypothesis was as stated as:

H_{04}: The joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance of manufacturing firms in Kenya is not significant.

On testing the above hypothesis, the following were the results based on the three firm performance perspective

i) Non-financial perspective;

The empirical results were presented in Table 5.20 as follows

Table 5.20: Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Non-Financial Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.466[a]	.217	-.057	11.202276

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

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	694.363	7	99.195	.790	.604[b]
1	Residual	2509.820	20	125.491		
	Total	3204.183	27			

a. Dependent Variable: NFIN

b. Predictors: (Constant), OF, ON, OD, TO, INVEST, CAPA, CS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	62.419	20.533		3.040	.006
	OF	2.044	2.590	.164	.789	.439
	OD	-3.139	2.777	-.240	-1.130	.272
	ON	-2.475	3.060	-.227	-.809	.428
	TO	3.284	7.672	.089	.428	.673
	CAPA	2.724	3.643	.208	.748	.463
	INVEST	.018	.283	.015	.065	.949
	CS	.001	.001	.279	1.208	.241

a. Dependent Variable: NFIN

The joint relationship amongst electric power outage dynamics four components, investment in backup generation and firm characteristics on non-financial performance of manufacturing firms in Kenya as per Table 5.20 resulted to F with a value of .790(p=.604) which did not show any statistically significant results. Hence the model was not appropriate to estimate non-financial performance of Kenya based firms dealing with manufacturing activities at 95% confidence level. Further best of fit test was undertaken pertaining R^2 and the slope (β).

In the case of Adj. R^2, it had a value of -.057 which implies that all the predictor variables, namely; OF, OD, ON and TO (EPOD), CAPA, INVEST (IBUG), and firm characteristics entailing capital structure and industry, taken together did not explain the variance in non-financial performance of manufacturing firms in Kenya. Test of the slope depicted that; a unit alteration in power outage frequency resulted to .164 unit variation in the organizational performance (non-financial performance) which was direct and lacked statistical significance with (p=.439). A further unit change in power outage duration (OD), translated into an inverse change of .240 of non-financial performance aspect of the manufacturing firms in Kenya which was not statistically significant with a (p=.272). For power outage notification, a unit change resulted into -.227 unit change in non-financial performance with p=.428 which implied that the relationship was not statistically significant. Also a unit change in time of power outage resulted to .089 unit alteration of non-financial performance. This change was not statistically significant for the p value was (.673).

For the case of IBUG, a unit conversion in CAPA resulted to .208 unit modification in non-performance which was positive and was lacking statistical significance with (p=.463). Also, a unit change in INVEST resulted to .015 unit change in non-financial performance aspect of the manufacturing firms in Kenya which was not statistically significant with (p-value of .949). On the other hand, a unit variation in capital structure (CS) resulted to .279 unit adjustment in non-financial performance although it lacked statistical significance with (p=.241).

For financial perspective, the empirical results were presented in Table 5.21 as follows;

Table 5.21: Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Financial Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.455[a]	.207	-.046	14.74701799

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

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1246.834	7	178.119	.819	.582[b]
	Residual	4784.440	22	217.475		
	Total	6031.274	29			

a. Dependent Variable: FIN

b. Predictors: (Constant),OF, ON, OD, TO, INVEST, CAPA, CS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-8.924	25.705		-.347	.732
	OF	-2.428	3.394	-.145	-.716	.482
	OD	1.072	3.551	.061	.302	.766
	ON	2.689	3.982	.181	.675	.506
	TO	-1.607	9.343	-.034	-.172	.865
	CAPA	4.261	4.767	.238	.894	.381
	INVEST	.202	.365	.117	.552	.586
	CS	-.001	.001	-.246	-1.147	.264

a. Dependent Variable: FIN

The joint association among electric power outage dynamics four constituents, investment in backup generation and firm characteristics on financial performance of manufacturing firms in Kenya as per Table 5.21 gave rise to F with a value of .790(p=.819) which did not show any statistically significant results. Hence the model was not suitable to appraise financial performance of Kenya based firms dealing with manufacturing activities at 95% confidence level. Further best of fit test was undertaken pertaining R^2 and the slope (β).

In the case of Adj. R^2, it had a value of -.046 which implies that all the predictor variables, namely; OF, OD, ON and TO (EPOD), CAPA, INVEST (IBUG), and firm characteristics entailing capital structure and industry, taken together did not explain the modification in financial performance of manufacturing firms in Kenya. Test of the slope depicted that; a unit alteration in power outage frequency resulted to -.145 unit variation in the organizational performance (financial performance) which was indirect and lacked statistical significance with (p=.482). A further unit change in power outage duration (OD), translated into a direct change of .061 of financial performance aspect of the manufacturing firms in Kenya which was not statistically significant with a (p=.766). For power outage notification, a unit change resulted into .181 unit change in financial performance with p=.506 which implied that the connection was not statistically significant. Also a unit change in time of power outage resulted to -.034 unit alteration of financial performance which was not statistically significant with (p-value of .865).

For the case of IBUG, a unit conversion in CAPA resulted to .238 unit modification in financial performance which was positive although lacking statistical significance with (p=.381). Also, a unit change in INVEST resulted to .117 unit change in financial performance aspect of the manufacturing firms in Kenya which was not statistically significant with (p-value of .586). On the other hand, a unit deviation in capital structure (CS) resulted to .246 unit adjustment in financial performance which was negative although it lacked statistical significance with (p=.264).

The total Performance perspective results were also presented as per Table 5.22 as follows;

Table 5.22: Electric Power Outage Dynamics, Investment in Back up Generation, Firm Characteristics and Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.383[a]	.147	-.152	10.63471758

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

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	388.397	7	55.485	.491	.830[b]
	Residual	2261.944	20	113.097		
	Total	2650.341	27			

a. Dependent Variable: PER

b. Predictors: (Constant), OF, ON, OD, TO, INVEST, CAPA, CS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	51.619	19.492		2.648	.015
	OF	1.252	2.459	.111	.509	.616
	OD	-2.549	2.637	-.214	-.967	.345
	ON	-1.541	2.905	-.155	-.531	.602
	TO	2.100	7.284	.062	.288	.776
	CAPA	2.939	3.459	.247	.850	.406
	INVEST	.050	.269	.043	.185	.855
	CS	.001	.001	.189	.783	.443

a. Dependent Variable: PER

The joint relationship among electric power outage dynamics four parts, investment in backup generation and firm characteristics on financial performance of manufacturing firms in Kenya as per Table 5.22 gave rise to F with a value of .491(p=.830) which did not show any statistically significant results. Hence the model was not suitable to evaluate performance of Kenya based firms dealing with manufacturing activities at 95% confidence level. Further best of fit test was undertaken pertaining R^2 and the slope (β).

In the case of Adj. R^2, it had a value of -.152 which implies that all the predictor variables, namely; OF, OD, ON and TO (EPOD), CAPA, INVEST (IBUG), and firm characteristics entailing capital structure and industry, taken together did not explain change in performance of manufacturing firms in Kenya. Test of the slope depicted that; a unit variation in power outage frequency resulted to .111 unit variation in the organizational performance (overall performance) which was direct and lacked statistical significance with (p=.616). Also a unit change in power outage duration (ON), translated into an indirect change of .214 of the overall performance aspect of the manufacturing firms in Kenya which was not statistically significant with a (p=.345). For power outage notification, a unit change resulted into -.155 unit change in performance with (p=.602) which implied that the connection was not statistically significant. In addition, a unit change in time of power outage resulted to .062 unit alteration of performance which was not statistically significant with (p-value of .776).

Further, one unit conversion in CAPA resulted to .247 unit modification in performance which was positive although lacking statistical significance with (p=.406). Also, a unit change in IVEST resulted to .043 unit change in performance aspect of the manufacturing firms in Kenya which was not statistically significant with (p-value of .855). On the other hand, a unit deviance in capital structure (CS) resulted to .189 unit adjustment in performance which was positive although it lacked statistical significance with (p=.443).

5.6 Discussion of the Findings

The findings of the current study were anchored on hypotheses which were subjected to significance testing as portrayed in chapter four. A comparison between the tests in the current study and past literature for both theoretical and empirical contexts was undertaken so as to demonstrate resultant parities and disparities for both. This introductory assessment gave an impetus to discuss the related conceptual, empirical and theoretical viewpoints based on existing theories relevant to this study. The discussions were anchored on the four objectives highlighted in the study as indicated in Table 5.23.

Table 5.23: Summary of Research Objectives, Hypotheses, Analytical Methods and Interpretation of Results

Objective	Hypothesis	Results	Inference
i) To establish the influence of electric power outage dynamics on performance of manufacturing firms in Kenya	**H_{01}:** The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significant.	The results portrayed statistically significant link between EPOD (ie outage frequency) and firm performance for OF had a p-value of less than the critical value 0.05. the rest of EPOD components did not imply significant link	From the results, H_{01} was rejected implying that there was statistical significance between EPOD (ie outage frequency)-firm performance correlation.The estimation equation is: FIN= .180– .332OF+ .061OD + .032ON +.008TO
ii)To assess the effect of investment in back up generation on the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya	**H_{02}:** The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in back up generation.	IBUG had intervening effect on the relationship between electric power outage dynamics (outage frequency) and firm performance. For capacity met the Baron and Kenny (1986) three step condition with $p<.05$ although investment did not fully meet the same condition.	According to this research finding, H_{02} was rejected implying that there was a statistical significance intervening effect of IBUG on the relationship between electric power outage dynamics (outage frequency) and firm performance. FIN= .108-.293OF+.257CAPA
iii) To determine the effect of firm characteristics on the relationship between electric power outage	**H_{03}:** The relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not	Firm characteristics (ie industry and capital structure) had no moderating effect on the correlation between EPOD and firm	This study finding failed to reject the H_{03} for there was no interaction term effects on the association between electric power outage dynamics and firm performance.

dynamics and performance of manufacturing firms in Kenya	significantly moderated by firm characteristics.	performance. For the moderating conditions of Baron & Kenny (1986) and Aiken & West (1991) were not met	
iv)To assess the joint relationship amongst electric power outage dynamics, investment in back up generation and firm characteristics on the performance of manufacturing firms in Kenya	**H_{04}:** The joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance of manufacturing firms in Kenya is not significant.	There was no statistically significant ($p>0.05$) joint effect amongst EPOD, IBUG and FC on firm performance	This research finding implied that there was no statistically significant joint effect of electric power outage dynamics, IBUG and firm characteristics on performance of manufacturing firms hence failed to reject the $H_{04.}$

Source, Author: 2019

The first specific objective was to establish the influence of electric power outage dynamics on performance of Kenyan firms undertaking manufacturing affiliated activities. The study considered the three mainstream aspects of organizational performance, namely; non-financial performance, financial performance and the total performance. This study hypothesized that the relationship between electric power outage dynamics and performance of firms in the manufacturing industry in Kenya is not significant. The study relied on multiple regression models to test the level of significant influence electric power outage had on firm performance. It was exposed that electric power outage dynamics in all its aspects had no significant influence to non-financial perspective. For financial perspective, only power outage frequency portrayed a statistically significant inverse relationship whereas, for the overall performance, all aspects of electric power outage dynamics did not have any statistically significant influence according to Table 5.23

Although the majority of the components of electric power outage dynamics did not portray statistically significant influence, power outage frequency portrayed statistically significant impact to financial performance perspective. Hence this study failed to accept the null hypothesis which states that the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significant. Therefore, the alternative hypothesis was adopted that states that electric power outage dynamics significantly influenced financial performance as far as power outage frequency is concerned. This implies that outage frequencies adversely influenced financial performance and in turn would have an impact on the overall performance. In order to address this concern, power utilities should address reliability in order to ensure sustained power supply to manufacturing firms. This can be achieved through efficient management of maintenance schedules of power generation plants by power generators, construction of redundancies in transmission and distribution systems that serve manufacturing firms and ensuring efficient maintenance of power distribution systems at all times.

On the power demand side, manufacturing firms may adopt alternative input strategies by purchasing of processed raw materials for sections of energy intensive production processes. The manufacturers may also establish efficient communication exchange on power outage programmes (where known by utility) and schedule production processes to periods when power outages were not likely to be experienced (no/minimal power outage frequency). This would enhance uninterrupted production, resulting in good financial performance.

Several past studies are in support of this outcome; for instance, the study of Frederick and Selase, (2014) analyzed the influence of electric power variation on the profitability and competitive edge of medium firms for sustenance of Ghana's middle income status. It was established that Ghanaian based enterprises faced challenges caused by electric power shortages which translated to a decline in productivity and product quality levels respectively, which further influenced performance in an adverse manner. Hence the correlation between power outage and organizational performance had an inverse link. Mensah (2016) sought to interrogate the influence of power outages on performance of the firms and assessed the effect of self-generation in minimizing the impact of outages. The study posited that electric power outage has negative impact on firm revenues and productivity and therefore on the overall performance.

Contrary to the studies of Frederick and Selase (2014) and Mensah (2016), other studies revealed dissimilar results on this relationship between power outage and firm performance for they established a positive link. Such that as power outage occurs, productivity and profitability of the firm increases. This was due to greater efficiencies adopted by firms as in order to close the production gaps that occurred due to power outages. For instance, in the study of Fisher-Vanden, Mansur and Wang (2015), it was established that enterprises in China responded to power shortage during the early 2000s by undertaking self-generation of electricity, which resulted in 8% increase in cost of production. To further improve productivity, the Chinese firms opted to purchase intermediate goods that they used to produce directly, or to improve their technical efficiency. The affected firms preferred to buy than to manufacture raw materials needed for production.

In another study by Quarshie, Agyeman, and Bonn, (2017) on the extent to which power outages impacted on productivity of designated industrial firms listed at the Ghanaian stock bourse, it was discovered that ROE (Return on Equity) in power outage and no-power outage years had no significant difference, implying that power outage did not affect ROE of manufacturing firms. On the other hand, power outage had effect on asset management ratio or asset turnover ratio of manufacturing firms in that Return on Asset (ROA) ratio of manufacturing firms was higher in no-power outage periods than during power outage periods. The paper concluded that power outages in the short run, did not explain much of the gap in productivity, but also noted that manufacturing firms may be affected by power outages in the long run.

The study further aimed at assessing the intermediating effect of investment in backup generation on the link between electric power outage dynamics and performance of firms engaged in manufacturing activities in Kenya. To achieve this second objective, power outage frequency which is a component of EPOD was considered for it had statistical significant influence on the financial performance aspect of firms undertaking manufacturing activities in Kenya. The corresponding null hypothesis stated that the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in backup generation.

According to Table 5.4^{c}, it was portrayed that capacity intervened the relationship between electric power outage dynamics (ie power outage frequency) and financial performance of firms engaged in manufacturing operations in Kenya. This results are further backed by the argument of James and Brett (1984), that the coefficient change between OF and CAPA of as far as explaining change in financial performance was sufficiently large for statistical decision making even though in step two the OF did not significantly influence capacity as the dependent variable. Whereas, investment, did not intervene the relationship between electric power outage dynamics (ie power outage frequency) and financial performance of firms engaged in manufacturing operations in Kenya. Since capacity portrayed intervening effect to the relationship between electric power outage dynamics (ie power outage frequency) unlike investment which did not, it was ruled that IBUG intervened the relationship. Therefore, the study rejected the second null hypothesis (H_{02}) which stated that; the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly mediated by investment in backup generation.

The intervening effect of capacity unlike investment whereby both are components of IBUG shows that the decision on financial performance is not only boosted by a firm investing heavily in acquisition of generators but the capacity thereof determines the level of productivity and profitability during the times of power outages. Therefore, as the management endeavor in mitigating power outage interruptions, the key area of focus should be on the capacity of the generator and not the amount of expenditure channeled to self-generation.

The intervening effect of IBUG (capacity) was in tandem with other several past studies supporting this study results. For instance, Ado and Josiah (2015) study evaluated the firm's proportion of investment in back up facility as a percentage of total investment. It was established that the majority of medium sized firms invested their financial resources to supplement the public provided but inadequate power source in the area. This led to investments of large financial resources for backup generation in order to mitigate losses as a result of the power outages. This action highly mitigated losses from outages. In a similar study by Reinikka and Stevesson (2002) firms devised mechanisms when faced with deficient public capital (services and infrastructure) to generate their own power by investing in complementary capital such as generators.

The aforementioned studies were in support of investment in self-generation being an intervening factor in the correlation between power outage and organizational performance. Contrary to those studies, other studies reported research findings which were against the current study results. For instance Adebayo, (2012) in his study established that most of the manufacturing firms in Nigeria operated below capacity because of unstable power supply, high cost of self-generation of power and high labor operation costs. Also, Olayemi, (2012) also employed both contemporary and old-fashioned philosophies of cost to interrogate the impression of energy catastrophe on production efficiency of industrial sector based firms in Nigeria whereby time series data was used which represented the time period between 1980 and 2008. The multiple regressions analysis results showed that utilization of generators and electric power supply had an adverse effect on output growth of manufacturing allied organizations in that sector, though he noticed without thorough investigation that there might be a significant different between electricity generation and supply from public grid.

The third specific objective aimed at determining the effect of business features (ie firm characteristics) on the connection between electric power outage dynamics and manufacturing oriented firms in Kenya. This study hypothesized that the electric power outage dynamics to performance linkage of manufacturing oriented firms in Kenya is not significantly moderated by firm characteristics. To test the third null hypothesis, a two-step stepwise multiple regression process was carried out. It should be noted that Electric Power Outage Dynamics (EPOD) composite score was used as the independent variable and the firm characteristics elements used were industry and capital structure.

From Table 5.6[a] and 5.19, the two components of firm characteristics namely; industry and capital structure did not depict moderation effect on the relationship between electric power outage dynamics and performance of manufacturing oriented firms in Kenya. In conclusion, the current study failed to reject the third null hypothesis (H_{03}) which stated that; the relationship between electric power outage dynamics and performance of manufacturing firms in Kenya is not significantly moderated by firm characteristics. This is because the two components of firm characteristics did not portrayed statistically significant moderating effects between electric power outage dynamics and performance of manufacturing firms except the case of pharmaceutical and Medical Equipment which portrayed statistically significant outcome. The research findings portrayed that top management should not focus on capital structure and industry classification as conditional factors when making decisions aiming at enhancing firm performance. Also, capital structure and industry classification does not significantly contribute towards mitigation of electric power outages which apparently seems to be a national disaster and uncontrollable.

In connection to the current research findings, past studies portrayed both similar dissimilar report pertaining the same subject of study. The studies in support include that of Too and Simiyu (2018) who investigated the influence of firm characteristics on financial performance of insurance firms listed at the Nairobi securities bourse. It was revealed that capital structure and firm age had a direct and statistically significant impact on the insurance companies' financial performance in Kenya. Also, according to the finding of Kisengo and Kombo, (2014), characteristics of the firms had direct effect on performance of micro finance institutions which was statistically significant. Structure related characteristics had the greatest while capital related had the least effect on performance of microfinances

Further, in the study of Saeedi and Mahmoodi (2011) the aim was to interrogate the link between capital structure and performance of firm listed at Tehran Stock Exchange. The study findings portrayed that capital structure- performance correlation was direct. While, on the other hand, Return on Asset (ROA) was positively related to capital structure as it was in the case of Kisenge (2012). For the case of ROE, there was no statistically significant association with capital structure unlike the case of ROA. Therefore, as per the Saeedi and Mahmoodi (2011) study, it shows that financial leverage may affect different measures of performance in different ways. In another study by Oladele, Omotunde and Adeniyi (2017), it was established that no statistical significant association that exist between capital structure return on equity linkage. But in the case of return of assets, earnings per share (EPS) and sales growth of listed manufacturing firms in Nigeria, it was portrayed that a statistically significant association prevailed. Therefore, the Nigerian based management listed manufacturing oriented firms were guided on how to make use of optimality concept of debt/equity quotient so as to enhance productivity through propelled returns on equity, assets and earnings per share.

The fourth specific aim of the current study was to assess the combined connection amongst electric power outage dynamics, investment in back up generation and firm characteristics on the performance of manufacturing oriented organizations in Kenya. The corresponding null hypothesis was as stated as the joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance of manufacturing firms in Kenya is not significant. According to multiple regression analysis results, (see Table 5.20 to Table 5.22), the joint relationship amongst electric power outage dynamics, investment in backup generation and firm characteristics on all the three performance aspects of manufacturing oriented organizations in Kenya resulted to statistically insignificant influence. Therefore this study failed to reject the fourth null hypothesis (H_{04}) which stated that the joint effect of electric power outage dynamics, investment in back up generation and firm characteristics on performance of manufacturing firms in Kenya is not significant.

Past studies demonstrated insignificant results to firm performance, be it non-financial, financial or the total performance of an organization. For instance, the study of Mensah (2016) investigated the impact of power outages on business performance and further assessed the influence of self-generation in minimizing the impact of outages. 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 established that electric power outage had negative impact on firm revenues and productivity and therefore on the same thing applied on the overall performance of companies. Also, the study further concluded that contrary to expectations that self-generation during outage periods may improve the adverse influences of electric power outages on firm performance, reliance on self-generation may have long run inverse impression on firm productivity.

In addition, both Reinikka and Stevesson (2002) evaluated the effect of poor public capital on firms. The study revealed that on average, the surveyed firms failed to get electric power originating from the national network, for eighty nine (89) days in a year, which prompted most of the organizations to invest more in backup power generator facilities whose cost represented an average of 16 percent of the entire investment worth. Whereas, another 25 percent of the company budget was channeled to other investment opportunities such as equipment and machinery. It was also portrayed through the data that running a private power generator cost three times more than cost of power from the national grid. Costs accounting for such expenditure entailed damages from direct raw materials, apparatus degeneration and loss of creative labour time and lost turnover income, production interruptions, declined profitability levels and administration courtesy amongst others issues. The result of investment in backup generation came at a cost of reduced overall investment and less productive capital. 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.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter highlights a summary of findings as well as conclusions and recommendations and areas of further research. In addition, the chapter points out the inferences of the research findings to knowledge, theory and managerial policies and practices. Finally, the chapter brings forth limitations of the research and suggestions for further research.

6.2 Summary of Findings

The section outlines research outcomes drawn from the specific objectives of this study. This study focused on firms drawn from membership of the Kenya Association of Manufacturers that are engaged in manufacturing activities in Kenya. The general objective was to determine the joint influence of electric power outage dynamics, investment in back up generation and firm characteristics on firm performance; which was presented in three perspectives namely, non-financial, financial and overall performance.

Both theoretical and past empirical literature was reviewed in that order. The theoretical foundations in support of this study were; financial theory of investment, transformation theory, trade-off theory and pecking order theory. In addition, past empirical literature affiliated to this study was reviewed and the research gaps acknowledged which were theoretical, conceptual, contextual and methodological. Past knowledge gaps were summarized in a table format and a conceptual model developed to describe the associations of the variables used in this study.

There are several philosophies in research which guide the acquisition of new knowledge such as positivism, interpretivism and realism (Johnson & Christensen, 2010). This study adopted positivism philosophy, which was found to be more suitable as compared to other theoretical prototypes. Its adoption by this study is based on the argument that, it advocates relying on already existing theories and again, it allows development of hypotheses which observe validity. This philosophical argument made it possible to establish categorical statements emanating from objective evaluation and deductive reasoning in relation to electric power outage dynamics and performance of firms focusing on manufacturing operations in Kenya.

Both primary and secondary data was utilized by this study to generate study information. The data was collected for 138 firms in Kenya that are engaged in manufacturing activities and had membership of KAM between 2014 up to 2018 (ie a period of five years). The information collected related to the four indicators: electric power outage dynamics, represented by power outage frequency, power outage duration, power outage notification and time of power outage; investment in back up generation (ie capacity and investment), firm characteristics which was measured using industry and capital structure and firm performance, modelled in three perspectives, namely; non-financial, financial and overall performance. The study undertook some analysis starting with descriptive, correlational and then regression analysis using SPSS program. Descriptive statistics used were frequency, average score, standard deviance, kurtosis and skewness for all the variables under investigation. Diagnostic test and correlation analysis using Pearson product-moment correlations was also performed.

The study was guided by four specific objectives. The first objective was to establish the effect of electric power outage dynamics on firms' performance. The first hypothesis was used to test this objective. The findings of the research established an inverse association between electric power outage dynamics and performance, which was statistically significant in the case of power outage frequency and financial performance. Contrary, all aspects of electric power outage dynamics had no statistically significant relationship with non-financial and overall performance perspectives. Overall, it was established that the association between electric power outage dynamics and firm performance was significant, hence failed to accept the null hypothesis one (H_{01}).

The second objective was to establish the intervening effect of investment in back up generation on the relationship between electric power outage dynamics and performance. Hypothesis two (H_{02}) was utilized to test this objective. The outcome of this test demonstrated that capacity which was part of IBUG significantly intervened the relationship between electric power outage dynamics and performance. Therefore, this study rejected the null hypothesis two (H_{02}).

The third objective was to establish the moderating effect of firm characteristics on the linkage between electric power outage dynamics and performance. Hypothesis three (H_{03}) was used to test this objective. The research findings supported the hypothesized relationship implying that the relationship between the electric power outage dynamics and performance is not significantly moderated by firm characteristics, thus the null hypothesis three (H_{03}) was accepted.

The fourth objective of the study was to examine the joint effects amongst electric power outage dynamics, IBUG and firm characteristics on performance. Hypothesis four was used to test this objective. The research findings established that the joint link of EPOD, IBUG and FC did not depict statistically significant association with all the three performance perspectives. Therefore, the null hypothesis four (H_{04}) was accepted.

6.3 Conclusions and Recommendations

Research findings related to the four specific objectives and the conforming hypotheses were dissimilar. The research outcome for each hypothesis testing was analyzed and conclusions made as explained. The data analysis outcome depicted that electric power outage dynamics was statistically significant to firm performance. Hence the study rejected H_{01} hypothesis which stated that; the relationship between electric power outage dynamics and performance of industrial firms in Kenya is not significant. This implies that the alternative hypothesis that the relationship between EPOD and performance of organizations associated to manufacturing undertakings in Kenya was significant was adopted. This was evident by the fact that power outage frequency statistically significantly influenced financial performance of manufacturing firms in Kenya. The number of times manufacturing firms experienced power outage, whether with notification or not, adversely affected their level of profitability. This was because any outage frequency experienced denoted electricity supply interruption (denoted by frequency of outage) that brought to a stop major operations in firms. This calls for an improvement of the policies and mechanisms used by power supply utilities in Kenya to sustain the flow of electricity to a critical segment of their customers; manufacturing firms, in order to avoid financial losses to these firms.

The rejection of the second null hypothesis implied a significant mediating effect of investment in backup generation on the relationship between electric power outage dynamics and firm performance for manufacturing firms in Kenya. The level of investment ratio between the values of backup generator to total assets did not significantly mediate this relationship. However, capacity of backup generator to total power capacity requirement in the firm significantly mediated this relationship. This implies that it is important for firms to make optimal decisions on capacity of backup generators so that critical operational activities are not paralyzed in the event of power outage. This provides continuity to the firms' operations and would ameliorate heavy losses leading to significant decline in performance.

The failure to reject the third null hypothesis implied that firm characteristics (capital structure and industry) did not moderate the relationship between electric power outage dynamics and firm performance for manufacturing firms in Kenya. This means that neither the level of capital structure nor industry variation provided differentiation in the negative effect of electric power outages on performance. The performance of firms in all categories of industry were negatively affected by electric power outages and significance in debt or equity levels did also not create a variation in the negative impact of power outages on firm performance.

Failure to reject the fourth null hypothesis implied that the joint relationship amongst electric power outage dynamics, investment in back up generation, firm characteristics and performance of firms was not statistically significant. This means that policy makers in manufacturing firms in Kenya should interrogate all the variables used in this study when determining the effects on firm performance.

6.4 Contributions of the Study

This study has diverse contribution to the body of knowledge in the domain of electric power outage dynamics, investment in backup generation, firm characteristics and firm performance. The theme of this section is to bring to light the study contribution to knowledge, theory, managerial policy and practices.

6.4.1 Contributions to Knowledge

The research findings from this study add new ideas to existing knowledge in four main ways. The study focused on the areas of electric power outage dynamics, investment in back up generation, firm characteristics and firm performance and made the following contributions;

One, this study has provided insights into measurement of both electric power outage dynamics and performance. Some of the controversial debate was on conceptual and methodological approaches in measurement of electric power outage and firm performance. These were dominated by dissimilar indicators which lacked universality amongst scholars as indicated in Mensah (2016), Ado and Josiah (2015), Siddiqui *et al.* (2012). The study has provided information on various features of power outages that provides impetus for analysis of power outage by considering the various characteristics that dominate it, that also affect firms in various ways, instead of the wholesome approach of evaluating the presence or absence of power outage as a single indicator. The study has also provided some acumen in the area of performance management that has largely been biased to measurement of firm performance based on financial perspectives, while ignoring non-financial perspectives that are equally important for a wholesome performance evaluation. The study combined the two perspectives by using the contemporary SBSC framework.

The study has also provided in-depth correlational perspectives between electric power outage dynamics and firm performance. Past literature was bivariate with electric power outage dynamics and firm performance (with consideration of both financial and non-financial perspectives) correlational aspects missing. Contrary, past studies focused on electric power outage as the dependent variable especially where the studies sought to establish the causes of power outages. For instance, Braimah and Amponsah (2012) study focused on determining the causes and effects of frequent and unannounced power blackouts on operations of small industrial firms in Ghana.

The stepwise regression results from this study revealed that electric power outage dynamics statistically significantly influenced firm performance from the perspective of power outage frequency and financial performance with ($p<.05$). An overall conclusion was that the association between electric power outage dynamics and performance of manufacturing firms in Kenya was statistically significant and power outage frequency negatively influenced financial performance. Therefore, the study supported the proposition that electric power outage dynamics (frequency) negatively contributes to financial losses in firms, which calls for the top management of manufacturing firms to ensure implementation of strategies that would mitigate power outages so as to enhance profitability.

Two, this study provided an empirical evidence that back up investment has an intervening effect on the relationship between electric power outage dynamics and performance of organizations of manufacturing kind in Kenya. This study highlights an intervening effect of investment in back up generation on the association between electric power outage dynamics and firm performance. The insight provided by this study highlights that the most critical indicator in back up investment for backstopping negative effect on performance of firm is the capacity of back up equipment (represented by capacity) relative to total power capacity for firm operations and not the ratio of back up investment to total assets (represented by investment). It is therefore important for firms to identify the optimal level of capacity of backup generators to invest in, as underinvestment may not adequately address the power supply shortage during outages, while over-investment of back up capacity may cause un-optimal investment of firm resources, that would require diversion of resources required for other operations to provide for backup generators.

Most past studies focused on the effects of electric power outage dynamics on performance of firms and the strategies adopted to mitigate such challenges. The studies were characterized by bivariate models where by self-generation was treated as a pure predictor of organization's output in addition to power outage. In the study of (Reinikka and Stevesson 2002; Braimah and Amponsah, 2012 & Ado and Josiah, 2015) considered power outage and self-generation as the predictor variables against the various criterion variables they had chosen. In their conclusion, self-generation in times of power outage increased various costs of the firm and hence this cushioning approach by firms did not revert the negative link between power outage and firm performance. Therefore, the use of investment in back up generation as an intervening variable and especially the capacity component in the relationship between electric power outage dynamics and firm performance (and not as a predictor variable as in the case of a bivariate model) provides the management with a more comprehensive explanation as to why consideration of the proportion of investment in self-generation to total firm investment (Reinikka and Stevesson, 2002; Ado and Josiah, 2015; Mensah, 2016) is inappropriate in mitigating power outage effects to the firm that is explainable by considering the capacity of backup generation.

Three, this study established that firm characteristics (ie industry and capital structure) did not statistically significantly moderate the correlation between electric power outage dynamics and firm performance. The current study provided empirical evidence that industry and capital structure has no interaction effect in the linkage between electric power outage dynamics and firm performance. That is, firm characteristics used are more of predictors and not conditional variable, since their presence or absence had no moderation effect on the interaction between power outage and firm performance. This therefore means that neither capital structure nor industry had any influence in the magnitude and direction of the relationship between electric power outage dynamics and performance.

6.4.2 Contributions to Theory

First, this study has provided new impetus to the transformation theory of production, which was propagated by Shephard in 1970. The study has attempted to draw parallels between the theory's major aspects of input, process and output; that are synchronized to a production process. The theory pursues optimization of the whole production process by optimizing singular tasks, supposing that decreasing the costs for individual units such as power outage results in the highest levels of performance. Electricity has been modeled as a major input factor for the production processes of all firms adopted in the study. The study has provided novel empirical foundation by modeling an input factor of production (electric power outage) in varying dynamics within the same study. The output factor of performance has also been modeled in three different dynamics; providing significance to both financial and non-financial measures of performance. The study therefore makes a contribution to the transformation theory through interrogation of the impact of varying characteristics of electric power outage to the production process and resultant performance.

Second, this study examines the effect of investment in back up generation as a mediator in pursuit of minimizing the effect of power outages on performance of firms. Since investments in backup generation equipment comprises of considerable investment of firms' resources and must be undertaken prudently, the investment decision must be based on a cost and benefit evaluation. Unlike other studies that have had singular consideration of back up investment, this study undertook a qualitative and quantitative evaluation of investment in power generation. The qualitative analysis was based on 'capacity of back up equipment', while the quantitative aspect was based on 'ratio of backup investment relative to total asset value'. The quantitative invest decision was thus based on the financial theory of investment and illustrates how firms make investment backup investments considerations.

The tradeoff theory was also empirically reinforced. The research outcome of this study confirmed the suppositions of the theory that for a profit maximizing firm, the capital structure (a component of firm characteristics) maintained by a firm should translate to equal marginal benefits and marginal costs so as to avoid impairment between liquidity and profitability. Therefore, if the top management successfully balances its marginal cost and marginal revenue, then they will only borrow up to the optimal level which will aid in minimizing financial distress costs such as the firm being put under receivership. The findings of this study on the role of firm features (capital structure and industry) consequently adds to the much needed empirical strength to this theory. Again, the contextualization of this study in manufacturing Kenyan firms registered by KAM, widens the scope of applicability and operationalization of the trade-off theory.

The pecking order theory proposes that firms adopt the use of the cheapest sources of finance before opting for the costly alternative. Therefore, an organization will utilize retained earnings first before borrowing externally and once these two options are exhausted, it will go for new issuance. This helps firms to minimize its information asymmetry costs. As per this supposition, capital structure optimality is irrelevant and firms will adopt the option of finance source that is economical. The study findings in this study established that firm characteristics had no moderating effect on the correlation between EPOD and performance. That is, both industry and a firm's capital structure were not conditional variables and the diverse costs involved in accessing investment financing should be well guided by the pecking order theory.

6.4.3 Contributions to Managerial Policy and Practices

Diverse categories of stakeholders shall benefit from the research findings of this study. These include investors, managers, regulators and the Government. The study will contribute to formulation and implementation of power policy in Kenya. Policy makers benefit in understanding the effect of poor quality of power supply on the performance of firms and are therefore guided in overseeing planning and implementation of proper infrastructure that will eliminate inefficiencies in power supply such as is experienced during power outages. In addition, the study also provides power utilities information that will aid their investment in adequate infrastructure and enhanced maintenance towards efficient power supply to firms at all times. This study also provided the electricty and petroleum sector regulatory body that is the Energy and Petroleum Regulatory Authority

(EPRA) information that should enhance protection of power consumers, more so manufacturing firms, for whom power outages have negative effects on performance. The regulator could put in place punitive mechanisms to power utilities when power outages are experienced due to their acts or omissions. This should work to minimize power outages and resultant effects on consumers. The Energy Act, 2019 contains good provisions towards protection of consumers against resultant effects of poor quality of electricity of power outages, subsidiary legislation (regulations) should stipulate practical means of bringing effect to the law, in order to protect the consumers.

Manufacturing has been identified as a key sector towards economic development of Kenya. The Vision 2030 envisions the transformation of the country from a developing to a middle-income country by 2030. The implementation of the Vision is based on three key pillars; economic, social and political. The greatest contributor to the economic pillar is expected to be the manufacturing sector. In addition, the economic agenda of President Uhuru Kenyatta's second term is based on the Big 4 Agenda that identified four sectors of the Kenya economy for prioritization and enhanced facilitation in order to transform the economy. These sectors are manufacturing, universal health care, food security and affordable housing. As clearly stipulated by Government policies, the manufacturing sector is a critical segment for the country's attainment of economic growth. Its success must therefore be guarded in every sense through adequate facilitation for business and provision of adequate infrastructure. Electric power is a key input factor for most manufacturing processes. Its efficient delivery will therefore ensure that performance is not affected by inadequacy in supply.

The causality relationship between electric power outage dynamics and firm performance as documented in the current study aids management in manufacturing firms to implement realistic investment policies to safeguard operations during power outage events. Decisions reagrding investment or access to back up generation facility should also be optimally made so as to ensure that power backup capacity decision is optimal with respect to firms operations. Adequate backup capacity should be provided if meaningful backstopping of negative effects of power outage on firm performance will be achieved. The investment decision as demonstrated in this study, must also be guided by the evaluation of benefits and associated costs.

This study guides policy makers of manufacturing firms on the approach to adopt when financing investment in backup generation. As per the two theories, namely; trade-off and pecking order theory, the top management need to establish capital structure policies that are not harmful to the organization by ensuring that there exists a balance between marginal benefits and marginal cost associated with financing terms and conditions. On the same breath, the pecking order theory guides top management in firms to adopt financing strategies that enhance the capital structure optimality state which, in turn aids in maximization of firm performance levels.

6.5 Limitations of the Study

This study was faced by several limitations but the researcher ensured that such limitations were minimized to circumvent major effects to the study outcomes. One of the limitations was on proxies used to estimate the study variables. Dissimilar methodologies were used by the past studies to measure the similar variables as used in this study which would result to different interpretation of the results. This study undertook operationalization of the variables to iron out those diversities. This objective was achieved by using methodologies that are in tandem with the study purposes. Therefore, the study was limited to those proxies that were authentic and suitable.

Similar studies used diverse research methodologies which resulted to dissimilar outcomes. Past studies used simple regression and multiple regression models which provided results that were contradicting. The current study was limited to stepwise and multiple regression approaches which were suitable to address the four specific objectives.

This study was focused on manufacturing firms registered under KAM, hence the contextual gap emanating from global, regional and local perspectives of manufacturing firms with no affiliation in membership with KAM has not been fully realized.

6.6 Suggestions for Further Research

The current study concluded that, there is a causality relationship between electric power outage dynamics and firm performance and investment in backup generation intervenes that aforementioned relationship. However, there are a number of future research opportunities based on the findings of this study.

This study considered only manufacturing firms in Kenya that are members of KAM. Future research could explore a similar study for all manufacturing firms in Kenya. A comparison between results of the two studies could present interesting perspectives.

This study adopted firm characteristics (capital structure and industry) as the moderating variable. The outcome of the analysis indicated that the moderating effect was not significant. Future research could explore other indicators for moderation between electric power outage dynamics and firm performance.

Further research is necessary to determine whether there are other more intervening and moderating variables which may significantly intervene or moderate the relationship between electric power outage dynamics indicators and the three firm performance perspectives of manufacturing firms in Kenya. In addition, other future studies may deliberate other non-financial performance indicators other than customer focus, operations efficiency, employee productivity, green performance and social responsibility so as to establish whether the general outcome would be similar or otherwise.

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APPENDICES

Appendix i: Manufacturing Firms in Kenya

Company	Location	Company	Location
Building, Mining & Construction (17)			
Bamburi Cement Limited	Athi River	Kurawa Industries Ltd	Mombasa
Boyama Building Materials	Nairobi	Malindi Saltworks Ltd	Mombasa
Glenn Investments Ltd	Nairobi	Mombasa Cement Ltd	Athi River
Homa Lime Co. Ltd	Koru	Orbit Enterprises Ltd	Nairobi
Kay Salt Ltd	Mombasa	Reliable Concrete Works Ltd	Nakuru
Kenbro Industries Ltd	Nairobi	Tana River Quarrying Ltd	Nairobi
Kenya Builders & Concrete Ltd	Nairobi	Tile & Carpet Centre	Nairobi
Kisumu Concrete Products	Kisumu	Vallem Construction Ltd	Thika
Krystalline Salt Ltd	Mombasa		
Chemical & Allied (47)			
Beiersdorf East Africa Ltd	Nairobi	PolyChem East Africa Ltd	Nairobi
Blue Ring Products Ltd	Nairobi	Procter & Gamble East Africa Ltd	Nairobi
BOC Kenya Limited	Nairobi	Protea Chemicals Kenya Ltd	Nairobi
Buyline Industries Ltd	Nairobi	Pyrethrum Board of Kenya	Nakuru
Carbacid (CO2) Limited	Nairobi	PZ Cussons EA Ltd	Nairobi
Central Glass Industries Ltd	Nairobi	Reckitt Benckiser (E.A.) Ltd	Nairobi
Chryso Eastern Africa Limited	Nairobi	Revolution Stores Ltd	Nairobi
Decase Chemicals (Ltd)	Nairobi	Rok Industries Ltd	Nairobi
Deluxe Inks Ltd	Nairobi	Rumorth EA Ltd	Nairobi
Desbro Kenya Limited	Nairobi	Sadolin Paints (E.A.) Ltd	Nairobi
Galaxy Paints & Coating Co. Ltd	Nairobi	Sanergy Ltd	Nairobi
Henkel Polymer Company Ltd	Nairobi	SC Johnson and Son Kenya	Nairobi
Kel Chemicals Limited	Nairobi	Seweco Paints Ltd	Nairobi
Kemia International Ltd	Nairobi	Style Industries ltd	Nairobi
Kip Melamine Co. Ltd	Nairobi	Super foam ltd	Ruiru
L'Oreal East AfricaLtd	Nairobi	Syngenta East Africa Ltd	Nairobi
Maroo Polymers Ltd	Nairobi	Synresins Ltd	Nairobi
MEA Limited	Nairobi	Tata Chemicals Magadi Ltd	Magadi
Milly Glass Works Ltd	Mombasa	Tri-Clover Industries (K) Ltd	Nairobi
Murphy Chemicals (E.A) (Ltd	Nairobi	Tropikal Brand (Afrika) Ltd	Nairobi
Norbrook Kenya Limited	Nairobi	Twiga Chemical Industries Limited	Nairobi
Odex Chemicals Ltd	Nairobi	Unilever Kenya Ltd	Nairobi
Osho Chemicals Industries Ltd	Nairobi	Westminister Paints & Resins Ltd	Nairobi
Pan Africa Chemicals Ltd	Eldoret		
Energy, Electrical & Electronics (30)			
Aquila Development Co. Ltd	Nairobi	Optimum Lubricants Ltd	Nairobi

Aucma Digital Technology africa Ltd	Nairobi	Patronics Services Limited	Nairobi
Avery (East Africa) Ltd	Nairobi	PCTL Automation Ltd	Nairobi
Burn Manufacturing USA LLC	Ruiru	Pentagon Agencies	Nairobi
East African Cables Ltd	Nairobi	Philips East Africa Limited	Nairobi
Holman Brothers (E.A) Ltd	Nairobi	Powerex Lubricants Limited	Nairobi
Kenwest Cables Ltd	Nairobi	Protel Studios	Nairobi
Libya Oil Kenya Limited.	Nairobi	Schneider Electric Ltd	Nairobi
Manufacturers & Suppliers (K) Ltd	Nairobi	Sloimppexs Africa Limited	Nairobi
Marshall Fowler (Engineers) Ltd	Nairobi	Solimpexs Africa Limited	Nairobi
Metlex International Ltd	Nairobi	Solinc East Africa Limited	Naivasha
Metsec Cables Ltd	Nairobi	Sollatek Electronics (Kenya) Limited	Mombasa
Mustek East Africa	Nairobi	Specialised Power Systems Ltd	Nairobi
Nationwide Electrical Industries Ltd	Nairobi	Synergy-Pro	Nairobi
Oilzone (East Africa)	Nairobi	Vivo Energy	Nairobi
Food & Beverages (119)			
Africa Spirits Ltd	Nairobi	Kwale International Company Limited	Kwale
Afrimac Nut Company	Nairobi	Kwality Candies & Sweets Ltd	Nairobi
Agricultural & Veterinary Supplies Ltd	Eldoret	Mafuko Industries Ltd	Meru
Agro Chemical & Food Company Ltd	Muhoroni	Mama Millers Limited	Thika
Alliance One Tobacco Kenya Ltd	Nairobi	Manji Food Industries Ltd	Nairobi
Alpha Fine Foods Ltd	Nairobi	Mastermind Tobacco (K) Ltd	Nairobi
Alpha Grain Millers Limited	Nairobi	Megatech Limited	Nairobi
Alpine Coolers Ltd	Nairobi	Melvin Marsh International	Nairobi
Aviano East Africa	Nairobi	Meru Greens Horticulture Ltd	Meru
Bakex Millers Ltd	Thika	Milly Fruit Processors Ltd	Mombasa
Bidco Africa Ltd	Nairobi	Mini Bakeries (Nbi) Ltd	Nairobi
Bio Food Products Limited	Nairobi	Miritini Kenya	Nairobi
Breakfast Cereal Company (K) Ltd	Nairobi	Mjengo Limited	Nairobi
British American Tobacco Kenya Plc	Nairobi	Mombasa Maize Millers Ltd	Mombasa
Broadway Bakery Ltd	Nairobi	Mount Kenya Bottlers Ltd	Nyeri
Brookside Dairy Ltd	Nairobi	Mumias Sugar Company Limited	Kakamega
Butali Sugar Mills Ltd	Western	Mwanga Millers	Meru
C. Dormans Ltd	Nairobi	Mzuri Sweets Ltd	Mombasa

Cadbury Kenya Ltd	Nairobi	Nairobi Bottlers Ltd	Nairobi
Candy Kenya Ltd	Nairobi	Nairobi Flour Mills Ltd	Nairobi
Capwell Industries Ltd	Nairobi	NAS Airport Services Ltd	Nairobi
Centrofood Industries Ltd	Nairobi	Nestle Kenya Ltd	Nairobi
Chai Trading Company Limited	Mombasa	New Kenya Co-Operative Creameries	Nairobi
Chemelil Sugar Company Ltd	Western	Olivado EPZ Limited	Nairobi
Coastal Bottlers Limited	Coast	Palmhouse Diaries Ltd	Nairobi
CoffTea Agencies	Mombasa	Patco Industries Limited	Nairobi
Crown Beverages LTD	Mombasa	Pearl Industries Ltd	Nairobi
Del Monte Kenya Ltd	Thika	Pembe Flour Mills Ltd	Nairobi
DPL Festive Ltd	Nairobi	Premier Flour Mills Ltd	Nairobi
Dutch Waters Limited	Mombasa	Premier Food Industries Limited	Nairobi
East African Breweries Ltd	Nairobi	Pride Industries Ltd	Mombasa
East African Sea Food Ltd	Nairobi	Pristine International Ltd	Nairobi
East African Seed Co. Ltd	Nairobi	Proctor & Allan (E.A.) Ltd	Nairobi
Equator Bottlers Ltd	Kisumu	Propack Kenya Limited	Nairobi
Farmers Choice Ltd	Nairobi	Pwani Oil Products Ltd	Mombasa
Frigoken Ltd	Nairobi	Rafiki Millers Ltd	Nairobi
General Mills East Africa Limited	Mombasa	Raka Milk Processors	Nyeri
Giloil Company Limited	Nairobi	Razco Limited	Nairobi
Githunguri Dairy Farmers Co-operative	Githunguri	Re-Suns Spices Limited	Nairobi
Glacier Products Ltd	Nairobi	Sameer Agriculture & Livestock Ltd	Nairobi
Gold Crown Foods (EPZ) Ltd	Mombasa	SBC Kenya Limited	Nairobi
Green Forest Foods Ltd	Nairobi	Selecta Kenya Gmbh & Co. .KG	Juja
Highlands Mineral Water Co. Ltd	Nyeri	Sigma Supplies Ltd	Nairobi
Jetlak Foods Ltd	Ruiru	Sky Foods Limited	Juja
Jungle Group	Thika	Spectre International Ltd	Kisumu
Kamili Packers Ltd	Nairobi	Spice World Ltd	Nairobi
Karirana Estate Ltd	Limuru	Sunny Processors Ltd	Makuyu
Kenafric Bakery	Thika	Sweet Rus Limited	Mombasa
Kenafric Industries Limited	Nairobi	T.S.S. Grain Millers Limited	Mombasa
Kenblest Limited	Thika	Tropical Heat Limited	Nairobi
Kenchic Ltd	Nairobi	Trufoods Ltd	Nairobi
Kenlab Supplies Ltd	Kisumu	Trust Feeds Ltd	Thika
Kentaste Proucts Limited	Mombasa	Trust Flour Mills Ltd	Mombasa
Kenya Nut Company Ltd	Nairobi	Umoja Flour Mills Ltd	Thika
Kenya Tea Growers Association	Kericho	Unga Group Ltd	Nairobi
Kenya Wine Agencies Limited	Nairobi	United Millers Ltd	Kisumu
Kevian Kenya Ltd	Nairobi	Usafi Services Ltd	Nairobi
Kibos Sugar and Allied Industries	Kibos	Wanji Food Industries Limited	Nairobi

Kilimanjaro Biscuits Limited	Mombasa	Wrigley Company (E.A.) Ltd	Nairobi
Koba Waters Ltd/ Broomhill Springs Water	Nairobi		
Leather & Footwear (5)			
Bata Shoe Co (K) Ltd	Nairobi	Leather Industries of Kenya Limited	Nairobi
Budget Shoes Ltd	Nairobi	Sandstorm Africa Limited	Nairobi
C & P Shoes Industries Ltd	Nairobi		
Metal & Allied (50)			
Alloy Steel Castings Ltd	Nairobi	Nails & Steel Products Ltd	Nairobi
Ashut Engineers	Nairobi	Nalin Steel Works	Naivasha
ASL Ltd	Nairobi	Nampak Kenya Limited	Thika
ASP Company Ltd	Nairobi	Napro Industries Limited	Nairobi
Athi River Steel Plant Ltd	Athi River	Orbit Engineering Ltd	Nairobi
Blue Nile Wire Products Ltd	Thika	Palak International Limited	Nairobi
Booth Extrusions Limited	Thika	Safal Mitek Ltd	Nairobi
Cook 'N Lite Limited	Mombasa	Sheffield Steel Systems Ltd	Nairobi
Corrugated Sheets Limited	Mombasa	Siya Industries (K) Ltd	Nairobi
Davis & Shirtliff Ltd	Nairobi	Soni Technical Services Ltd	Kisumu
Doshi & Company Hardware	Mombasa	St Theresa Industries Kenya Limited	Nairobi
East Africa Spectre Limited	Nairobi	Standard Rolling Mills Ltd	Mombasa
East African Foundry Works (K) Ltd	Nairobi	Steel structures Ltd	Nairobi
East African Glassware Mart (Nairobi)	Nairobi	Steelmakers Ltd	Nairobi
Farm Engineering Industries Ltd	Nairobi	Sufuria World Limited	Nairobi
Fine Engineering Works Limited	Nairobi	Superfit Steelcon Ltd	Nairobi
Friendship Container Manufacturers Ltd	Nairobi	Tarmal Wire Products Ltd	Mombasa
Hebatullah Brothers Ltd	Nairobi	Technoconstruct Kenya Ltd	Nairobi
Kaluworks Limited	Mombasa	Technosteel Industries Ltd	Nairobi
Kenya General Industries Ltd	Nairobi	Tononoka Rolling Mills Ltd	Nairobi
Khetshi Dharamshi & Co. Ltd	Nairobi	Tononoka Steel Ltd	Nairobi
Kitchen King Ltd	Mombasa	Vivek Investments Ltd	Nairobi
Mecol Limited	Nairobi	Welding Alloys Ltd	Nairobi
Metal Crowns Limited	Nairobi	Wire Products Limited	Nairobi
Modulec Engineering Systems Ltd	Nairobi	Zenith Steel Fabricators Ltd	Nairobi
Motor Vehicle Assemblers & Accessories (26)			
Associated Battery Manufacturers (E.A.) Ltd	Athi River	Mann Manufacturing Co. Ltd	Nairobi
Auto Ancilliaries Ltd	Nairobi	Master Fabricators Ltd	Nairobi
Auto Industries Ltd	Nairobi	Megh Cushion Industries Ltd	Nairobi
Banbros Ltd	Athi River	Mobius Motors Kenya Ltd	Nairobi

Bhachu Industries Ltd	Nairobi	Mutsimoto Motor Company	Nakuru
Choda Fabricators Ltd	Nairobi	Pipe Manufacturers Ltd	Nairobi
Dodi Autotech	Nairobi	R.T. (East Africa) Limited	Nairobi
Foton East Africa Ltd	Nairobi	Sohansons Ltd	Nairobi
General Motors East Africa Limited	Nairobi	Songyi Motocycles International Ltd	Nairobi
Harveer Bus Body Builders Limited	Nairobi	Theevan Enterprises Ltd	Nairobi
Kenya Vehicle Manufacturers Limited	Thika	Toyota Tshusho East africa Limited	Nairobi
Kibo Africa Ltd formerly Koneksie Ltd	Nairobi	Transafrica Motors Ltd	Nairobi
Labh Singh Harnam Singh Ltd	Nairobi	Unifilters Kenya Ltd	Nairobi
Paper & Board (46)			
Associated Paper & Stationery Ltd	Nairobi	Paper House of Kenya Ltd	Nairobi
Autolitho Ltd	Nairobi	Paperbags Limited	Nairobi
Bags & Balers Manufacturers Ltd	Nairobi	Pressmaster Ltd	Nairobi
Cempack Solutions Limited	Nairobi	Printing Services Ltd	Nairobi
Chandaria Industries Limited	Nairobi	Printpak Multi Packaging Ltd	Nairobi
Dodhia Packaging Limited	Nairobi	Printwell Industries ltd	Nairobi
East Africa Packaging Industries Limited	Nairobi	Punchlines Ltd	Nairobi
East African Paper Mills	Thika	Ramco Printing Works Ltd	Nairobi
Flora Printers Ltd	Mombasa	Regal Press Kenya Ltd	Nairobi
General Printers Limited	Nairobi	Rodwell Press Ltd	Nairobi
Green Pencils Ltd	Nairobi	Sintel Security Print Solutions Limited	Nairobi
Kartasi Industries Ltd	Nairobi	Soloh Worldwide Inter-Enterprises Ltd	Nairobi
Kim-Fay East Africa Ltd	Nairobi	Statpack Industries Ltd	Nairobi
Kul Graphics Ltd	Nairobi	Taws Limited	Nairobi
Manipal International Printing Press Ltd	Nairobi	Tetra Pak Ltd	Nairobi
Mega Pack (K) Ltd	Nakuru	Tissue Kenya Limited	Nairobi
Modern Lithographic (K) Ltd	Nairobi	Twiga Stationers & Printers Ltd	Nairobi
Palmy Enterprises	Nairobi	United Bags Manufacturers Ltd	Nairobi
Pharmaceutical & Medical Equipment (14)			
Autosterile (East Africa Limited	Nairobi	Pharm Access Africa Ltd	Nairobi
Biodeal Laboratories Ltd	Nairobi	Pharmaceutical Manufacturung Co. Ltd	Nairobi
Dawa Limited	Nairobi	Regal Pharmaceuticals Ltd	Nairobi
Glaxo Smithkline Kenya Ltd	Nairobi	Skylight Chemicals Limited	Nairobi
Laboratory & Allied Limited	Nairobi	Toyota Kenya Ltd	Nairobi

Medisel Kenya Ltd	Nairobi	Universal Corporation limited	Kikuyu
Medivet Products Ltd	Nairobi	Vetcare Kenya Limited	Nairobi
Plastics & Rubber (49)			
ACME Containers Ltd	Nairobi	Polly Propelin Bags Ltd	Mombasa
Africa PVC Industries Ltd	Mombasa	Polyblend Limited	Nairobi
Afro Plastics (K) Ltd	Nairobi	Polyflex Industries Ltd	Nairobi
Bobmil Industries Ltd	Nairobi	Polythene Industries Ltd	Nairobi
Brush Manufacturers Ltd	Nairobi	Premier Industries Ltd	Nairobi
Dune Packaging Ltd	Nairobi	Prosel Ltd	Nairobi
Dynaplas Limited	Nairobi	Raffia Bags (K) Ltd	Nairobi
General Plastics Limited	Nakuru	Rubber Products Ltd	Nairobi
Kenpoly Manufacturers Ltd	Nairobi	Safepak Limited	Nairobi
Kenrub Ltd	Ruiru	Sameer Africa Ltd	Nairobi
Kenya Suitcase Manufacturers Limited	Mombasa	Signode Packaging Systems Ltd	Nairobi
King Plastic Industries	Nairobi	Silafrica Kenya Ltd	Nairobi
Kinpash Enterprises Limited	Nairobi	Silpack Industries Limited	Nairobi
L.G. Harris & Co. Ltd	Nairobi	Singh Retread Ltd	Nairobi
Laneeb Plastic Industries Ltd	Nairobi	Solvochem East Africa Ltd	Nairobi
Malplast Industries Ltd	Nairobi	Springbox Kenya Ltd	Nairobi
Metro Plastics Kenya Limited	Nairobi	Styroplast Limited	Nairobi
Mombasa Polythene Bags Ltd	Mombasa	Super Manufacturers ltd	Nairobi
Nairobi Plastics Ltd	Nairobi	Supreme Poly Pack (K) Ltd	Juja
Nakuru Plastics	Nakuru	Techpak Industries Ltd	Nairobi
Ombi Rubber Rollers Ltd	Kiambu	Treadsetters Tyres Ltd	Nairobi
Packaging Industries Ltd	Nairobi	Umoja Rubber Products Ltd	Mombasa
Packaging Masters limited	Nairobi	Uni-plastics	Nairobi
Plastic Electricons	Nairobi	Zaverchand Punja Ltd	Mombasa
Plastics & Rubber Industries Ltd	Nairobi		
Textiles & Apparel (39)			
Africa Apparels EPZ LTD	Nairobi	Oriental Mills Ltd	Nairobi
Alpha Knits Limited	Nairobi	Penny Galore Ltd	Nairobi
Ashton Apparel EPZ Ltd	Coast	Rivatex (East Africa) Ltd	Eldoret
Beberavi Collections Ltd	Nakuru	Shin-Ace Garments Kenya (EPZ) Ltd	Mombasa
Bedi Investments Limited	Nakuru	Simba Apparel EPZ Ltd	Mombasa
Brilliant Garments EPZ Ltd	Mombasa	Spin Knit Limited	Nakuru
Dharamshi & Co. Ltd	Nairobi	Spinners & Spinners Ltd	Nairobi
Gone Fishing	Nakuru	Straightline Enterprises Ltd	Nairobi
Kamyn Industries Limited	Mombasa	Summit Fibres Ltd	Mombasa
Kavirondo Filments Ltd	Kisumu	Sunam Shakti	Nairobi
Kenya Shirts Manufacturers Company Ltd	Mombasa	Sunflag Textile & Knitwear Mills Ltd	Nairobi
Kenya Tents Limited	Nairobi	Tarpo industries	Nairobi
Le-Stud Limited	Nairobi	Teita Estate Ltd	Nairobi
Manchester Outfitters Limited	Nairobi	Thika Cloth Mills Ltd	Nairobi

Mega Apparel Industries (EPZ) Ltd	Mombasa	TSS Spinning and Weaving Ltd	Mombasa
Mega Garment Industries Kenya (EPZ)	Mombasa	Tulips Collections Limited	Nakuru
Midco Textiles (EA) Ltd	Nairobi	United Aryan (EPZ) Ltd	Nairobi
Mills Industry Ltd	Nairobi	Vaja's Manufacturers Limited	Nairobi
Mombasa Apparells	Mombasa	Wildlife Works (EPZ) Ltd	Voi
Ngecha Industries Ltd	Nairobi	Oriental Mills Ltd	Nairobi
Timber, Wood & Furniture (15)			
Comply Industries Ltd	Nakuru	Rosewood Furniture Manufacturers Ltd	Nairobi
Fine Wood Works Ltd	Nairobi	Shah Timber Mart Ltd	Nairobi
Furniture International Limited	Nairobi	Shamco Industries Ltd	Nairobi
Kenya Wood Products Limited	Nairobi	Shayona Timber Ltd	Nakuru
Marvel Lifestyle Ltd	Nairobi	Timsales Limited	Nairobi
Match Masters Ltd	Nairobi	Turea Ltd	Ruiru
Panesar's Kenya Ltd	Nairobi	Woodmakers (K) Ltd	Nairobi
PG Bison Ltd	Nairobi	Rosewood Furniture Manufacturers Ltd	Nairobi

Source: Kenya Association of Manufacturers (2017)

Appendix ii: Survey Questionnaire For firm operations/financial managers

The purpose of this questionnaire is to collect data, strictly for research purposes, from medium, large and very large manufacturing firms. The data will be used to analyze the influence of investment in back up power generation and firm characteristics on the relationship between electric power outage dynamics and performance of medium, large and very large manufacturing firms in Kenya. Your support in this regard is highly valued.

Section A: The Organization

i. Name of the organization (Optional)____

Section B: Electric Power Outage Dynamics

Please rate the following statements with respect to power outage as experienced at your organization by indicating a tick (√) in the appropriate box

1. What is the average **Frequency** of power outages in a month experienced at your firm?

Less than 5 times	5 – 10	11-15	16 - 20	Over 20 times

2. What has been the **average Duration** of each outage in the last one month?

Less than 5 min.	5 - 20 min.	20 – 60 min	1- 5 hours	Over 5 hours

3. Does the power company provide notification of power outage to the firm before the actual occurrence?

Yes	No	Sometimes

4. What has been the **average Notification duration** (if any) over the last one month?

Less than 5 min.	5 - 60 min.	1 – 5 hours	6 – 12 hours	Over 24 hours

5. What is the average number of electric power outages experienced at your firm in the last one month in the following categories of **Day/Time**?

Day/Time	None (0)	1 – 5	5 – 10	10 – 15	>15
Weekday/Day *6 a.m. – 6 p.m.*					
Weekday/Evening *6 p.m. – 10 p.m.*					
Weekday/Night *10 p.m. – 6 a.m.*					
Weekend/Day *6 a.m. – 6 p.m.*					
Weekend/Evening *6 p.m. – 10 p.m.*					
Weekend/Night *10 p.m. – 6 a.m.*					

Section C: Back Up Power Generation

Please rate the following statements with respect to back up (alternative) power generation at your organization by indicating a tick (√) in the appropriate box

1. Does your Firm have access to Backup power generation equipment?

Yes	No

If yes, answer the questions below on Capacity
If No, move to Section D

2. **Capacity:** If yes above, what capacity of power requirement in the Firm is the backup generator capable of providing?

0 – 5%	5 – 10%	10 – 20%	20 – 30%	Over 30%

3. **Investment in Back Up Generation:** Kindly indicate the amount invested in back up generation as per the latest balance sheet (2016).

Investment in Back up generation (Ksh) (as per balance sheet)	

Section D: Firm Characteristics

Industry type: Check the box that corresponds to the type of industry your company is in;

Tick (√) as appropriate

Building, Mining & Construction	Motor Vehicle Assemblers & Accessories
Chemical & Allied	Paper & Board
Energy, Electricals & Electronics	Pharmaceutical & Medical Equipment
Food & Beverages	Plastics & Rubber
Leather & Footwear	Textiles & Apparel
Metal & Allied	Timber, Wood & Furniture

Section E: Firm Performance

Kindly provide the following information to enable me compute the firm performance indices

Criteria/Domain	**Unit of measure**	**2016**
Firm Performance		
Profit Before Tax	Kes (million)	
Total Assets	Kes (million)	
Customer Focus		
Level of customer satisfaction	%	
Level of resolution of customer complaints	%	
Operations Efficiency		
Rate of automation of processes in the firm	%	
Level of existing capacity utilization	%	
Employee Productivity		
Level of employee satisfaction	%	
Rate of employee retention	%	
Competency and development budget in relation to firm's total budget	%	
Green Performance		
Implementation of environmental protection policy in the firm's operations	%	
Level of adoption of green technologies in the firm's operations	%	
Social Responsibility		
Rate of implementation of social responsibility policy	%	
Social responsibility programmes budgetary allocation in relation to firm's total budget	%	

THANKS FOR TAKING TIME OUT OF YOUR BUSY SCHEDULE FOR THIS STUDY

Appendix iii: Industry Dummy Variables

NO	Industry	No of Firms	Firms in Industry	Firms not in that Industry
1	Building, Mining and Construction	5	DUMMY 1	DUMMY 0
2	Chemical and Allied	15	DUMMY 1	DUMMY 0
3	Energy, Electricals and Electronics	9	DUMMY 1	DUMMY 0
4	Food and Beverages	37	DUMMY 1	DUMMY 0
5	Leather and Footwear	2	DUMMY 1	DUMMY 0
6	Metal and Allied	15	DUMMY 1	DUMMY 0
7	Motor Vehicle Assemblers and Accessories	8	DUMMY 1	DUMMY 0
8	Paper and Board	11	DUMMY 1	DUMMY 0
9	Pharmaceutical and Medical Equipment	4	DUMMY 1	DUMMY 0
10	Plastics and Rubber	15	DUMMY 1	DUMMY 0
11	Textiles and Apparel	12	DUMMY 1	DUMMY 0
12	Timber, Wood and Furniture	5	DUMMY 1	DUMMY 0

Appendix iv: Industry Moderation Results

Table 5.6[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Building, Mining and Construction Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.175[a]	.031	-.023	14.69671278	.031	.568	2	36	.572

a. Predictors: (Constant), EPOD, Building Mining & Construction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	245.445	2	122.722	.568	.572[b]
	Residual	7775.761	36	215.993		
	Total	8021.206	38			

a. Dependent Variable: FIN gt
b. Predictors: (Constant), EPOD, Building Mining & Construction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.433	17.283		1.472	.150		
	EPOD	-5.745	7.954	-.119	-.722	.475	.993	1.007
	Building Mining & Construction	5.504	6.545	.138	.841	.406	.993	1.007

a. Dependent Variable: FIN

Table 5.6[b]: Results of Hypothesis Testing of EPOD and non-Financial Performance as Moderated by Building, Mining and Construction Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.117[a]	.014	-.020	12.807563	.014	.409	2	59	.666

a. Predictors: (Constant), EPOD, Building Mining &Construction,

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	134.071	2	67.035	.409	.666[b]
	Residual	9677.986	59	164.034		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Building Mining & Construction,

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	73.946	8.923		8.287	.000		
	EPOD	-2.764	4.346	-.083	-.636	.527	.971	1.030
	Building Mining & Construction	4.138	5.583	.097	.741	.462	.971	1.030

a. Dependent Variable: NFIN

Table 5.6[c]: Results of Hypothesis Testing of EPOD and Overall Performance as as Moderated by Building, Mining and Construction Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.159[a]	.025	-.036	9.70082008	.025	.413	2	32	.665

a. Predictors: (Constant), EPOD, Building Mining & Construction,

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	77.659	2	38.829	.413	.665[b]
	Residual	3011.389	32	94.106		
	Total	3089.048	34			

a. Dependent Variable: PER

b. Predictors: (Constant), EPOD, Building, Mining & Construction,

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta		T	Sig. Tolerance	Collinearity Statistics VIF
1	(Constant)	69.201	12.263		5.643	.000		
	EPOD	-4.054	5.608	-.128	-.723	.475	.974	1.027
	Building Mining & Construction	3.131	4.748	.117	.659	.514	.974	1.027

a. Dependent Variable: PER

Table 5.7[a]: Results of Hypothesis Testing of EPOD and financial Performance as Moderated by Chemical and Allied Industry Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.172[a]	.030	-.024	14.70333816	.030	.551	2	36	.581

a. Predictors: (Constant), Chemical & Allied, EPOD

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	238.432	2	119.216	.551	.581[b]
	Residual	7782.774	36	216.188		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD, Chemical & Allied

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	23.155	17.446		1.327	.193		
	EPOD	-4.557	7.969	-.094	-.572	.571	.991	1.010
	Chemical & Allied	7.289	8.878	.135	.821	.417	.991	1.010

a. Dependent Variable: FIN

Table 5.7[b]: Results of Hypothesis Testing of EPOD and Non-financial Performance Moderated by Chemical and Allied Industry Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.074[a]	.006	-.028	12.860373	.006	.164	2	59	.850
2	.112[b]	.013	-.038	12.924609	.007	.415	1	58	.522

a. Predictors: (Constant), EPOD, Chemical & Allied,
b. Predictors: (Constant), EPOD, Chemical &Allied, Chemical Allied*Epod

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	54.094	2	27.047	.164	.850[b]
	Residual	9757.963	59	165.389		
	Total	9812.057	61			
2	Regression	123.417	3	41.139	.246	.864[c]
	Residual	9688.640	58	167.046		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Chemical & Allied
c. Predictors: (Constant), EPOD, Chemical & Allied, Chemical Allied*Epod

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	72.870	9.027		8.073	.000		
	EPOD	-2.110	4.322	-.064	-.488	.627	.990	1.010
	Chemical & Allied	1.284	5.187	.032	.248	.805	.990	1.010
2	(Constant)	71.597	9.285		7.711	.000		
	EPOD	-1.489	4.449	-.045	-.335	.739	.944	1.060
	Chemical & Allied	18.466	27.177	.465	.679	.500	.036	27.455
	Chemical Allied*Epod	-9.212	14.300	-.439	-.644	.522	.037	27.266

a. Dependent Variable: NFIN

Table 5.7[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Chemical and Allied Industry Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.118[a]	.014	-.048	9.75611103	.014	.227	2	32	.798

a. Predictors: (Constant), EPOD, Chemical & Allied

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	43.233	2	21.617	.227	.798[b]
	Residual	3045.814	32	95.182		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD, Chemical & Allied

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	67.806	12.439		5.451	.000		
	EPOD	-3.271	5.613	-.103	-.583	.564	.984	1.017
	Chemical & Allied	1.551	5.940	.046	.261	.796	.984	1.017

a. Dependent Variable: PER

Table 5.8[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Food & Beverage Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	**F Change**	df1	df2	Sig. F Change
1	.109[a]	.012	-.043	14.83789509	.012	.217	2	36	.806
2	.119[b]	.014	-.070	15.03158894	.002	.078	1	35	.781

a. Predictors: (Constant), EPOD, Food & Beverages
b. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	95.333	2	47.667	.217	.806[b]
	Residual	7925.873	36	220.163		
	Total	8021.206	38			
2	Regression	113.003	3	37.668	.167	.918[c]
	Residual	7908.203	35	225.949		
	Total	8021.206	38			

a. Dependent Variable: FIN
b. Predictors: (Constant), EPOD, Food & Beverages,
c. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	24.826	17.609		1.410	.167		
	EPOD	-5.147	8.015	-.107	-.642	.525	.997	1.003
	Food & Beverages	.579	5.287	.018	.110	.913	.997	1.003
2	(Constant)	24.070	18.042		1.334	.191		
	EPOD	-4.727	8.257	-.098	-.572	.571	.964	1.037
	Food & Beverages	.438	5.380	.014	.081	.936	.988	1.012
	Food & Beverage*Epod	-2.177	7.784	-.048	-.280	.781	.957	1.045

a. Dependent Variable: FIN

Table 5.8[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Food & Beverage Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df 2	Sig. F Change
1	.111[a]	.012	-.021	12.816033	.012	.369	2	59	.693
2	.172[b]	.030	-.021	12.812342	.017	1.034	1	58	.313

a. Predictors: (Constant), EPOD Food & Beverages
b. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121.266	2	60.633	.369	.693[b]
	Residual	9690.791	59	164.251		
	Total	9812.057	61			
2	Regression	291.003	3	97.001	.591	.623[c]
	Residual	9521.054	58	164.156		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD Food & Beverages
c. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF

1	(Constant)	73.266	8.877		8.253	.000		
	EPOD	-2.573	4.317	-.078	-.596	.553	.986	1.015
	Food & Beverages	2.521	3.675	.089	.686	.495	.986	1.015
2	(Constant)	74.466	8.953		8.318	.000		
	EPOD	-3.319	4.378	-.100	-.758	.451	.958	1.044
	Food & Beverages	2.895	3.692	.103	.784	.436	.976	1.025
	Food & Beverage*Epod	6.682	6.571	.134	1.017	.313	.966	1.035

a. Dependent Variable: NFIN

Table 5.8[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Food & Beverage Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.214[a]	.046	-.014	9.59772081	.046	.767	2	32	.473
2	.270[b]	.073	-.017	9.61054287	.027	.915	1	31	.346

a. Predictors: (Constant), EPOD, Food & Beverages,

b. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	141.328	2	70.664	.767	.473[b]
	Residual	2947.720	32	92.116		
	Total	3089.048	34			
2	Regression	225.809	3	75.270	.815	.495[c]
	Residual	2863.239	31	92.363		
	Total	3089.048	34			

a. Dependent Variable: PER

b. Predictors: (Constant), EPOD, Food & Beverages,

c. Predictors: (Constant), EPOD, Food & Beverages, Food & Beverage*Epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	65.740	12.310		5.340	.000		
	EPOD	-2.803	5.510	-.088	-.509	.614	.988	1.013
	Food & Beverages	3.747	3.517	.185	1.066	.295	.988	1.013
2	(Constant)	67.384	12.446		5.414	.000		
	EPOD	-3.728	5.602	-.118	-.666	.511	.958	1.044
	Food & Beverages	4.078	3.538	.202	1.153	.258	.978	1.022
	Food & Beverage*Epod	4.766	4.983	.169	.956	.346	.957	1.045

a. Dependent Variable: PER

Table 5.9[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Leather and Footwear Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.107[a]	.012	-.015	14.63844911	.012	.433	1	37	.515

a. Predictors: (Constant), EPOD

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.691	1	92.691	.433	.515[b]
	Residual	7928.515	37	214.284		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.089	17.210		1.458	.153		
	EPOD	-5.193	7.896	-.107	-.658	.515	1.000	1.000

a. Dependent Variable: FIN

Table 5.9[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Leather and Footwear Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.177[a]	.031	-.002	12.693069	.031	.951	2	59	.392

a. Predictors: (Constant), EPOD, Leather & Footwear

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	306.330	2	153.165	.951	.392[b]
	Residual	9505.727	59	161.114		
	Total	9812.057	61			

b. Predictors: (Constant), EPOD, Leather & Footwear

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	74.756	8.872		8.426	.000		
	EPOD	-2.835	4.272	-.086	-.664	.510	.987	1.013
	Leather & Footwear	-16.436	12.880	-.165	-1.276	.207	.987	1.013

a. Dependent Variable: NFIN

Table 5.9[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Leather and Footwear Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.109[a]	.012	-.018	9.61738735	.012	.397	1	33	.533

a. Predictors: (Constant), EPOD

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	36.741	1	36.741	.397	.533[b]
	Residual	3052.307	33	92.494		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	68.348	12.089		5.654	.000		
	EPOD	-3.458	5.487	-.109	-.630	.533	1.000	1.000

a. Dependent Variable: PER

Table 5.10[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Metal and Allied Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.111[a]	.012	-.043	14.83539395	.012	.223	2	36	.801

a. Predictors: (Constant), EPOD, Metal & Allied

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	98.005	2	49.003	.223	.801[b]
	Residual	7923.201	36	220.089		
	Total	8021.206	38			

a. Dependent Variable: FIN
b. Predictors: (Constant), EPOD, Metal & Allied,

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	24.599	17.724		1.388	.174		
	EPOD	-5.032	8.069	-.104	-.624	.537	.984	1.017
	Metal & Allied	1.113	7.165	.026	.155	.877	.984	1.017

a. Dependent Variable: FIN

Table 5.10[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Metal and Allied Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.244[a]	.059	.027	12.507744	.059	1.860	2	59	.165

a. Predictors: (Constant), EPOD, Metal & Allied

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	581.880	2	290.940	1.860	.165[b]
	Residual	9230.177	59	156.444		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Metal & Allied

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	76.539	8.845		8.653	.000		
	EPOD	-3.363	4.228	-.102	-.795	.430	.979	1.022
	Metal & Allied	-10.071	5.431	-.237	-1.854	.069	.979	1.022

a. Dependent Variable: NFIN

Table 5.10[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Metal and Allied Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.393[a]	.155	.102	9.03317913	.155	2.928	2	32	.068

a. Predictors: (Constant), EPOD, Metal & Allied

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	477.901	2	238.951	2.928	.068[b]
	Residual	2611.146	32	81.598		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD, Metal & Allied

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	69.882	11.374		6.144	.000		
	EPOD	-3.663	5.155	-.116	-.711	.482	1.000	1.000
	Metal & Allied	-12.684	5.455	-.378	-2.325	.027	1.000	1.000

a. Dependent Variable: PER

Table 5.11[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Motor Vehicle Assemblers & Accessories Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.195[a]	.038	-.016	14.64134423	.038	.709	2	36	.499

a. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories,

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	303.923	2	151.962	.709	.499[b]
	Residual	7717.283	36	214.369		
	Total	8021.206	38			

a. Dependent Variable: FIN
b. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories,

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	27.086	17.330		1.563	.127		
	EPOD	-5.866	7.926	-.121	-.740	.464	.993	1.007
	Motor Vehicle Assemblers & Accessories	-10.590	10.668	-.163	-.993	.328	.993	1.007

a. Dependent Variable: FIN

Table 5.11[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Motor Vehicle Assemblers &Accessories Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.140[a]	.020	-.014	12.768462	.020	.592	2	59	.556

a. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	193.073	2	96.536	.592	.556[b]
	Residual	9618.984	59	163.034		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	73.204	8.844		8.277	.000		
	EPOD	-2.342	4.272	-.071	-.548	.586	.999	1.001
	Motor Vehicle Assemblers & Accessories	8.782	9.182	.123	.956	.343	.999	1.001

a. Dependent Variable: NFIN

Table 5.11[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Motor Vehicle Assemblers &Accessories Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.130[a]	.017	-.045	9.74187175	.017	.275	2	32	.762

a. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories,

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	52.118	2	26.059	.275	.762[b]
	Residual	3036.930	32	94.904		
	Total	3089.048	34			

a. Dependent Variable: PER

b. Predictors: (Constant), EPOD, Motor Vehicle Assemblers & Accessories

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	67.421	12.460		5.411	.000		
	EPOD	-3.087	5.634	-.097	-.548	.588	.973	1.028
	Motor Vehicle Assemblers & Accessories	4.033	10.020	.072	.403	.690	.973	1.028

a. Dependent Variable: PER

Table 5.12[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Paper and Board Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.107[a]	.012	-.015	14.63844911	.012	.433	1	37	.515

a. Predictors: (Constant), EPOD

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.691	1	92.691	.433	.515[b]
	Residual	7928.515	37	214.284		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.089	17.210		1.458	.153		
	EPOD	-5.193	7.896	-.107	-.658	.515	1.000	1.000

a. Dependent Variable: FIN

Table 5.12[b]: Results of Hypothesis Testing of EPOD and Non-Performance as Moderated by Paper and Board Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.070[a]	.005	-.029	12.864674	.005	.144	2	59	.866
2	.258[b]	.067	.018	12.566361	.062	3.834	1	58	.055

a. Predictors: (Constant), EPOD, Paper & Board
b. Predictors: (Constant), EPOD, Paper & Board, paper board_epod

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	47.567	2	23.783	.144	.866[b]
	Residual	9764.490	59	165.500		
	Total	9812.057	61			
2	Regression	653.078	3	217.693	1.379	.258[c]
	Residual	9158.979	58	157.913		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Paper & Board
c. Predictors: (Constant), EPOD, Paper & Board, paper_board_epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	73.343	8.942		8.202	.000		
	EPOD	-2.240	4.305	-.068	-.520	.605	.999	1.001
	Paper & Board	-.983	6.655	-.019	-.148	.883	.999	1.001
2	(Constant)	68.985	9.014		7.653	.000		
	EPOD	-.104	4.344	-.003	-.024	.981	.936	1.069
	Paper & Board	50.508	27.087	.986	1.865	.067	.058	17.386
	Paper board_epod	-29.355	14.991	-1.036	-1.958	.055	.058	17.376

a. Dependent Variable: NFIN

Table 5.12[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Paper and Board Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.109[a]	.012	-.018	9.61738735	.012	.397	1	33	.533

a. Predictors: (Constant), EPOD

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.741	1	36.741	.397	.533[b]
	Residual	3052.307	33	92.494		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	68.348	12.089		5.654	.000
	EPOD	-3.458	5.487	-.109	-.630	.533

a. Dependent Variable: PER

Table 5.13[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Pharmaceutical & Medical Equipment Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.107[a]	.012	-.015	14.63844911	.012	.433	1	37	.515

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.691	1	92.691	.433	.515[b]
	Residual	7928.515	37	214.284		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.089	17.210		1.458	.153		
	EPOD	-5.193	7.896	-.107	-.658	.515	1.000	1.000

a. Dependent Variable: FIN

Table 5.13[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Pharmaceutical & Medical Equipment Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.348[a]	.121	.091	12.089533	.121	4.067	2	59	.022
2	.602[b]	.363	.330	10.384938	.241	21.958	1	58	.000

a. Predictors: (Constant), EPOD, Pharmaceutical & Medical Equipment,

b. Predictors: (Constant), EPOD, Pharmaceutical & Medical Equipment, Pharmaceutical*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1188.805	2	594.403	4.067	.022[b]
	Residual	8623.252	59	146.157		
	Total	9812.057	61			
2	Regression	3556.934	3	1185.645	10.994	.000[c]
	Residual	6255.123	58	107.847		
	Total	9812.057	61			

a. Dependent Variable: NFIN

b. Predictors: (Constant), EPOD, Pharmaceutical & Medical Equipment,

c. Predictors: (Constant), EPOD, Pharmaceutical & Medical Equipment, Pharmaceutical*Epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	80.887	8.809		9.182	.000		
	EPOD	-5.574	4.217	-.168	-1.322	.191	.919	1.088
	Pharmaceutical & Medical Equipment	-25.369	9.064	-.356	-2.799	.007	.919	1.088
2	(Constant)	75.070	7.668		9.790	.000		
	EPOD	-2.745	3.672	-.083	-.747	.458	.894	1.118
	Pharmaceutical & Medical Equipment	81.016	24.001	1.138	3.376	.001	.097	10.338
	Pharmaceutical_ *Epod	-69.770	14.889	-1.552	-4.686	.000	.100	9.979

a. Dependent Variable: NFIN

Table 5.13[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Pharmaceutical & Medical Equipment Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.109[a]	.012	-.018	9.61738735	.012	.397	1	33	.533

a. Predictors: (Constant), EPOD

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.741	1	36.741	.397	.533[b]
	Residual	3052.307	33	92.494		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	68.348	12.089		5.654	.000		
	EPOD	-3.458	5.487	-.109	-.630	.533	1.000	1.000

a. Dependent Variable: PER

Table 5.14[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Plastic and Rubber Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.168[a]	.028	-.026	14.71563103	.028	.520	2	36	.599
2	.285[b]	.081	.003	14.51034753	.053	2.026	1	35	.163

a. Predictors: (Constant), EPOD, Plastics & Rubber,
b. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	225.413	2	112.707	.520	.599[b]
	Residual	7795.793	36	216.550		
	Total	8021.206	38			
2	Regression	651.949	3	217.316	1.032	.390[c]
	Residual	7369.256	35	210.550		
	Total	8021.206	38			

a. Dependent Variable: FIN
b. Predictors: (Constant), EPOD, Plastics & Rubber,
c. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	24.642	17.310		1.424	.163		
	EPOD	-4.550	7.980	-.094	-.570	.572	.989	1.011
	Plastics & Rubber	-4.593	5.867	-.129	-.783	.439	.989	1.011
2	(Constant)	13.352	18.821		.709	.483		
	EPOD	.717	8.695	.015	.082	.935	.810	1.234
	Plastics & Rubber	36.936	29.745	1.040	1.242	.223	.037	26.722
	Plastics Rubber*Epod	-18.634	13.092	-1.208	-1.423	.163	.036	27.429

a. Dependent Variable: FIN

Table 5.14[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Plastic and Rubber Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
					Change Statistics				
1	.105[a]	.011	-.023	12.824858	.011	.328	2	59	.722
2	.116[b]	.014	-.037	12.918164	.003	.151	1	58	.699

a. Predictors: (Constant), EPOD, Plastics & Rubber,
b. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	107.915	2	53.957	.328	.722[b]
	Residual	9704.142	59	164.477		
	Total	9812.057	61			
2	Regression	133.077	3	44.359	.266	.850[c]
	Residual	9678.980	58	166.879		
	Total	9812.057	61			

a. Dependent Variable: NFIN
b. Predictors: (Constant), EPOD, Plastics & Rubber,
c. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	72.499	8.961		8.091	.000		
	EPOD	-1.647	4.385	-.050	-.376	.709	.957	1.045
	Plastics & Rubber	-2.948	4.728	-.083	-.624	.535	.957	1.045
2	(Constant)	71.579	9.331		7.671	.000		
	EPOD	-1.188	4.572	-.036	-.260	.796	.893	1.120
	Plastics & Rubber	6.201	24.038	.174	.258	.797	.038	26.639
	Plastics Rubber*Epod	-4.163	10.722	-.264	-.388	.699	.037	27.246

a. Dependent Variable: NFIN

Table 5.14[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Plastic and Rubber Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
					Change Statistics				
1	.304[a]	.093	.036	9.35964010	.093	1.631	2	32	.212
2	.323[b]	.104	.017	9.44798419	.012	.404	1	31	.530

a. Predictors: (Constant), EPOD, Plastics & Rubber,
b. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	285.756	2	142.878	1.631	.212[b]
	Residual	2803.292	32	87.603		
	Total	3089.048	34			
2	Regression	321.851	3	107.284	1.202	.325[c]
	Residual	2767.197	31	89.264		
	Total	3089.048	34			

a. Dependent Variable: PER
b. Predictors: (Constant), EPOD, Plastics & Rubber
c. Predictors: (Constant), EPOD, Plastics & Rubber, Plastics Rubber*Epod

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	68.491	11.766		5.821	.000		
	EPOD	-2.857	5.352	-.090	-.534	.597	.996	1.004
	Plastics & Rubber	-6.366	3.776	-.285	-1.686	.102	.996	1.004
2	(Constant)	64.743	13.258		4.883	.000		
	EPOD	-1.132	6.045	-.036	-.187	.853	.795	1.258
	Plastics & Rubber	5.903	19.668	.264	.300	.766	.037	26.743

Plastics Rubber*Epod	-5.489	8.632	-.565	-.636	.530	.037	27.332

a. Dependent Variable: PER

Table 5.15[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Textile and Apparel Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.119[a]	.014	-.041	14.82103879	.014	.258	2	36	.774

a. Predictors: (Constant), EPOD, Textiles & Apparel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	113.331	2	56.666	.258	.774[b]
	Residual	7907.875	36	219.663		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD, Textiles & Apparel,

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.506	17.477		1.459	.153		
	EPOD	-5.465	8.043	-.113	-.679	.501	.988	1.012
	Textiles & Apparel	3.318	10.826	.051	.307	.761	.988	1.012

a. Dependent Variable: FIN

Table 5.15[b]: Results of Hypothesis Testing of EPOD and Non-Financial Performance as Moderated by Textile and Apparel Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.213[a]	.045	.013	12.600488	.045	1.400	2	59	.255
2	.214[b]	.046	-.004	12.704993	.001	.033	1	58	.856

a. Predictors: (Constant), EPOD, Textiles & Apparel

b. Predictors: (Constant), EPOD, Textiles & Apparel, Textiles Apparel*Epod

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	444.492	2	222.246	1.400	.255[b]
	Residual	9367.565	59	158.772		
	Total	9812.057	61			
2	Regression	449.879	3	149.960	.929	.433[c]
	Residual	9362.178	58	161.417		
	Total	9812.057	61			

a. Dependent Variable: NFIN

b. Predictors: (Constant), EPOD, Textiles & Apparel

c. Predictors: (Constant), EPOD, Textiles & Apparel, Textiles Apparel*Epod

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	69.921	8.973		7.792	.000		
	EPOD	-1.006	4.282	-.030	-.235	.815	.968	1.033
	Textiles & Apparel	8.737	5.501	.205	1.588	.118	.968	1.033
2	(Constant)	70.226	9.201		7.633	.000		
	EPOD	-1.154	4.393	-.035	-.263	.794	.935	1.069
	Textiles & Apparel	3.960	26.730	.093	.148	.883	.042	23.988
	Textiles Apparel*Epod	2.587	14.161	.114	.183	.856	.042	23.666

a. Dependent Variable: NFIN

Table 5.15[c]: Results of Hypothesis Testing of EPOD and Performance as Moderated by Textile

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.241[a]	.058	-.001	9.53550930	.058	.987	2	32	.384

a. Predictors: (Constant), EPOD, Textiles & Apparel

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	179.418	2	89.709	.987	.384[b]
	Residual	2909.630	32	90.926		
	Total	3089.048	34			

a. Dependent Variable: PER

b. Predictors: (Constant), EPOD, Textiles & Apparel

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	69.300	12.010		5.770	.000		
	EPOD	-4.123	5.466	-.130	-.754	.456	.991	1.010
	Textiles & Apparel	8.740	6.977	.216	1.253	.219	.991	1.010

a. Dependent Variable: PER

Table 5.16[a]: Results of Hypothesis Testing of EPOD and Financial Performance as Moderated by Timber Wood and Furniture Industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.158[a]	.025	-.029	14.73827472	.025	.464	2	36	.633

a. Predictors: (Constant), EPOD, Timber Wood & Furniture

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	201.403	2	100.702	.464	.633[b]
	Residual	7819.803	36	217.217		
	Total	8021.206	38			

a. Dependent Variable: FIN

b. Predictors: (Constant), EPOD, Timber Wood & Furniture,

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	26.422	17.429		1.516	.138		
	EPOD	-5.684	7.980	-.118	-.712	.481	.992	1.008
	Timber Wood & Furniture	-10.603	14.988	-.117	-.707	.484	.992	1.008

a. Dependent Variable: FIN