CAPACITY MANAGEMENT STRATEGIES AND OPERATIONAL EFFICIENCY IN THE ENERGY SECTOR IN KENYA

BY

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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION,

SCHOOL OF BUSINESS,

UNIVERSITY OF NAIROBI

NOVEMBER, 2018

DECLARATION

This research project is my original work and has not been presented for degree consideration in any other University.

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DEDICATION

I dedicate this work to my family, all who have been supportive every stretch of the way during the duration of my studies. Their encouragement and guidance has seen me through. A word of gratitude also goes to my fellow classmates and lecturers with whom we have walked this journey together. Thank you all.

ACKNOWLEDGEMENT

First, I thank the Almighty God for giving me strength and courage throughout the period of my studies and for guiding me up to the completion of this research project. My family and classmates, I say thank you for your support during my entire period of study. I salute my supervisor, Dr. Iraki, for his efforts of providing guidance that resulted to this work. Lastly, I thank the administration of the University of Nairobi, Main Campus and Lower Kabete Campus, as well as all my lecturers, especially in the Department of Management Science, for their support. God bless you all.

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ABBREVIATIONS AND ACRONYMS

ERC	Energy Regulatory Commission
IPPs	Independent Power Producers
IT	Information Technology
KEBS	Kenya Bureau of Standards
KPLC	Kenya Power and Lighting Company
KENGEN	Kenya Electricity Generating Company
KETRACO	Kenya Electricity Transmission Company
MOEP	Ministry of Energy and Petroleum
REA	Rural Electrification Authority
TOE	Tonnes of Oil Equivalent
OECD	Organization for Economic Cooperation and Development

ABSTRACT

Capacity Management has changed in the face of evolving businesses and the recent trends give a very good idea about what to expect in the coming future. Capacity management strategies include level capacity strategy, chase capacity strategy and coping strategy. The study was aimed at establishing capacity management strategies in energy sectors in Kenya. Additionally, the study established the performance of electric utility firms in Kenya and determined the relationship between capacity management strategies and performance of energy sectors in Kenya. The type of data collected was both primary and secondary data. The primary data collection instrument for this study was a designed questionnaire, as questionnaires are one of the widely-used primary data collection tools. The secondary data on performance was obtained from the electric utility firms end year financial report. It was found that there is a chance of improving the activities of the companies by employees. The operation costs in the firms were also found to have reduced due to improved activity and work in the organization proving that they were efficient. The study recommended that they should utilize supply chain management initiatives since it will enhance transformation process of the raw materials to end-user services, continuously monitor quality in their services, always undertake proper inventory control, identify risks in all processes in the utility and encourage research and development.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Capacity management can be defined as the ability to fulfill customer's requirements with the resources available (labor, factory, machinery, raw materials and others). Capacity management is therefore capable of dealing with the capacity of an organization's processes like development of new product or marketing as well as with capacity constraints that results due to combination of several resources. Since capacity constraints in any process or resource can be a major challenge for a company, then ensuring capacity management will automatically lead to smooth operations of the organization. According to Shumsky and Zhang (2009), capacity management in any organization can relate the potential output from the resources available to actual output. According to Noel (2005), operational efficiency can be defined as the potential of an organization to produce products and services of high quality with minimum costs. Efficiency is measured as a ratio of observed productivity to maximum productivity. If an organization has excellent capacity management then it will attain the required level of operational efficiency.

There is a defined relationship between quality management, efficiency management or resource productivity and capacity management which is at the center of the control process and planning for operational management in services. According to Armistead and Clark (1994) capacity is the ability of a manufacturing or service resource such as a process, workstation, and piece of equipment or facility to successfully attain its goals over a specified period. The available resources to the organization like equipment, labor and facilities determines capacity but depending on how they are organized and their efficiency as determined by specific work methods and procedures (Abrahao, Almeida, Almeida, Zhang, Beyer & Safai, 2006). The maximum productivity levels serve as a benchmark for desired performance. Most of the utility companies nowadays face a convergence of several powerful forces and market developments. Therefore, the companies must be capable of withstanding to the current global political upheavals that influences the cost of energy, navigate an increasingly complex supply chain and content with rising environmental consciousness in both private and public sectors.

According to Lazard's Levelized (2015) in the Cost of Energy Analysis over the last six years, he found out that there is an increase in cost-competitive for wind and solar photovoltaic (PV) with the help of conventional power generation technologies, on an unsubsidized basis, as the prices of system components (e.g., panels, inverters, racking, turbines, etc.), and constant improvements in efficiency.

A lot has to be done on capacity management in the Kenyan energy sector. For example, Hindpal Jabbal, a power sector expert and a former Chairman of the Energy Regulatory Commission (ERC) concluded that the Ministry of Energy plan to add energy amounting to 5,000 MW of generation capacity to the national grid by early 2017 would result to excess power supply as demand is low compared to what they had projected. He further suggested that by adding 250 MW of thermal power plants in recent years was not justified as these plants will not work for several years, while attracting almost $60 million in capacity charges that would lead to high electricity tariffs.

1.1.1 Capacity Management

According to Rolia, Cherkasova, Arlitt and Andrzejak (2005), for effective capacity management then there must be a good connectivity between the capacity of the operating system and the demand placed on that system. Therefore, capacity management as a process must involve decision making on planning, optimizing capacity and analyzing in order to achieve various demands in a timely manner and at a reasonable cost. According to Abrahao, Almeida, Almeida, Zhang, Beyer & Safai, (2006), the strategic decisions in services operations are much more than in the case in manufacturing as a result of the overlapping in production and consumption. There is no possibility of producing complete service package in advance of demand because the decisions on how much capacity to be made available are made at the same time as the decisions on how much capacity to utilize. Goldratt (1990) developed systems-management philosophy known as the theory of constraints (TOC). The main thesis of analyzing TOC is that constraints establish the barriers to performance for any system. Most organizations contain only a few core constraints. According to Goldratt (1990), in order to improve the performance of any organization then the managers must focus on effectively managing the capacity and capability of these constraints.

There are various challenges that face operations managers in managing supply and demand in services whereby they are unable to maintain quality standards while achieving productivity targets. The main problem is actually dealing with the changing levels of demand which can occur rapidly and with an element of uncertainty while having some limiting factors on the ability to alter capacity. Electric utilities for many years in Kenya have been satisfying various customer demands by generating electricity centrally and distributing it through an extensive transmission and distribution (T&D) network. The utility will be in a position of generating more electricity if demand increases. The capacity of the generation, transmission, and distribution systems can become constrained once demand

increases beyond a certain level. According to Musardo, Rizzoni, Guezennec & Staccia, (2005), the traditional utility response to these constraints is to build new facilities.

Kenya's installed power capacity as at June 2016 was 2,341 MW against a peak power demand of 2,552 MW according to former Kenya Power Company Managing Director Ben Chumo. Vision 2030 categorizes energy as a key determiner for economic growth in the country and therefore Kenya's electricity peak demand is opted to increase from 1,370 MW in 2012 to 21,075 MW by 2033 according to the Least Cost Power Development Plan (LCPDP, March 2013). Kenya power was aiming at achieve 70 percent electricity connectivity by the end of 2017 and universal access by 2020 through the Last Mile Connectivity Project (Chumo, 2016).

1.1.2. Operational Efficiency

Efficiency can be categorized into three forms which include allocative, scale and structural efficiency. According to Saliba (2016), the scale efficiency has been realized in three different ways. Farrell (1957) used the most restrictive technology having constant returns to scale (CRS) and exhibiting strong disposability of inputs. Constant return to scale measure of efficiency can be expressed as the product of a technical efficiency measure and a scale efficiency measure. According to Kortmann et al, (2014) the third method of scale normally uses non-linear specification of the production function such as Cobb-Douglas or a translog function, from which the scale measure can be directly computed. The organizational success in choosing an optimal set of inputs with a given set of input prices is measured by the allocative efficiency in economic theory; this is differentiated from the technical efficiency concept associated with the production frontier, which measures the firm's success in producing maximum output from a given set of inputs (Kortmann et al, 2014).

Efficiency is associated with how well a relevant action is performed by the fields of engineering and management and therefore an organization will be termed as efficient it achieve its goals with minimal resources. According to Abbasi and Kaviani (2016), operational efficiency is the potential of an organization to produce products and services of high quality with minimum costs. Ideal benchmarks to measure efficiency are usually developed in a design laboratory under perfect operating conditions. It is very challenging

to determine the sources of efficiency loss between ideal performance and the observed performance. Abbasi & Kaviani (2016), defines Relative operational efficiency (ROE) as the ratio of actual throughput compared to best observed throughput.

1.1.3 Capacity Management Strategies and Efficiency

According to Preda and Watts (2003), the differences between the capacity of an organization and the demands of its customers will automatically lead to inefficiency into two ways which may be dissatisfied customers or underutilized resources. The former may be a serious cost, but the latter may result in lost sales, lost customers and potentially loss of reputation. Minimization of these discrepancies can be achieved by the ability of the operation to adjust the key resources. The capacity changes can happen at different stages as others can happen instantly while others take longer time to be put in place. The capacity of an operation is a complicated mix of resources. These resources are inputs to the process that allow capacity to be expanded or contracted, by changing the inputs into the process. The flexibility of the resource depends on how quickly it can be altered. Several methods can be used in increasing the capacity which involves adjusting the resources and inputs into an organization such as: introducing new approaches and materials, increasing the number of service providers or machines and increasing the number of operational hours (White, Froehle & Klassen, 2011).)

According to Rolia, Cherkasova, Arlitt & Andrzejak (2005), Chase strategy involves the process of adjusting or controlling the level of capacity to exactly fit demand by altering the number of service providers and/or the hours worked, sharing capacity between different parts of the service delivery system, transferring resources to where they are needed at that time, using outside suppliers through subcontracting or leasing to provide resources and asking customers to provide more resource by way of self service. The process is applicable when customers will not wait long for the service and there is an urgent need to get the process running. Level capacity strategy needs organizations to have their capacity at a reasonable level and live with it. By so doing it aims at influencing the level of demand by way of advertising and promotion, price changes, developing off peak demand, use of appointment and reservation systems and making customers queue for the service thus it is applicable where capacity is limited, and the focus is on influencing demand to be in line with capacity. According to Stevenson & Sum (2002), the demand should be visible before the time of use and the time customers are willing to wait when demand cannot be satisfied.

The ability of the service delivery system to achieve service quality and resource productivity

targets is directly influenced by matching supply and demand in services (Buxey, 2003). In addition to the chase and level strategies for managing capacity in services, a coping strategy for capacity management is described which aims to improve the overall delivery of service quality while achieving resource productivity targets. At some times coping strategy is very important for all organizations. There is an indication of a less than satisfactory handling of the coping situation from various research results derived from the experience of a range of service organizations. The main of coping strategy is to improve the overall delivery of service quality while achieving resource productivity targets. It involves increasing the prices during the peak times and lowering them during the off-peak to manage demand (Jones & Kutsch, 2007). Coping strategy calls for all service managers to influence potential customers to wait, get a system for prioritizing customers where there are conflicting demands from several customers and train staff to increase their willingness to solve problems when need arises (Abrahao, Almeida, Almeida, Zhang, Beyer & Safai, 2006).

1.1.4 Electrical Energy Sector in Kenya

The Government of Kenya has assumed an essential job in the energy sector institutional structure as it comprises of a few bodies with explicit goals. The administration bodies that bargains with vitality in Kenya incorporates the Ministry of Energy and Petroleum (MOEP), the Geothermal Development Company (GDC), the Energy Regulatory Commission (ERC), the Kenya Electricity Generating Company (KenGen), the Kenya Power and Lighting Company (KPLC), the Kenya Electricity Transmission Company (KETRACO), and the Rural Electrification Authority (REA). There are likewise private financial specialists who partake in the vitality segment and falls under Independent Power Producers (IPPs).

The Ministry of Energy and Petroleum is in charge of making appropriate condition for development, speculation and proficient tasks in the Kenyan vitality part. Control of the energy sector is finished by the Energy Regulation Commission (ERC) since 2007 whereby it capacities is to ensure the premiums of purchasers, financial specialists and partners. The commission is likewise ordered to direct in a reasonable, straightforward and prescient way, and keep up great contact with government strategy by been touchy to partners in the division (Kenya Energy Act, 2006). GDC which is claimed by the Government completely it has the command of investigating geothermal fields, boring creation wells and overseeing steam fields with the point of pitching steam to financial specialists in the geothermal vitality part including KenGen and the IPPs. It is KenGen that possesses all Kenya open power age offices which deliver roughly 75% of intensity produced in the nation.

KETRACO is additionally an organization that is completely possessed by the administration to grow high-voltage power transmission framework so as to empower to gigantic association and matrix interconnectivity to control plants and neighboring nations, in this way empowering exchange with different utilities in the area. KPLC is the main purchaser of power committed by Kenyan laws to purchase control from all power generators through an organized Power Purchase Agreement (PPA). It is likewise the principle transmitter and wholesaler of power from the national framework to purchasers in Kenya. IPPs have an introduced limit of 606 MW which establish roughly 28% of the nation's introduced limit and involves the accompanying significant makers:

Tsavo Power, Iberafrica, Thika Power, Gulf Power, Rabai Power, Triumph, OrPower4, Mumias Sugar Company and Strathmore University Rooftop Solar (Langat, 2016).

The power industry in Kenya faces a lot of challenges which includes; inadequate generation capacity, unskilled or low numbers in the skilled workforce, poor maintenance of existing power stations, poor transmission infrastructure, as well as poor metering and billing systems which leads to delayed supply of power (Ulsrud, Winther, Palit & Rohracher, 2015). According to Kiplagat, Wang and Li (2011), the Kenyan power sector is not different from the other power sectors in the East African region. The rate of energy production in Kenya has been estimated at about 13.89 million TOE. The growing economy of the country has led to demand for energy. The rate of growth of the country's energy generation is not proportional to the growth in demand. Electricity accounts for about 8% of the total national energy demand. Access to electricity has been estimated at 23% of the population on national level and 4% in rural areas. The national per capita consumption of electricity is estimated to be 121 kWh per year. Kenya's current installed power capacity is 2,229 MW, with a latent demand of 2,552 MW. Large and small hydropower, geothermal, thermal, wind, solar and cogeneration are the major sources of electricity in Kenya (Republic of Kenya, 2014).

A study conducted by United Nations Economic Commission for Africa (UNECA) on the energy efficiency policies of Eastern African countries shows the inconsistency of institutional commitment to energy efficiency over a sufficiently long time frame. The reasons behind this are large fluctuations in international energy prices over time or lack of patience and foresight of public decision makers who expect immediate results from energy efficiency actions. In such cases, the results fall far below their expectations because market players are not willing to participate in energy efficiency initiatives if they do not see long

term signals from the government (UNECA, 2015). The Power Africa Programme initiated by former US President Barack Obama in 2013 has a goal to add 30,000 MW of cleaner and more efficient electricity generation capacity, and a commitment to increase electricity access by 60 million new home and business connections (House, 2013). This study aims at looking at the capacity management strategies and operational efficiency in the energy sector in Kenya in order to come up with strategies of improving operational efficiency in the energy sector in Kenya.

1.2 Statement of the Problem

Kenyan government has to increase the level of investment in its power sector in order to the growing demand of the power. Investigation of a scope of nation and local examinations proposes Africa should include around 250 GW of limit among now and 2030 to take care of demand development. This will call for limit increments to twofold to around 7 GW a year for the time being and to fourfold by 2030. So as to build the size of investment then the governments will need public-private partnerships and favorable policies for private investors in order to scale up investment in generation capacity (Kiplagat, Wang & Li, 2011). Beyond the low level of energy utilization per capita, and unsustainable over-reliance on bio-mass then the vitality area is looked with gigantic issues in the journey for feasible vitality advancement. Kenya's economy has been developing at around 5.1% every year in the course of the most recent 10 years whereby financial development has been tested by deficient and untrustworthy supply of power.

As at September 2018, Kenya has an introduced age limit of just 2,351 MW or 0.049 kW per capita. As watched, this has developed from an introduced limit base of 1,885 MW as of the finish of June 2014, it is still low. The Government of Kenya's Vision 2030 financial improvement outline program expects to twofold Kenya's rate of development. For the Kenyan government to accomplish the vision 2030 diagram then high interest in the power administrations industry is basic (Republic of Kenya, 2014). As indicated by the Ministry of Energy's Draft National Energy and Petroleum Policy, October 2014, crest power request

was anticipated to develop to 18,000 MW by 2030 because of an expansion in the quantity of clients associated with power and in addition expanded force of vitality use (Brew-Hammond, 2014). This would meet a compound yearly development rate of 16.2% from the present base (Republic of Kenya, 2014). Wairimu (2014) studied capacity management strategies and service quality in petroleum distribution firms in Kenya, Ong'ondo (2014) studied effect of capacity management strategies on service quality in Safaricom Limited retail outlets, Mwangangi (2015) studied capacity management and service delivery of commercial banks in Kenya while Odhiambo (2013) investigated the operational efficiency of container freight stations at the port city of Mombasa. All these studies focused on firms in the private sector, with little having been researched on the effect of capacity management on the operational efficiency in the energy sector, a sector that is crucial for the development of regional economies, but which has been operating with inefficiency. This is the gap that the present study aims to fill, by investigating the effect of capacity management on operational efficiency in the energy sector in Kenya.

1.3 Research Questions

The research question is the fundamental core of the research project and it determines the methodology, and guides all stages of the inquiry, analysis and reporting. The research questions that will guide this study are:

1. What is the capacity management strategies employed by the energy sector in Kenya?
2. How do capacity management strategies affect operational efficiency of the energy sector in Kenya?
3. What are the capacity management constraints facing the energy sector in Kenya?

1.4 Objectives of the Study

The research objectives are what we expect to achieve from the study. These objectives serve to guide the activities of the research. The objectives of this study are:

1. To find out the capacity management strategies employed by the energy sector in Kenya
2. To investigate the impact of capacity management strategies on operational efficiency of the energy sector in Kenya
3. To determine the capacity management constraints facing the energy sector in Kenya

1.5 Value of the Study

The study will benefit regional power generating companies, public as well as private. The study will help the management and especially operations managers in these companies get a deeper understanding of capacity management and its importance enhancing operational efficiency. They will also be able to identify the challenges facing their capacity management efforts in energy generation and come up with viable capacity management strategies. This will in effect help increase efficiency in the energy sector in Kenya and enhance economic development.

This study will enable the government and development partners come up with better policies to increase the capacity of energy generating companies in the country. This will be in the form of increased investment in human, financial and technology resources. The government will also increase funding for research and development in the energy sector.

The findings will also be valuable to future researchers and academicians as it will extent the existing knowledge in capacity management besides acting as a source of reference. In addition, the study would suggest areas for further research that future scholars and academicians can further knowledge on. Academicians can do further research on the effect of capacity management on the operational efficiency in other sectors in the country.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter begins by reviewing theories that underpin the study before discussing the various strategies employed in capacity management. Related studies are then reviewed before exposing the research gap that the current study seeks to fill.

2.2 Theoretical Review

A theory is a body of internally consistent empirical generalization of descriptive and explanatory power. A theory explains, describes and predicts phenomena. The theoretical review is the structure that identifies and describes the major elements, variables or constructs that organize your scholarship (Labaree, 2009). This study will be guided by the theory of constraints and contingency theory of management.

2.2.1 Theory of Constraints

The theory of constraints (TOC) was developed by Goldratt (1990) and is mostly concerned with systems-management philosophy. The foundation of thesis of TOC is that constraints establish the limits of performance for any system. Most organizations contain only a few core constraints. TOC urges the managers to focus on effectively managing the capacity and capability of these constraints in order to improve the performance of their organization. TOC insists managers to restructure some of their fundamental assumptions about how to achieve the goals of their organizations, about what they consider productive actions, and about the real purpose of cost management. TOC aims at understanding and managing the constraints that stand between an organization and the attainment of its goals. Once the constraints are well known, TOC subordinates all the non-constraining resources of the organization to the needs of its core constraints.

According to Madani, Sojoudi, & Lavaei (2015), some of the constraints that cause severe energy shortages include; weak financial position of energy companies, liquidity crunch, falling gas production, low exploitation of indigenous coal and hydro resources, high dependence on oil/gas as power generation source and unutilized power generation capacity. There are also transmission constraints that limit deliverance of generation to customer demand. The capacity constraints do limit electricity production in power generation firms. In many parts of the world, wholesale markets are linked together via a transmission grid.

According to Bartos & Chester (2015), transmission capacity constraints may limit the ability of buyers to acquire power from distant generation firms.

2.2.2 Contingency Theory of Management

Contingency theory was developed to aid in the study of organizational behavior in which explanations are given as to how contingent factors such as technology, culture and the external environment affects the design and function of organizations. The theory underlies to the assumption that no single type of organizational structure is equally applicable to all organizations. Rather, organizational effectiveness is dependent on a fit or match between the type of technology, environmental volatility, the size of the organization, the features of the organizational structure and its information system. Contingency theory was developed from the sociological functionalist theories of organization structure such as the structural approaches to organizational studies (Reid & Smith, 2000).

The concept of fit has been defined by Van de Ven and Drazin (1985) in three approaches; selection, interaction and systems approaches. First, in the selection approach, the interpretation of fit was that, if an organization wants to survive or be effective, it must adapt to the characterizations of its organizational context. In this view, organizational design is caused by organizational context. Second, fit is interpreted as an interaction effect of organizational structure and context on performance (Khandwalla, 1977). Third, another approach in the contingency theory literature regarding fit is the systems approach. According to the systems approach, one can understand organizational design only by simultaneously investigating the contingencies, structural alternatives and performance criteria existing in an organization (Van de Ven & Drazin, 1985). The organizational structure influences capacity management. For operations to be effective there must be the right organizational structure. This requires the management to analyze the operational needs of the organization, function by function or department by department, and create an organization that helps employees work together efficiently (Stevenson & Sum, 2002).

2.3 Capacity Management Strategies

Capacity management strategies involve analysis, planning and optimization of potentiality to meet demands efficiently and cheap cost (Armistead & Clark, 1994). They observed capacity management as a process with wide dimension that sums up business; utility and asset capacity requirements to secure maximum utilization of assets to attain the acceptable standards of performance.

Capacity management, therefore, is the most important and strategic decision area of operations incorporating decisions on how to juggle demand and the potential of delivering services to meet demands. A service company's achievement or failure in the process of juggling service quality and assets control, represented in terms of asset productivity, depends on its skill in controlling capacity to meet demand (Armistead & Clark, 1991). On the contrary, if the company were to embrace a plan to utilize surplus demand by constantly operating over optimal or close to full capacity, it would make the firm vulnerable to continual threats of decline in the service quality Heskett (1990). The following sub-sections discuss various capacity management strategies.

2.3.1 Chase Strategy

The chase strategy is one of three planning strategies, used more in conjunction with determining work force size, and backlogs. According to Chase and Jacobs (2011), the chase strategy compares the production rate to the order rate by hiring and lying off employees as the order rate varies. In comparison with level capacity strategy, chase service managers who use the chase strategy are generally responsible for training unskilled laborers who are hired for the minimal pay jobs in the least attractive work conditions (Sasser, 1976). According to Jacobs and Chase (2011), the success of the chase strategy depends on having a pool of easily trained applicants to hire to fill orders as needed, usually when there is an increase in order sizes.

Capacity management in service sector presents additional problems to those of manufacturing industries because service firms are faced with a strong seasonality in demand. Kim et al., (2004) also notes that many service industries face considerable demand uncertainty and seasonal variations. For instance, market demands typically are much higher during summer holidays and Christmas than during the rest of year (Kim et al, 2004). On the other, the need for the customer to be actually present when

the service is given is fundamental to many sectors. This personalized demand directly affects the quality of service offered. Additionally, services are perishable by nature and hence for each day those services are not put to profitable use, they cannot be saved (Thomas, 1978).

2.3.2 Level Capacity Strategy

According to Stevenson and Sum (2002), level capacity strategies are increasingly linked to yield management systems where effective capacity is constrained, for example in airlines, hotels, and car rental. In yield management the aim is not necessarily to gain the highest utilization from the limited resource but rather to maximize the revenue yield from pricing differentials. This brings with it an additional control mechanism of overbooking which may result in customers not being served at the time they expect. The first method is to have a fixed capacity irrespective of the demand. This is a very simple strategy and if the demand is lower than the capacity, the extra idle capacity is wasted. When the demand is more than the capacity, it cannot meet the higher demand. Level strategies are applicable when demand is more visible before the time of use and the service organizations can effectively tell customers to wait when demand cannot be satisfied, i.e. the service is valued by the customers and they are willing to wait (Armisted & Clark, 1993).

Katiraei and Iravani (2006) explain that in goods manufacturing or in logistics when the demand is low, the firms could continue its production to make and keep an inventory level for future demand. This will help to meet the high customer demand when capacity is lower than demand. However, in service delivery there is not the possibility of producing the complete service package in advance of demand and holding it as an inventory since the services are perishable by nature (Armistead & Clark, 1993). In addition, services tend to keep additional capacity in anticipation of additional business. Most service sectors have strict capacity constraints. Moreover, if the customer demand is not met, then there is a high risk of losing customer base. So, to serve as many customers as possible and to have competitive advantage companies prefer to keep the capacity at the maximum anticipated level (Irene et al., 1998). This also helps them to avoid implementation of the complicated capacity management techniques.

2.3.3 Coping Strategy

As we saw before, there is a relation between capacity management, quality management and efficiency management. Several authors have identified problems confronting when managing supply and demand, which affect the quality of services (Rhyme, 1988). As capacity is managed more efficiently, there is a possibility that the quality of services might get affected. Armistead and Clark (1993) say that it is inevitable that at times service organizations run out of capacity to meet demand. They call it the coping zone. In coping zone, there is more demand than can be managed with the available capacity. This inability of managing the demand leads to a fall in the quality of services offered to the customers (Kell & Fromentin, 2007).

Coping is the strategy that aims to improve the overall delivery of service quality to resource productivity targets. Matching supply and demand in services by capacity management has a direct influence on the ability of the service delivery system to achieve service quality and resource productivity targets. As service operations managers become adept at managing capacity and balancing it with demand it is at these capacity break-points where things start to go wrong. What is needed is some control over the decline in service quality which almost inevitable at these times or an accurate costing of steps to create new capacity and of the decision-making process. In addition to the chase and level capacity strategies proposed, we need an additional coping strategy which applies to the short-term inability to match effective capacity and demand. The coping strategy is appropriate for those circumstances which can be characterized by being busy or being slack (Kosnik, 2006).

According to Kell and Fromentin (2007), here are then four areas when the coping strategy becomes necessary: When a chase strategy becomes level in the short term because effective capacity cannot be increased to meet demand, usually because this would lead to under-utilization of resources, when a chase strategy becomes level because it is not possible to reduce the level of resources any lower in the short term, when a level strategy fails to stifle demand or overbooks and when a level strategy is unsuccessful at filling effective capacity. The chase and level strategies of Sasser are in themselves inadequate to handle the limits of effective capacity. The coping strategy has been presented as the additional tool based on observations of operation managers in service organizations (Kosnik, 2006).

2.4 Operational Efficiency

Deane, Gallachóir and McKeogh (2010) define operational efficiency as what occurs when the right combination of people, process, and technology come together to enhance the productivity and value of any business operation, while driving down the cost of routine operations to a desired level. The result is that resources previously needed to manage operational tasks can be redirected to new, high-value initiatives that bring additional capabilities to the organization. Operational efficiency deals with minimization of waste and maximization of resource capabilities, in order to deliver quality products and services to customers. Operational efficiency is concerned with identifying wasteful processes and resources that drain the organization's profits. It aims at maximizing delivery of outputs while minimizing costs of inputs and delivery. A fundamental requirement here is a radical shift from input-oriented line item incremental budget to a prioritized well-costed output-oriented budget (Sueyoshi & Goto, 2011).

An essential first step in getting started on improving the efficiency of operations is for the department head to make it a priority. The importance of operational efficiency must be communicated from the top (Musardo, Rizzoni, Guezennec & Staccia, 2005). The management needs to promote an environment in which an efficiency mentality can thrive. Instilling an operational efficiency mentality in a department can be difficult because it often requires some different ways of thinking than we are accustomed to. Operational efficiency requires everyone to become a ‘fire preventer,’ rather than a ‘fire fighter.’ The focus is on improving an activity’s efficiency over the long term, not just patching up procedures and work routines as problems occur (Alanne & Saari, 2006).

Energy efficiency is part of a process that we call energy management that always represents the first step of any energy-related project (Green, 2001). The assessment of power consumption habits and patterns, in a domestic, professional or manufacturing environment, must anticipate any energy generation project. Energy efficiency refers to using less energy to provide the same or improved level of service to the energy consumer in an economically efficient way; it includes using less energy at any time, including during peak periods. This will also include demand response which entails customers changing their normal consumption patterns in response to changes in the price of energy over time or to incentive payments designed to induce

lower electricity use when prices are high, or system reliability is in jeopardy (Rabaey & Verstraete, 2005).

2.5 Empirical Review

Quillérou, Roudaut and Guyader (2013) studied managing fleet capacity effectively under second-hand market redistribution. A gravity model and a random-effect Poisson regression model were used to analyze the determinants and spatial extent of the second-hand market in France. This study was based on panel data from the French Atlantic Ocean between 1992 and 2009. The trade flows between trading partners was found to increase with their sizes and to be spatially concentrated. Despite the low trade flows between regions, a net impact analysis showed that fishing capacity is redistributed by the second-hand market to regions on the Channel and Aquitaine from central regions.

Hofman (2014) investigated capacity management at the radiology department of Isala Hospital in the Netherlands. The study sought to find out the challenges facing the department in managing the variability of scheduled and unscheduled arrivals. Based on meetings with the stakeholders and observations, the study identified the main bottlenecks that negatively impact the performance namely: a shortage of emergency slots because of a lack of insight in the emergency arrivals and an incorrect or incorrectly used block schedule.

Feng (2009) investigated the causes and effects of rework on the delivery of healthcare facilities in California. The study aimed to identifying the causes of rework within a design and permitting process of healthcare facilities in California. Three computer simulations were created to illustrate the effect of rework on system performance. The study identified three throttles that control production throughput namely: inflow of projects, resource capacity and likelihood of rework. Simulations highlighted the tradeoffs management can make between the last two. It was also found that alternative review process can improve system performance and that negative rework can be detrimental to system performance.

Odhiambo (2013) investigated the operational efficiency of container freight stations at the port city of Mombasa. The study aimed at measuring the relative operational efficiency of the CFS's at the seaport town of Mombasa using DEA methodology and to establish the factors that determine operational efficiency at container freight

stations (CFS's). The results showed very narrow differentials between the most efficient CFS's and the most inefficient one. The study also found that personnel and equipment were the most relevant in determining operational efficiency among CFS's in Mombasa.

Wairimu (2014) studied capacity management strategies and service quality in petroleum distribution firms in Kenya. The study aimed to establish the relationship between capacity management strategies and perceived service quality in the oil distribution sector in Kenya. The study found that chase capacity management strategy to be the mostly employed capacity management strategy by firms in the oil distribution sector in Kenya. The study also established that capacity management approach and service context can interact and the interaction positively influences perceived service quality.

Ong'ondo (2014) investigated the effect of capacity management strategies on service quality in Safaricom Limited retail outlets. A correlation and a cross sectional survey study was designed in which the researcher used a questionnaire to collect both primary data and secondary data. A total of 36 respondents drawn from Safaricom retail outlets across the country participated in the study. The findings showed that implementation of capacity management strategies by Safaricom Limited at its various retail outlets throughout Kenya enhanced the provider's quality of service provision.

Mwangangi (2015) studied capacity management and service delivery of commercial banks in Kenya. The objective of the study was to the study was to establish the capacity management practices adapted by commercial banks in Kenya and how the same affects service delivery. A descriptive research design was used whereby all the 42 commercial banks in Kenya formed the sample frame. Findings showed that the common capacity management practices employed by the banks are shifting capacity, offloading capacity, sub-contracting and level capacity management.

2.6 Summary

The theory of constraints (TOC) is a systems-management philosophy developed by Goldratt (1990). The fundamental thesis of TOC is that constraints establish the limits of performance for any system. Contingency theory is an approach to the study of organizational behavior in which explanations are given as to how

contingent factors such as technology, culture and the external environment influence the design and function of organizations. The chase strategy is one of three planning strategies, used more in conjunction with determining work force size, and backlogs. According to Stevenson and Sum (2002), level capacity strategies are increasingly linked to yield management systems where effective capacity is constrained, for example in airlines, hotels, and car rental. Coping is the strategy that aims to improve the overall delivery of service quality to resource productivity targets.

Quillérou et al., (2013) studied managing fleet capacity effectively under second-hand market redistribution. This study did not investigate capacity management strategies employed in the market and their effects on efficiency. Hofman (2014) investigated capacity management at the radiology department of Isala Hospital in the Netherlands. Although the study established the challenges facing the department in managing the variability of scheduled and unscheduled arrivals, it did not find out the capacity management strategies that were employed in the hospital. Feng (2009) investigated the causes and effects of rework on the delivery of healthcare facilities in California. This study created computer simulations to illustrate the effect of rework on system performance but did not interview workers to get more information.

Odhiambo (2013) investigated the operational efficiency of container freight stations at the port city of Mombasa. The study did not look at the effect of capacity management strategies on efficiency. Wairimu (2014) studied capacity management strategies and service quality in petroleum distribution firms in Kenya. Although this study determined the capacity management strategies used by the various companies, it did not look at the effect the strategies had on efficiency. Ong'ondo (2014) investigated the effect of capacity management strategies on service quality in Safaricom Limited retail outlets. Although this study determined the capacity management strategies used by the various outlets, it did not look at the effect the strategies had on efficiency. Mwangangi (2015) studied capacity management and service delivery of commercial banks in Kenya. The study did not look at the effect of capacity management strategies on efficiency.

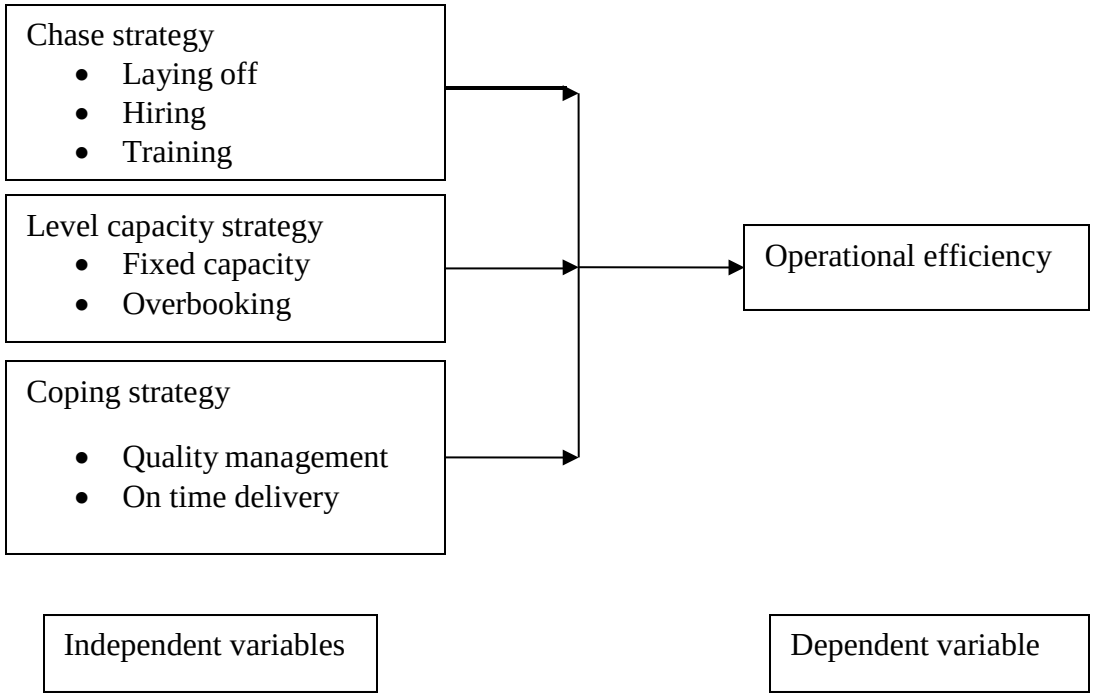
All the above strategies have focused on capacity management in various sectors of the economy, with none focusing on the energy sector. Second, none of the studies

has focused on the effect of capacity management strategies on operational efficiency. This is the gap that current study aims to fill by finding out the effect of capacity management strategies on the operational efficiency in the energy sector in Kenya.

2.7 Conceptual Framework

Conceptual framework is a graphical or diagrammatic interaction among variables in a study (Mugenda & Mugenda, 2003). It represents the relationship among the independent variable, and the dependent variable. The following is the conceptual frame work conceptualized from the research topic

Figure 1: Conceptual Framework



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology that was used in the study. It comprises the design to be employed, population of the study, data collection procedure and data analysis.

3.2 Research Design

This study adopted a survey design (Cooper & Schindler, 2003). This design was chosen because it is more precise and accurate as it involves description of events in a carefully planned way (Babbie, 2004). It also portrays the characteristics of a population in their natural setting fully (Chandran, 2004). The unit of analysis was proposed as the individual firms in the energy sector.

3.3 Population of the Study

The target population of this study was the 11 main public and private power generating companies in Kenya. These include the Kenya Electricity Generating Company (KenGen), which is partly owned by the Government of Kenya and private investors, and private power generating companies, also known as Independent Power Producers (IPPs). KenGen produces about 78% of electricity consumed in the country. Table 1 below shows the list of the 11 main energy producing companies in Kenya.

Table 1: List of Main Power Producing Companies in Kenya

Company	Installed Capacity as at Sept 2018 (MW)
1.Kengen	1,631
2.Iberafrica (MSD)	109
3.Tsavo Power (MSD)	74
4. Mumias Co-generation (Bagasse)	38
5. OrPower4 (Geothermal)	150
6. Rabai Power (MSD)	90
7. Thika Power (MSD)	87
8. Gulf Power (MSD)	80
9. Triumph Power (MSD)	83
10. Bidco (Biomass)	2
11. Strathmore University (Solar PV)	0.25

3.4 Sampling Technique and Sample Size

The study randomly selected one employee from top management, one from middle level management and one from functional level in each of the 11 firms. This gave a sample size of 33.

3.5 Data Collection Method

Primary data was collected from operations managers of the various companies using self-completion structured questionnaires. Self-completion questionnaires are more time saving for the researcher. Use of self-completion questionnaires also reduces interviewer bias unlike the case when the researcher helps in completing questionnaires ending up revealing their own opinions when replying to areas where the respondent needs clarity (Berdie, Anderson & Niebuhr, 1986).

A preliminary structured questionnaire containing closed questions was prepared and presented to the supervisor for evaluation and approval after which it was pre-tested to identify and change any ambiguous, awkward, or offensive questions. The study used a structured questionnaire because every respondent is asked the same question in the same way, which makes it a reliable method (Cooper & Schindler, 2003). Questionnaires was administered using a drop and pick later method. The advantage

with this method is that respondents can fill in at their own convenient time so as to reduce interruptions in their work schedules. This also saves time for the researcher as well as enabling him/her to reach as many respondents as possible (Berdie et al., 1986).

3.6 Data Analysis

Descriptive statistics was used to determine the capacity management constraints facing the energy sector in Kenya. Descriptive statistics was also used to analyze the capacity management strategies employed by the energy sector in Kenya. To determine the impact of capacity management on operational efficiency of the energy sector in Kenya, multivariate regression was used. The regression model was:

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon}$$

Where: Y = Operational efficiency

X_1= chase strategy X_2 = coping strategy

X_3 = level capacity strategy

The data was analyzed using the IBM Statistical Program for Social Sciences (SPSS) version 25. Descriptive statistics was used to summarize the data. This includes percentages and frequencies. Tables, pie charts and other graphs was used to present the data collected for ease of understanding. Measures of central tendency was also used (mean, standard deviation median, mode and percentages).

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION

4.1. Introduction

This chapter presents analysis and findings of the study as per the research methodology. The results were presented on the capacity management and operational efficiency in the Kenya energy sector. The study targeted the 11 main power producers, with each firm having 3 employees as respondents. In this case, 24 out of

33 subjects responded and returned their questionnaires contributing to a 72.7% response rate. This response rate can be classified as excellent and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting, a rate of 60% is good, and a response rate of 70% and above is excellent. This chapter covers analysis of the capacity strategies: level capacity strategy, chase strategy and coping strategy, capacity management constraints and operational efficiency.

4.2. Descriptive Statistics

The study used a Likert scale to collect data on the views of employees regarding various statements for the variables under study. A scale of 1 - 5 was used where responses were categorized by level of agreement as:

1 – Strongly disagree; 2 –

Disagree;

3 – Neutral;

4 – Agree;

5 – Strongly Agree.

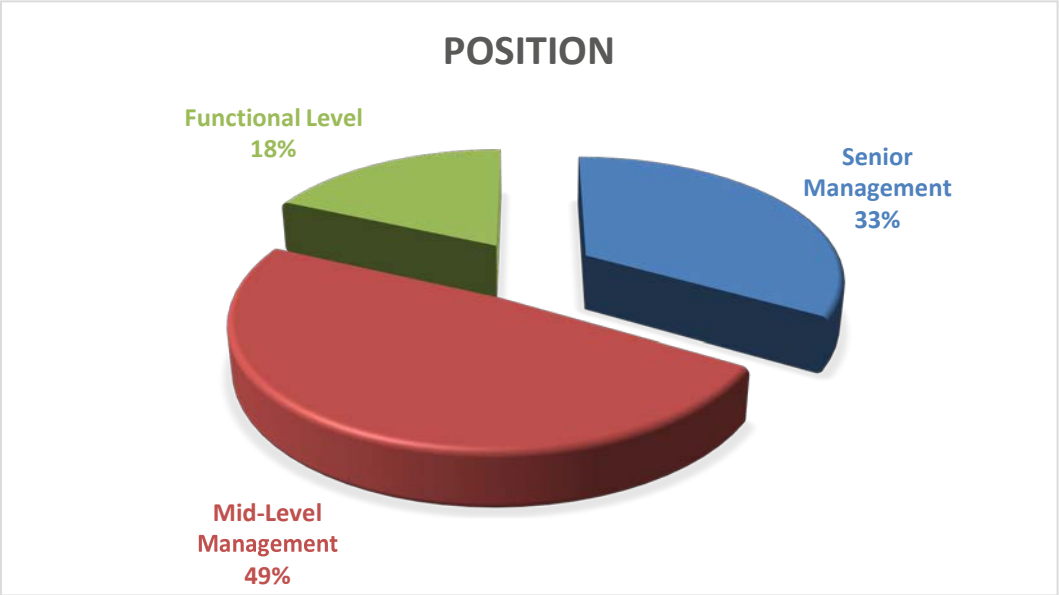
The mean and standard deviation for each statement was generated and the mean index for each variable arrived at.

4.3. General Information

When questioned on general information, including their position in the organization, the subjects indicated their appropriateness in replying to the questions on the capacity management strategies and operational efficiency of power companies in Kenya. This part of the study sought to ascertain the subjects involved in the study. The information points to the subjects' ability in answering the questions on the capacity management strategies and operational efficiency on electric energy companies in Kenya.

4.3.1. Position in the Organization

Figure 2: Position in the Organization



The study sought to find out at what level in the organization each respondent came from. From the findings, 33% of the respondents were from Senior Management, 48% were from Mid-Level Management, and 18% came from Functional Level. The senior management comprised of operations managers and maintenance managers, mid-level management comprised of supervisors, while functional level employees comprised of plant operators and technicians. This composition of respondents indicates that the

questionnaires were filled by qualified employees in their areas as far as the study is concerned. The results are presented in Figure 2 above.

4.3.2. Number of Employees

Table 2: Number of Employees

Company	**Installed Capacity (MW)**	**Number of Employees**	**Employees per MW**
1.Kengen	1,631	**2,407**	**1.48**
2.Iberafrica (MSD)	109	**50**	**0.46**
3.Tsavo Power (MSD)	74	**63**	**0.85**
4. Mumias Co-generation (Bagasse)	38	**-**	**N/A**
5. OrPower4 (Geothermal)	150	**29**	**0.19**
6. Rabai Power (MSD)	90	**50**	**0.56**
7. Thika Power (MSD)	87	**45**	**0.52**
8. Gulf Power (MSD)	80	**60**	**0.75**
9. Triumph Power (MSD)	83	**52**	**0.63**
10. Bidco (Biomass)	2	**-**	**N/A**
11. Strathmore University (Solar PV)	0.25	**-**	**N/A**

The study sought to find out the average staffing levels in each organization. This informs the more effective use of labour, optimized for the creation of value, increased productivity, and eventually leading to reducing costs. The number of employees in each of the organizations sampled varied according to the power generation source, with some technologies requiring higher staff numbers for each unit of installed capacity than others. The results are presented in Table 2 above.

4.4. Capacity Management Strategies

Table 3: Capacity Management Strategies

STATEMENT	Mean	Standard Deviation
Flexible workforce	**4.01**	**0.136**
Variable shifts	**4.23**	**0.111**
Scheduled working hours	**3.01**	**0.38**
Part time/contracted employees	**3.64**	**0.147**
Sharing capacity with other energy producers	**2.43**	**0.482**
Use of outsourced capacity	**3.75**	**0.251**
Transferring capacity to where they are really needed	**3.56**	**0.267**
Averages	**3.52**	**0.253**

The study sought to find out the responses about capacity management strategies. On whether the organization has flexible workforce, the findings generated a mean of 4.01 and standard deviation of 0.136, on whether the organization has variable shifts the findings generated a mean of 4.23 and a standard deviation of 0.111, on whether the organization has scheduled working hours, the findings generated a mean of 3.01 and a standard deviation of 0.38, on whether the organization has part time/contracted employees, the findings generated a mean of 3.64 and a standard deviation of 0.147, on whether the organization has been sharing capacity with other energy producers, the findings generated a mean of 2.43 and a standard deviation of 0.482, on whether the organization has use of outsourced capacity, the findings generated a mean of 3.75 and a standard deviation of 0.251, and on whether the organization has transferring capacity to where they are really needed, the findings generated a mean of 3.56 and a standard deviation of 0.253.

Results are given on Table 3 above.

4.5. Capacity Management Constraints

Table 4: Capacity Management Constraints

Top Ranked Challenges	**Frequency**	**Percentage**
Bad start (under/over provisioning)	**7**	**29.17**
Lack of skilled employees	**3**	**12.50**
Lack of top management support	**10**	**41.67**
Insufficient financing	**3**	**12.50**
Competition	**1**	**4.17**
Total	**24**	**100**

The study sought to establish the subject's opinion on the capacity management constraints that are faced by the energy companies in Kenya. As presented in Table 4 above, majority of the respondents said that most of the firms lack top management support which is represented by 41.67%, bad start 29.17%, insufficient financing 12.50%, lack of skilled employees 12.50% and finally completion 4.17%. In summary, this would mean that most employees feel that inadequate top management support creates the biggest impediment to effective capacity management in energy companies in Kenya. This has caused some of them to be shut down, like the Mumias co-generation plant, while some of them suffer from frequent breakdowns and outages.

4.6. Operational Efficiency

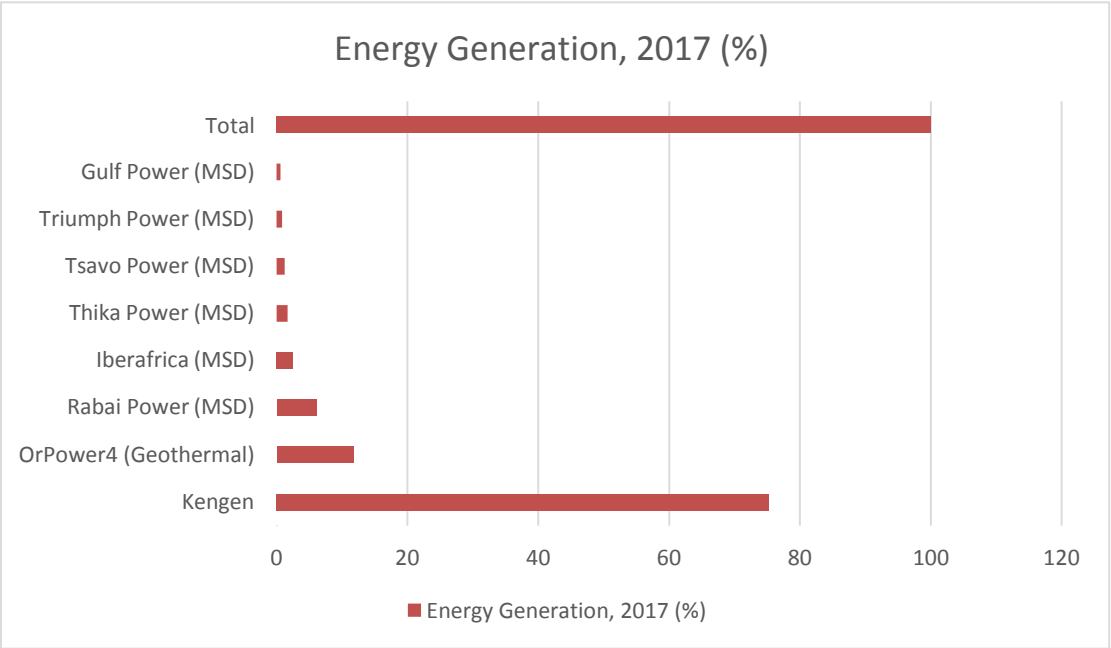
Table 5: Plant Availability and Capacity Factor

Company	Plant Availability (%)	Annual Energy Generation, 2017 (GWh)	Capacity Factor (%)
1.Kengen	88.99%	7,513	53%
2.Iberafrica (MSD)	93.92%	252	26%
3.Tsavo Power (MSD)	97.21%	121	19%
4. Mumias Co-generation (Bagasse)	-	-	-
5. OrPower4 (Geothermal)	98.9%	1,172	89%
6. Rabai Power (MSD)	91.65%	607	77%
7. Thika Power (MSD)	95.72%	168	22%
8. Gulf Power (MSD)	93.60%	61	9%
9. Triumph Power (MSD)	92.87%	83	11%
10. Bidco (Biomass)	-	-	-
11. Strathmore University (Solar PV)	-	-	-

The study sought to establish the organization operational efficiency of various energy firms in Kenya which was measured by the capacity factor, which is analysis of the total energy production during the year compared to the total potential electricity that could have been generated if the plant operated at 100% during the same period. Plant availability is also impacted by variation of the cost of operations and maintenance, number of plant breakdowns and the number of customer complaints. Plant availability is considered among the best indicators of power plant performance, and the study offers an interesting opportunity to compare power plants

using similar technologies. KenGen has a wide-ranging portfolio of generation assets cutting across different technologies, which affects their average availability rating.

Figure 3: Annual Energy Generation



In comparing energy generation for the year 2017, KenGen contributed 7,513 GWh to the national grid, or 74% of the total energy sold to KPLC, mainly from its geothermal and hydropower sources. Orpower4, also a geothermal source, contributed 12% of the total energy, while the other IPPs contributed the remainder, mainly due to merit-order dispatch and transmission constraints. This data is presented in Table 6 above.

Table 6: Operational Efficiency

Metric	**Increased**	**Unchanged**	**Decreased**
Cost of Operation & Maintenance	75.00%	20.83%	4.17%
Plant Breakdowns	20.83%	66.67%	12.50%
Customer Complaints	4.17%	83.33%	12.50%

Respondents were also asked their opinion about changes in the cost of operations and maintenance, frequency of plant breakdowns and number of customer complaints. Three quarters of the respondents felt that the cost of operations and maintenance had gone up, while two thirds felt that the number of breakdowns had remained unchanged, with 20 respondents saying that the number of customer complaints had not increased or decreased. The results are presented in Table 7 above.

4.7. Capacity Management Strategies and Operational Efficiency

A multiple regression analysis was conducted to determine the relationship between capacity management strategies and operation efficiency in the energy sector in Kenya. The coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (Operational Efficiency) that is explained by all the three independent variables (Chase Capacity Strategy, Coping Strategy and Level Capacity Strategy).

Table 7: Data Used for the Regression Analysis

Company	Operational Efficiency (Y)	Chase Strategy (X1)	Coping Strategy (X2)	Level Capacity Strategy (X3)
KenGen	0.53	4.4	4.6	4.5
Iberafrica (MSD)	0.26	3.6	3.4	3.33
Tsavo Power (MSD)	0.19	3.6	4.2	4.33
Mumias Co-generation (Bagasse)	-	-	-	-
OrPower4 (Geothermal)	0.89	4	3.63	3.67
Rabai Power (MSD)	0.77	3.8	3.4	3.33
Thika Power (MSD)	0.22	3.4	3.8	4
Gulf Power (MSD)	0.09	4.8	5	5
Triumph Power (MSD)	0.11	3.4	4.1	3.2
Bidco (Biomass)	-	-	-	-
Strathmore University (Solar PV)	-	-	-	-

Statistical package for social sciences (SPSS V 25.0) was used in coding, entering and computing the measurements of the multiple regressions for the study. The results from the package are summarized in the tables below. As shown in Table 9 below, the three independent variables that were studied explain 61.5% of the operational efficiency as represented by the R2. This therefore means that other factors not accounted for in this model contribute to 39.5% of the operational efficiency in energy companies in Kenya. Therefore, further research should be conducted to investigate the other factors (39.5%) that influence operational efficiency in the energy generating companies in Kenya.

Table 8: Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.784[a]	.615	.327	.25344

a. Predictors: (Constant), X3, X1, X2

As shown in Table 10 below, the significance value is 0.239 which is more than 0.05 thus the model is statistically not significant in predicting how chase capacity strategy, coping strategy and level capacity strategy influence operational efficiency in electric utility companies in Kenya. A reason for this could be the small sample size, or it could be that the three predictors are competing with each other for significance. The F critical at 5% level of significance was 3.23. Since F calculated (2.132) is less than the F critical (value = 3.23), this shows that the overall regression model was not significant.

Table 9: Analysis of Variance

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.411	3	.137	2.132	.239[b]
	Residual	.257	4	.064		
	Total	.668	7			

a. Dependent Variable: Y

b. Predictors: (Constant), X3, X1, X2

Multiple regression analysis was conducted to determine the relationship between capacity management strategies and operational efficiency and the three variables as per the regression equation, taking all factors (chase capacity strategy, coping capacity strategy and level capacity strategy) at zero, operational efficiency will be

0.612. The data findings in Table 11 below also show that taking all other independent variables at zero, a unit increase in chase capacity strategy will lead to a 0.547 increase in operational efficiency, a unit increase in coping capacity strategy will lead to a 0.557 decrease in operational efficiency and a unit increase in level strategy will lead to a 0.029 decrease in operational efficiency. This infers that all the factors are significant to the achievement of operational efficiency.

Table 10: Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.612	.790		.775	.482
	X1	.547	.287	.887	1.907	.129
	X2	-.557	.325	-1.035	-1.716	.161
	X3	-.029	.304	-.060	-.094	.929

a. Dependent Variable: Y

4.8. Discussion of Findings

The relations to each of the specific objectives were compared with the literature review. It was found that the findings agreed with the works of previous researchers. The findings of the study are discussed below in relation to the objectives. On application of capacity management strategies and operational efficiency, the study found that the two had a positive relationship. The model equation developed has shown the extent to which application of capacity management strategies has influenced operational efficiency in the 11 main electric utility firms in Kenya.

According to Bartos & Chester (2015), the ability of consumers to acquire power from distant generation plants may be limited by transmission capacity constraints.

Transmission capacity determines how much generation capacity can be added to the grid, which in turn affects the operational efficiency of power plants since they would not be able to run at full capacity if the grid's capacity is insufficient. This study's findings agree with this observation, which tallies with the Theory of Constraints, and found that capacity management strategies of both utility operators and power generating companies positively affected operational efficiency (Table 9). In the absence of error, the table indicates that the three independent variables had a 61.5% influence on organizational operational efficiency.

The study findings on the extent of application of capacity management practices also agree with the recommendation by Daya and Duffaa (1995). The two had noted that capacity management practices should be viewed as a value adding activity instead of a necessary evil of expenses. The findings also agree with Armistead & Clark, (1991) who suggested that capacity management is the most critical and strategic decision area of operations incorporating decisions on how to juggle demand and the potential of delivering services to meet demands. A service company's achievement or failure in the process of juggling service quality and assets control, represented in terms of asset productivity, depends on its skill in controlling capacity to meet demand. From the findings, electric utility firms with the highest extent of capacity management strategies had the best operational efficiency. The OrPower4 geothermal power plants had the highest organizational operational efficiency of 89, which also translates to high plant availability levels of 98.9%.

The application of chase capacity management strategy, according to Jacobs and Chase (2011), depends on having a pool of easily trained applicants to hire to fill orders as needed, usually when there is an increase in generation requirements and as plants age, which leads to increased breakdowns. According to the findings of the

study, a pool of highly skilled workers, who often work on short-term contracts is shared among different power generating companies. However, some companies prefer to retain a constant number of staff, which would result in wasted idle capacity in seasons of low power demand. This is due to the volatile nature of power demand and the demands set by the agreements in place with the power purchaser which set strict staffing requirements. This would agree with Irene et al., 1998, who postulated that to serve customers as effectively as possible and to have competitive advantage companies prefer to keep the capacity at the maximum anticipated level. In cases of inability to meet contractual demand, such as was observed with several plants operated by the public generator, KenGen, the companies enter a coping zone where there is more demand than can be managed with the available capacity. This inability of managing the demand leads to a fall in the quality of services offered to the customers (Kell & Fromentin, 2007). This is exhibited by the lower levels of operational efficiency in terms of plant availability (89% for KenGen).

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings on the study of capacity management strategies and the operational efficiency of the energy sector in Kenya. The conclusions and recommendations are drawn here as well. The chapter is therefore structured into summary of findings, conclusions, recommendations and area for further research. The conclusions and recommendations have drawn focus on the purpose of the study.

5.2 Summary of Findings

The study found out that the energy companies in Kenya have flexible workforces in their organizations. It was also found that energy companies in Kenya have variable shifts for their employees. The study also found that these organizations have scheduled working hours to make sure that they serve their customers effectively. It was also found that energy companies in Kenya have part time or the so-called contracted employees who usually work for the companies. The study also found that the companies have been sharing capacity with other energy producers which is beneficial to the whole sector. It was also found that the organizations have been using outsourced capacity in their daily operations. Finally, it was found that the organizations have been transferring capacity to where they are really needed.

The study also found that there are quality management systems in place and they provide key performance indicators to evaluate awareness of quality of work at all levels of the organization. It was also found that the companies' quality levels are determined by end user benchmarks and the regulatory authorities as a means of enhancing quality management. The findings confirmed the literature that quality of

service offered in the market for consumption locally or for export are expected to be of high quality because of regulation due to quality control regulations.

The study also found that most companies in the energy sector in Kenya have in- service training for their employees so that that they can improve their productivity. The study has also shown that most of the companies have an adequate number of employees who are in a position of giving adequate services to their customers. The study also found that all employees are trained to be conversant with all equipment available and can use them effectively. The study has also shown that there has been a good relationship between the companies and their customer hence services are being given equally. The study also found that the biggest challenge affecting energy companies in Kenya is lack of top management support. This has led to poor operational performance of several the energy generating companies in Kenya. The study also found that most of the unsuccessful energy companies are as a result of bad start, insufficient project finance and insufficient skilled personnel, among other challenges affecting the energy sector.

The regression analysis applied in the study to study the relationship between capacity management strategies and operational efficiency had a significance value greater than the significance level, which indicates that there is insufficient evidence from the study to conclude that a non-zero correlation exists. On the other hand, the model coefficients tell us that all other variables held constant, chase strategy increases by a factor of 0.547 given a one-unit shift in operational efficiency, while coping and level strategies decrease by factors of 0.557 and 0.029 respectively with other variables held constant.

5.3 Conclusion

It was found that the traditional way of measuring organizational performance is by financial analysis of net profit, return on sales, return on investment and cash flow. In the case of the energy sector, companies regularly use capacity management strategies to accomplish and maintain market share with limited resources. Capacity management strategy manages the plan and management of materials, procedures, operations, maintenance and supply chain. Capacity management strategy also incorporates level capacity strategy, chase capacity strategy and coping strategy.

The study concluded that the focus on Kenya is to advance co-operation amongst neighboring country power markets so as to build a robust transmission network as well as develop new markets for the generation capacity being brought onto the grid.

Quality of services offered in the market for consumption locally or for export are expected to be of high quality because of regulation due to quality control and safety regulations. Conclusively, management of risk is the planned measures of procedures and strategies that are utilized to coordinate a firm to control the numerous risks that can influence its capacity to accomplish goals. Organizations are now adopting capacity management practices as a profit generating business element. Additionally, the operational efficiency function plays a major role in providing a service that is suited to the company's abilities and for which there is an adequate market. The market has imposed high efficiency norms and firms that neglect to meet them are immediately marginalized.

5.4 Recommendations

The study recommends that the top management in energy generating companies should increase awareness of staff at all levels on ways to achieve higher levels of operational efficiency through reduction of operations and maintenance costs,

reduction of plant breakdown times through preventive maintenance among other initiatives, reduction of customer complaints through concise and transparent communication to the utility company, and eventual increase in plant availability and increased energy generation. Each capacity management strategy should also be measured and evaluated for their contribution to operational efficiency.

Additionally, it also recommended that energy generating companies should utilize effective procurement procedures that eliminate delayed payment processes that prevent quick access to critical spare parts in an emergency plant breakdown. Moreover, the study recommended that building up an effective preventive and reactive maintenance program could turn into a competency center or even a specialized competency, depending on the technology of power generation in use.

5.5 Limitations of the Study

Getting information from respondents was a major challenge faced by the researcher due to the busy nature of the respondents' work. Additionally, many of the respondents were not comfortable with providing sensitive company information related to their operational performance as well as administrative information. Despite these challenges, the findings from the study are informative and would be of great benefit to electric utility firms in Kenya.

Some of the targeted respondents did not respond within the allocated time while some failed to acknowledge the questionnaire. However, the researcher minimized non-response cases by following up with emails and calls.

5.6 Suggestion for Further Studies

Further studies using a larger sample size should be done on capacity management strategies and operational efficiency in the energy sector in Kenya to enhance the

study and determine more relationships between capacity management strategies and operational efficiency in the energy sector in Kenya. Similarly, in the study, not all measures of operational efficiency were covered, therefore more detailed studies can be embarked on. Furthermore, the study can go further and test the reliability of the collected data.

Going by the findings and conclusion, it is evident that capacity management strategies have an influence on operational efficiency. This study was only done for energy companies in Kenya. The scope can be broadened to cover the rest of Africa and even globally to capture more data points and to have a global perspective.

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APPENDIX I: QUESTIONNAIRE

This questionnaire contains questions meant to measure Capacity Management Strategies and Operational Efficiency in the energy sector in Kenya.

Section A: General Information

Kindly respond by ticking [√] in the boxes provided (where applicable).

1. Name of Organization:
2. Position in the organization:

   Senior Management [ ]
   Supervisor [ ]
   Operator/ Technician [ ]
   Any Other _____

3. Number of employees in the organization: _____

Section B: Capacity Management Strategies

Please indicate to what extent your company uses the following strategies to match customer demand?

1=extremely often 2=very often 3=moderately often 4=rarely 5=not at all

STATEMENT	**1**	**2**	**3**	**4**	**5**
Flexible workforce					
Variable shifts					
Scheduled working hours					
Part time/contracted employees					
Sharing capacity with other energy producers					
Use of outsourced capacity					
Transferring capacity to where they are really needed					
Others (please specify)					

Section C: Capacity Management Constraints

Rank the following capacity management challenges as faced by your organization from the most faced to the least faced.

1= Most Faced Challenges; 5 = Least Faced Challenges

Challenges	**Rank**
Bad start (under/over provisioning)	
Lack of skilled employees	
Lack of top management support	
Insufficient financing	
Competition	
Other (please specify)	

Section D: Operational Efficiency

1. What has been the change in operational efficiency in your organization for the last three years?

STATEMENT	**Increased**	**Constant**	**Decreased**
Cost of Operation & Maintenance			
Profitability/surplus			

2. What is your average plant availability?_____%
3. What is the average annual energy generation?_____GWh

THANK YOU FOR YOUR TIME!