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Panaceas To Load Shedding Faced By Small Scale Businesses (SMEs) - A case study of SMEs in Lusaka district

Dr. Chaste Nsama (PhD), Mr. Edward Nyambe
Graduate School of Business, The University of Zambia

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ABSTRACT
The research was aimed at investigating the impact of load shedding and then providing solutions to load shedding faced by small scale businesses in Zambia. The study indicated that load shedding generally started between 2014 and 2015, when Zambia recorded poor rainfall in the 2014/15 rain season. This led to lower water levels in the water reservoirs. Before the year 2014, Zambia was experiencing good rainfall for instance, in Lusaka, rainfall reduced from 490.4mm to 247.5mm and Ndola, from 599.1mm to 320.6mm between 2013 and 2014. The Zambia Electricity Supply Corporation (ZESCO) was then compelled to reduce generation at its major power stations resulting in a national electricity capacity deficit of 560 Megawatts and this led to the beginning of load shedding in Zambia. The presence of load shedding makes it very costly for small scale businesses to operate. When there is no electricity, it means work comes to a standstill for businesses like barbershops, hair salons and welders and for shops that store various food stuffs in fridges, for example, dairy products, fresh fish and beef. Therefore, this study has provided solutions to load shedding faced by small scale businesses in Zambia. From the current researcher's stand point, Zambia has many of its citizens operating small scale businesses and their operations depend on energy which comes from Zambia electricity Supply Corporation (ZESCO). The bigger challenge faced by small scale business operators in doing business is due to the presence of load shedding, and the increase in the load shedding hours. The study sample was taken from Chipata, Chazanga and Kabanana compounds in Lusaka, Zambia. This study recommends that the small-scale businesses should consider forming cooperative partnerships and contribute funds to invest in the implementation of alternative sources of energy. The pragmatic mixed methods (convergent parallel) approach was used in this study. There were (n=80) participants who were conveniently selected as participants for this study out of which only 63 actually participated. Data was collected from them through questionnaires. Also, more information was obtained from Strategic Informers who were interviewed using semi-structured interviews approach. Interviews verbatim were written up narratively in Microsoft Office word. The study findings revealed that there is load shedding affecting small scale businesses in Zambia. Load shedding negatively affects small scale businesses and this in turn negatively affects the entire economy of Zambia. Further, this may result in high unemployment and also increases in other unethical activities. Therefore, the researcher recommends investing in alternative energy sources such as solar panels, inverters, gensets etc. if the SMEs are to run their business operations without interruption.

The study recommended Small-scale businesses should consider forming cooperatives and contribute funds to invest in the alternative sources of power which they can distribute among themselves. The recommended alternative sources of power are; Solar energy, Biomass energy, Wind energy, Geothermal energy, Nuclear energy, inverters and batteries.

Key Words:
Load shedding

ZESCO Zambia Electricity Supply Corporation
CSO Central Statistics Office
PMRC Policy Monitoring and Research Centre
ZDA Zambia Development Agency
GDP Gross Domestic Product
ERB Energy Regulation Board
IISD International Institute for Sustainable Development
CUTS Consumer Unit Trust Society
USAID United States Aid for International Development

EMT *Ecological Modernization Theory*
EIZ *Engineering Institute of Zambia*
CEIC *Census and Economic Information Centre*
IAEA *International Atomic Energy Agency*

Background of the Study

- Load shedding in Zambia generally started in 2014 when Zambia recorded poor rainfall in the 2014/15 rain season.
- The Zambia Electricity Supply Corporation (ZESCO) was then compelled to reduce generation at its major power stations resulting in a national electricity capacity deficit of 560 Megawatts
- This led to the beginning of load shedding in Zambia (PMRC, 2015).

Statement of the Problem

- Many Zambian citizens are trying to survive by engaging in entrepreneurial activities such as operating small-scale businesses (CEIC, 2021)
- However, this has proven to be very challenging because of load shedding, as most of the operations for small scale businesses depend on electricity which is in short supply. (PMRC, 2015); (Alfred et al., 2017).
- By increasing operating costs, load shedding reduces productivity of small-scale business operators, which in turn affects taxes, council levies, disposable income and Gross Domestic Product (GDP).

General Objective

- The general objective of this research is to provide solutions to load shedding faced by small scale businesses in Zambia.

Specific Objectives

1. To evaluation the effect of load shedding faced by small scale businesses in Zambia.
2. To identify appropriate remedies or solutions to the load shedding problem affecting small scale businesses in Zambia.
3. To establish how the small-scale businesses can implement the alternative source of energy to mitigate load shedding.

I. LITERATURE REVIEW

Introduction

This chapter provides the literature reviewed by the researcher in relation to the study at hand. Reviewing other literature helps to demonstrate the researcher's familiarity with the body of knowledge and establish credibility, as well as, showing how the current research project is linked to past research (Neuman, 2006). This chapter reviews the necessary literature for the study. The review will rely greatly on, empirical studies, data obtained from published materials such as books, online magazines, and journals. The review will provide an overview of major past activities that have earlier been studied.

Causes of load shedding and when it started

Load shedding in Zambia generally started in 2014/15, when Zambia recorded poor rainfall in the 2014/15 rain season. This led to lower water levels in the water reservoirs. The Zambia Electricity Supply Corporation (ZESCO) was then compelled to reduce generation at its major power stations resulting in a national electricity capacity deficit of 560 Megawatts. This eventually led to the start of load shedding (PMRC, 2015). Since then, load shedding has persisted and the country has been experiencing it every year, with load shedding hours increasing to more than four hours on a daily basis in some parts of the country (Chabala, 2019); (Chisanga, 2016). Load shedding negatively affects small scale businesses a lot as their businesses depend highly on steady supply of electricity. This is because they do not have adequate capacity to easily switch to other sources of energy as compared to larger businesses (Chabala, 2019).

According to the Energy Regulation Board (ERB), the economic impact in 2015 caused by load shedding on small scale enterprises in four towns (Kitwe, Lusaka, Livingstone and Ndola) surveyed came to a total of K623,871,514.50 incurred as a result of load shedding by small scale enterprises translating into US$ 0.95/kWhlos (kilowatt hours lost). In terms of kilowatt hours lost per town, Kitwe town had the highest loss at US$ 1.94/kWhlos, followed by Lusaka at US$ 0.97/kWhlos. Livingstone town was third at US$ 0.53/kWhlos, while Ndola was the lowest at US$ 0.51/kWhlos, (Alfred et al., 2017).

2.2 Zambia's growing economy and the increase in electricity demand

Zambia's economy has been growing at an average of 5% per annum over the past 10 years, (PMRC, 2015). Growth in the economy has certainly exceeded the growth in demand for electricity. Adding to this, new settlements have been established as well as new businesses, industries and new mines, for example, in North Western Province where new mines have been established such as; Lumwana Copper Mine, Kansanhi, Kalumbilia Mine and Sentinel Copper Mine.

Electricity demand in Zambia outweighs supply especially during peak hours (PMRC, 2015).

Zambia largely depends on hydro-power as a means of generating and supplying power or electricity to its citizens. This is achieved through hydro generators which generate power by harnessing the power of moving or falling water to produce electrical energy and for this to take place, there must be good rainfall, generally.

Electricity demand has been increasing by 3 to 4 per cent per annum since 2015 (Bridle, 2018). Since the year 2014, a number of new electrical power generators have been introduced, including Zambia's first coal power station and several diesel and heavy fuel oil generators. These have reduced the dependence on hydropower but have increased operating costs as fuel costs for thermal generators must now be factored into the cost of supply.

Some past suggestions on how to mitigate load shedding

An alternative vision for the energy sector was discussed at an event in Lusaka hosted on May 15, 2018 by the International Institute for Sustainable Development (IISD) and Consumer Unity Trust Society (CUTS). The discussion was about the possibility of renewable energy sources replacing fossil fuel generators, power further expansion and deliver electricity without the risk of locking Zambia into expensive fuel contracts. Further discussions were on how the capital costs of renewable energy could be funded. Research by the International Institute for Sustainable Development (IISD) and Consumer Unity Trust Society (CUTS) suggested that one solution could be freeing up resources by phasing out subsidies to fossil fuels and to reallocate some of these funds to support development of renewables (Bridle, 2018).

Phase out diesel generators and replace with cheaper solar energy. Recent auctions show that prices for solar may now be lower than diesel generation, so a transition would reduce costs for the national utility company, ZESCO (Bridle, 2018). Reduce access to subsidized electricity in the mining sector. Some of the additional revenues generated could be allocated to fund energy efficiency and clean energy projects to further improve mining sector (Bridle, 2018).

Similar reforms in Zambia would offer a way to improve electricity sector cost recovery and increase generation capacity without a big increase in polluting coal or diesel generation. Further work is needed to develop these concepts into practical policies that are acceptable to the energy sector and to its stakeholders. (Bridle, 2018)

According to (Get.Invest, n.d.) , approximately 70% of the country's electricity demand is driven by its mining sector, which benefits from highly subsidized electricity rates. Peak demand has been recorded at 1,960 MW. Growth in electricity demand has been estimated at between 150 MW and 200 MW per year.

Also, (USAID, 2020), stated that Zambia has 2,800 MW of installed electricity generation capacity, of which 85% is hydro based and 15% relating to non-hydro (Coal, Heavy Fuel Oil, and others). It also mentioned that the Zambian government would bring additional energy through solar, hydro, and thermal power in 2020.

Significance of small-scale businesses to economic productivity and growth

Small scale businesses form a significant part of the economic productivity and contribute greatly to the economic growth of Zambia. They are a source of employment as well as steady income for many of the country's citizens. According to (Invest.com, 2017), SMEs account for 70% of Zambia's GDP and 88% of the employment.

Effects of load shedding

Therefore, when small scale businesses are negatively affected by load shedding, the entire economy of Zambia will be affected as this may result in high unemployment and also increases in other unethical activities like thefts, robberies, and people begging on the streets among others. Load shedding has the potential of significantly increasing hunger through reduction in food production as it reduces business operating hours. It is also likely to reduce the GDP of the country, like what happened in 2015 when the country's GDP reduced by about 20% due to load shedding, (Chabala, 2019).

The current energy deficit in Zambia has caused a lot of disturbances in the economy because energy plays a critical role in economic development. Currently, Zambia faces a critical energy shortage that has crippled both formal and informal businesses. Load Shedding, unannounced power-cuts and fuel shortages have characterized Zambia's economy with both domestic and commercial consumers struggling to acclimatize to the new order. In many places across Zambia, both large- and small-scale businesses have slowed down on production as they have to work only when there is electricity.

Theoretical framework

The study will use the ecological modernization theory (EMT). This theory will be

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used because it is line with the study at hand and the conceptual framework. This theory can be used to understand the empirical phenomenon of increasing adoption of alternative sources of energy. The alternative sources of energy, which generally comprise renewable energy sources as mentioned above are; solar energy, biomass, wind energy, geothermal and petroleum products. The theory considers the human-environment relationship and theoretically ground modernization and environmental degradation. This study shall apply this theory to the alternative sources of energy adoption and explore what the theory offers for understanding potential policies and practices that promote renewable energy technology adoption (Resources, 2015); (Sonnenfeld, 2000).

This study will examine the viability of the renewable energy sources on the Zambian environment. The study will consider the availability of these renewable energy sources in Zambia, the user-friendliness of the energy sources to the Zambian environment as well as the citizens, the cost of implementing them and thereafter, recommend the best renewable or alternative energy sources to be implemented in Zambia. The study will further guide on how the recommended renewable energy sources can be implemented in Zambia.

II. METHODOLOGY

Research Design

The Pragmatic mixed methods (convergent parallel) research design was used as it was considered the appropriate approach because by using quantitative or qualitative method as stand-alone approach was inadequate to best understand the research problem and triangulation of research methods provided the best understanding.

Target Population

The target population was 80 SMEs in Kabanana, Chazanga and Chipata compounds and three institutions; ZESCO, ERB and EIZ.

Data Collection Instruments

Data was collected using a structured interview schedule and a questionnaire.

Data Analysis

Data analysis involved organizing the raw data in order to make sense out of it. Raw data on its own may not bring out the lessons and outcomes unless it is organized. This study used both qualitative and quantitative data. The quantitative data collected was first checked, cleaned and finally coded. After the quantitative data was coded properly, it was entered into a software for analysis called Statistical Package for Social Sciences (SPSS).

III. DISCUSSION OF FINDINGS

Characteristics	Asymp Sig (2 sided) p-value (unadjusted estimates)	Asymp Sig (2-sided) p-value (Adjusted estimates)
Revenue	0.002	0.048***
Expenditure	<0.0001	0.003***
Longest period of load shedding	0.001	0.012***
Shortest period of load shedding	0.391	0.115^{ns}
Profit/loss	<0.0001	0.024***
Knowledge about load shedding	0.354	0.831^{ns}
Knowledge about alternative source of power	0.446	0.783^{ns}

Revenue

The p-value for revenue was at 0.048***. Loadshedding significantly affected the revenue levels among SMEs. In that, the more they experienced load shedding, the lower their revenue. It was further observed that those SMEs who were not affected by load shedding, their levels of revenue were not negatively affected by load shedding. It is also worth noting that, there were significant differences in terms of revenue among SMEs who were affected by load shedding and those who were not affected by load shedding.

Expenditure

The p-value for expenditure/cost was at 0.003***. There were significant differences between the SMEs who were affected by load shedding and those who were not affected by load shedding in terms of expenditure/cost of running the business. Those who were affected by load shedding had a great deal in trying to stabilize their business operation in that, they opted to buy new equipment such as gensets, inverters, and batteries thus increasing the expenditure/cost and this further reduced the profit of the said SMEs compared to those who were not affected.

Longest period of load shedding

The p-value for the longest period of load shedding was 0.012***. Significant differences were also observed between the SMEs who were affected by load shedding and those who were not affected. The SMEs who were affected, recorded longer hours of load shedding on average compared to those who were not affected.

Profit/loss

The p-value for the profit/loss level was 0.024***. Long periods of load shedding and high expenditure/cost of business operations, translated into low profits or losses for most of the SMEs who were affected by load shedding. Significant differences in terms of profits were observed among SMEs. SMEs who were partly or not affected at all with load shedding had better profit percentages compared to the SMEs who were badly affected by load shedding. Most of the SMEs who were badly affected by load shedding recorded losses in their businesses and others ended up laying-off employees, changing businesses or completely closing their businesses.

Other variables: shortest period of load shedding, Knowledge about load shedding, and Knowledge about alternative source of power.

Non-significant differences were recorded in other variables such as shortest period of load shedding, knowledge about load shedding and knowledge about alternative sources of power. Non-significant differences (p=0.115) in the shortest period of load shedding indicate that both, the affected and non-affected SMEs experienced the same levels of load shedding in terms minimum hourly exposure to load shedding. This further indicates that, all the SMEs were exposed to load shedding however, the significant difference was in the longest period for load shedding experienced and not the shortest period. In terms of knowledge about load shedding and knowledge about alternative source of power, non-significant differences were observed. Both the affected and non- affected SMEs had knowledge about load shedding and about alternative sources of power. The only difference is that, those non affected SMEs, besides the knowledge about load shedding and the knowledge about alternative sources of power, they had already developed the strategize on how to run their business operation amidst load shedding.

IV. CONCLUSION AND RECOMMENDETIONS

Conclusions

- This study established that load shedding exists and negatively affects the operations of small-scale businesses.
- This is because most small-scale businesses depend on hydroelectricity provided by ZESCO.
- However, hydroelectricity has proven not to be sufficient as it depends on the availability of rain, which has been in short supply.

Recommendations

Solar energy - energy obtained from sunlight

- Zambia is exposed to an abundance of sunshine in most of the provinces throughout the year.
- This makes solar energy a highly viable source of energy for the country.
- Small-scale businesses should consider forming cooperatives and contribute funds to invest in high tech solar equipment and create a network of solar power which they can distribute among themselves.
- Also, they can be assisted to buy solar equipment cheaply by removing import duty and other import taxes on the importation of solar-related equipment.

Petroleum Products and gensets

- There are various Petroleum products available in Zambia, for example Petrol, Diesel, Kerosene among others, though they are mostly imported.
- These are used to generate electricity by putting them in motor powered generators, which can be connected to different electrical appliances or equipment.
- The Zambian government and other stakeholders should consider making petroleum products and gensets affordable to procure.

❖ One of the ways through which this can be achieved is through subsidizing petroleum products and gensets.

Inverters and batteries

❖ SMEs should also invest in inverters and batteries, as they have been proven to be an efficient alternative to hydropower.

Biomass energy

❖ This is renewable organic material that comes from plants and animals.

❖ Biomass energy can also be considered to be an alternative source of energy as there are considerable forest areas in Zambia, for example, Copperbelt, Western, North Western, Northern, Muchinga, Luapula, Southern provinces and other parts of Central and Lusaka provinces (Forestry Department, 2016).

❖ SMEs should form cooperative partnerships and put their funds together or source for finance to invest in machinery that can be used to convert plant organic material into electricity.

❖ As Biomass energy may cause deforestation, SMEs should also consider investing in tree planting programs to maintain the country's vegetation.

Wind energy

❖ This is a clean, free, and readily available renewable energy source.

❖ SMEs should form cooperatives and contribute funds to invest into wind masts and other equipment so they can be able to generate and distribute wind energy.

❖ Areas like; Chisamba, Petauke, Lumezi, Mpika, Nakonde, Mansa, Choma and Mwinilunga are known for windy climates. SMEs should consider installing wind masts in such area.

❖ SMEs cooperatives should also survey other open land spaces or semi - deserts with a lot of winds in the country for consideration as potential areas where more wind energy can be generated.

Geothermal energy

❖ This is the heat that comes from the sub-surface of the earth. SMEs should consider surveying areas in which Geothermal energy can be generated.

❖ Known areas that are potential locations for Geothermal energy generation include Chinyunyu Hot Springs, Gwisho Hot-Springs and Longola Hot Springs.

❖ SMEs should consider forming cooperatives and contributing funds to invest in machinery that can be used to generate geothermal energy for distribution amongst themselves.

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