

**UNIVERSITY OF ZAMBIA IN COLLABORATION WITH
ZIMBABWE OPEN UNIVERSITY**

**SITUATIONAL ANALYSIS OF THE EFFECTS OF LOAD
SHEDDING ON DAIRY MILK PRODUCTION INDUSTRY IN
ZAMBIA: A CASE OF FINTA FARMS, 2013 – 2016**

BY

DEAN MASULE

**SUBMITTED TO THE UNIVERSITY OF ZAMBIA/ ZIMBABWE
OPEN UNIVERSITY IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF MASTER OF
BUSINESS ADMINISTRATION (MBA)**

LUSAKA ZAMBIA

YEAR

2017

DECLARATION

I, Dean Masule declare that this dissertation is purely from my own efforts and it has never been submitted in any form either in full or part for a Master's degree at UNZA/ZOU or any other institution. Information from publication or unpublished works of others has been acknowledged in the text and is given in the references.

Signature..... **Date:**

Full names: Dean Masule

DEDICATION

This work is dedicated to my wife Kamwengo, my children, Joshua, Joanna, Emmanuel, Sepo, Musa and Ezra Masule for the support they gave me during the time of my study.

APPROVAL

This dissertation of Dean Masule is approved and submitted in partial fulfilment of the requirement for the award of the degree of Master of Business Administration (MBA) by the University of Zambia in corroboration with Zimbabwe Open University.

Name of Supervisor: Dr, William Phiri

Supervisor's signature.....Date.....

ACKNOWLEDGEMENT

My special gratitude goes to my employer, for having given me time off to study each time I applied for study leave.

My special gratitude go to my supervisor Dr. William Phiri for his support guidance and encouragement for making it easier for me to complete my studies successfully. I heartily thank my Regional Manager Mr. Billy Nsontaulwa for permissions he has been granting me each time I wanted to travel for school. My sincere thanks go to the management and staff of University of Zambia IDE for their hard work, understanding and made it easy for me to reach this level by ensuring that all the materials were available throughout the study.

Lastly I owe a million thanks to my beloved wife Kamwengo for her endless support, understanding and enduring the long hours of my absence from home during the period of my study. Special thanks to my children, Joshua, Joanna, Emmanuel, Sepo, Musa and Ezra for enduring my absence. I love you all.

TABLE OF CONTENTS

DECLARATION	i
DEDICATION	ii
APPROVAL.....	iii
ACKNOWLEDGEMENT	iv
List of Tables.....	ix
ACRONYMS	xi
ABSTRACT	xii
CHAPTER ONE: INTRODUCTION	1
1.0 Introduction	1
1.1 Background of the Study.....	1
1.2 Statement of the problem	2
1.3 Purpose of the study	3
1.4 Objectives of the Study	3
1.5 Research questions	4
1.6 Significance of the study	4
1.7 Scope of the study	5
1.8 Limitation of the study	5
1.9 Theoretical framework: Production theory	5
1.10 Definitions of terms.....	7
1.11 Summary	7
CHAPTER TWO: LITERATURE REVIEW	8
2.0 Introduction	8

2.1 General information on milk Production	9
2.2 Effects of load shedding on dairy industry in the world	9
2.2.1 A case of USA California.....	9
2.2.2 A case of Australia	11
2.3 Effects of load shedding on dairy farming in the region.....	12
2.3.1 A case of South Africa	12
2.3.2 A case of Kenya	14
2.3.3 A case of Zimbabwe.....	17
2.3.4 A case of Uganda	17
2.4 Effects of load shedding on the dairy milk production in Zambia.....	18
2.5 Effects of load shedding on profitability of firms-Zambia.	19
2.6 Situation of Finta before, during and after load shedding, 2013 -2016.	21
2.7 Critique of the literature reviewed.	22
2.8 Summary	23
CHAPTER THREE: METHODOLOGY OF THE STUDY	24
3.0 Introduction	24
3.1 Research Design	24
3.2 Target Population	24
3.3 Sample and Sampling Procedure.....	25
3.4 Data Collection Procedure	26
3.2 Data Collection Instruments.....	27
3.6 Data Analysis Methods	28

3.7 Ethical Considerations.....	28
3.8 Summary	29
CHAPTER FOUR: FINDINGS OF THE STUDY	30
4.0 Introductions.....	30
4.1 Participants according to gender	30
4.2 Distribution of participants according to age	31
4.3 Distribution of participants according to position.....	32
4.4 Distributions of participants according to experience.....	33
4.6 Presentation and analysis of load shedding information.....	35
4.7 Dairy industries would go for alternative power supply to mitigate for load shedding.....	36
4.8 Dairy industries that use alternative power system experiences an increase in production cost	37
4.9: Dairy industry is business enterprise processing milk and is not profitable in Zambia today due to load shedding.....	38
CHAPTER FIVE: DISCUSSIONS.....	39
5.0 Introduction	39
5.1 Research questions	39
5.2 Discussions.....	39
5.3 Summary	44
CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS.....	46
6.0 Introduction	46
6.1 Conclusions.....	46
6.2 Recommendations	48

6.2.1 Short term solutions to load shedding include 48

6.2.2 Long term solutions to load shedding include 49

REFERENCES 50

List of Tables

page

Table: 4.1 Distribution of questionnaire to participants from whom
data was collected.....25

Table: 4.4 Distribution of participants according to position.....33

Table: 4.6 Distribution of participants according to level of education.....35

Table: 4.7 Load shedding reduces quantity of milk harvested per day.....36

Table: 4.8 Dairy industries would go for alternative power supply to mitigate for
load shedding36

List of Figures

page

Figure: 4.2 Distribution of participants according to gender..... 31

Figure: 4.3 Distribution of participants according to age.....32

Figure: 4.5 Distribution of participants according to experience.....34

Figure: 4.9 The use of alternative supply and production cost.....37

Figure: 4.10 Dairy industry is business enterprise processing milk and is not profitable
in Zambia today due to load shedding.....38

ACRONYMS

ZESCO	Zambia electricity supply corporation
ZNFU	Zambia national farmers union
UNZA	University of Zambia
ZOU	Zimbabwe Open University
KVA	Kilovolt ampere
MCC	Milk collection Centre
MAZ	Millers association of Zambia
CCHP	Combined cooling heating and power
ECASA	Electrical contractors association of South Africa
NCPHSBBR	National commission for protection of human subjects of biological and Behavioral research
CPUC	California Public Utilities Commission
SCE	Southern California Edison
PG&E	Pacific gas and electric
CDFA	California Department of Food & Agriculture
KCC	Kenya Cooperative Creamers.

ABSTRACT

This research sought to assess the effects of load shedding on dairy milk production industries in Zambia. The researcher was motivated to undertake this study due to lack of socio economic development as a result of erratic power supply caused by load shedding to Zambian industries. The research sought to establish how load shedding affected the quantities of milk produced per day and to determine if the reduction of milk affected the company profits. The research further sought to ascertain whether the selected firm had resorted to the use of alternative sources of energy and its effects on productivity and profitability.

In order to achieve the objectives of the research, a case study of Finta farms limited, a Livingstone based dairy industry was undertaken. The primary data was obtained by the use of closed ended, self-administered questionnaires. From the analysis of the primary data, the research established that load shedding had a negative effect of a 20% drop on the quantities of milk harvested per day as it reduced from 2500 litres of milk to 2000 litres per day. The drop in the quantity collected from milk collection centres was due to challenges of power outages.

In order to mitigate the impact of load shedding, Finta farms reported that they had resorted to the use of alternative sources of energy and measures such as standby generators and overtime. Over time saw an increase from 5% to 11%. Another cost that swelled was energy cost from an average cost K21, 000, Zesco monthly bills to K70, 632 cost of diesel per month representing 29.7% increase and a combination of these costs reduced the profits of Finta farms.

Since some firms resort to procure standby generator sets during times of power interruptions, the republic of Zambia should consider encouraging investors to build a plant that would be manufacturing these big generators so that these sets can be easily procured even by the small scale farmers locally.

During times of load shedding the government should consider subsidizing the price of fuel to dairy farmers who in turn should not pass on high production cost to consumers.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This section discussed introduction, background of the study, statement of the problem, purpose of the study, objectives, research questions, significance and scope of the study and theoretical frame work”

1.1 Background of the Study

According to Swasigood (1985) a dairy is a business enterprise established for the harvesting or processing of animal milk for human consumption. A dairy is typically located on a dedicated dairy farm or in a section of a multi-purpose farm (mixed farm) that is concerned with the harvesting of milk. It is a well-known fact that the milk industry actively contributes to the economies of a number of communities, regions and countries. An increasing demand worldwide is noticeably emerging at present, and the industry is globalizing, thus increasing the scope and intensity of the global dairy trade (Potter and Hotchkiss, 1995).

This study was centered on assessing the effects of electricity load shedding on dairy industry; a case of Finta Farms in Livingstone.

In 2015 load shedding of electricity supply by ZESCO Limited started in April following a reduction in generation capacity. This intensified around June 2015, with most areas receiving eight hours of load-shedding per day in order to manage the shortfall of 2,100 Megawatt-hours (MWh) (ZNFU 2015b).

To manage this load shedding ZESCO came up with the shedding schedule for different locations. Zesco has four divisions across the country, namely Copper belt division, Lusaka division,

Northern division and Southern division and each of these divisions were covered with load shedding schedule. The time of load-shedding as stipulated by ZESCO was eight hours in most cases and was rotated among the sub-areas of the divisions. The load-shedding varied according to the division. For example, in Southern division where Livingstone which hosts Finta Dairy Farms, load shedding in October 2016 lasted for a period of 8 hours and it was rotational. (www.zesco.co.zm)

1.2 Statement of the problem

As early as 2006, ZESCO's installed capacity was about 1631 MW against the total demand of 1200 MW. This gave the company a surplus capacity of 431 MW some of which was exported within the region (www.zesco.co.za). However, by early 2007, ZESCO's generation capacity dropped to 1000 MW while demand increased to 1300 MW resulting in a shortfall of 300 MW. The generation capacity currently stands at 1,300 MW while peak demand has further increased to 1,450 MW resulting in a shortfall of 150 MW. ZESCO has further predicted that Zambia's power demand will drastically increase from the current 1,450 MW to 2,500 MW in the next five years resulting in a shortfall of 1,200 MW or 92% if the current generation capacity remains at the current levels (Chirwa and Sinyangwe, 2015).

This situation has resulted into electricity demand outstripping supply (shortage) by as much as 150 MW during peak periods.

When load shedding is in effect, firms are off electricity supply, during this period, production does not take place because firms need electricity to drive their productive equipment. Repeated

load shedding eventually leads to a decline in production and consequently the failure by firms to reach their planned sales volume. According to Ahuja (2008) reduced sales volume translates into reduced income because firms are unable to produce enough of their products to meet targeted sales volume.

In order to safe guard themselves against combined drop in production, firms are forced to use alternative standby generators and over time to recover part of the lost production, however the use of the alternatives leads to an increase in production costs impacting negatively on firm productivity. A combination of reduced income and increase in production costs ultimately results in reduced profits. (Singádu 2009).

This study therefore, sought to establish to what extent productivity and profitability in the dairy milk production industry had been affected as a result of load shedding.

1.3 Purpose of the study

The purpose of this study was to assess the effects of load shedding on dairy milk production industries: a case of Finta Farms.

1.4 Objectives of the Study

This study was guided by the following objectives.

1.4.1 General objective:

To assess the effects of load shedding on dairy production.

1.4.2 Specific objectives:

1. To establish the quantity of milk harvested per day before and after load shedding.
2. To ascertain alternative back up power system to being used by dairy industries.

3. To find out the correlation between the use of alternative power supply system and production cost.
4. To determine relationship between the quantities of milk collected per day and profitability of Finta farms.

1.5 Research questions

The following research questions were addressed:

- What is the quantity of milk harvested per day before and after load shedding?
- What is the alternative back up power system being used by dairy industry?
- What is the correlation between the use of alternative power supply systems and production cost?
- What is the relationship between the quantities of milk collected per day and profitability of Finta farms?

1.6 Significance of the study

The study could be used to persuade the Donor Community, private investors and other financiers to fund power generation rehabilitation, maintenance and expansion programme.

In addition, ZESCO, Government and other stakeholders would gain access to the firms' proposed long term solutions to load shedding which could be used to address the power deficit.

Furthermore the study may contribute to the body of knowledge for use by other researchers and interested parties.

Last but not the least, the study is a requirement for the university of Zambia and Zimbabwe Open University master of business administration students to write a research paper before they graduate and be awarded a degree.

1.7 Scope of the study

The study was conducted between September 2016 and March, 2017 in southern province. Specifically the study was conducted in Livingstone town.

The study concentrated on assessing the effects of load shedding on dairy milk production industries in Zambia: A Case of Finta Dairy Farms limited as such its findings cannot be generalized to other sectors or industries elsewhere where there is no load shedding.

1.8 Limitation of the study

The researcher of this study experienced some limitations such as unwillingness of the respondents in providing the much needed information. The researcher travelled several times to research centres in order to have the questionnaires completed and interviews conducted.

Survey research generally does not penetrate below the surface as more emphasis is given to the extent of information sought rather than to an in-depth analysis and this is a limitation.

The researcher focused on dairy milk industry particularly Finta Farm, due to this limitation, findings of this study may not be used to draw conclusions on the effects of load shedding on productivity and profitability of firms in other sectors.

Levels of literacy amongst the respondents affected the set time in collection of data. Gathering of secondary data was difficult in that this area of study has not been researched enough.

1.9 Theoretical framework: Production theory

Theory of production in economics is an effort to explain the principles by which a business firm decides how much of each commodity that it sells (its outputs or products) it will produce and how much of each kind of labor, raw materials, fixed capital good that it employs (its inputs or factors of production) it will use. The theory involves some of the most fundamental principles

of economics (Ahuja 2008). These include the relationship between the prices of commodities and the prices (or wages or rents) of the productive factors used to produce them and also the relationships between the prices of commodities and productive factors that are produced or used on the other.

According to Ahuja (2008) production is basically an activity of transformation which connects factor inputs and outputs.

The process of transforming inputs into outputs can be any of the following kinds.

Change in the form (raw material transformed to finished goods)

Change in place (supply chain factory to retailers). (Ahuja 2008)

With these three kinds of transformations, usability of goods or materials increases.

Labor, capital, land, raw material, time, and the variables are measured per unit of time and hence referred to as flow variables. Entrepreneurship has been added as part of the production inputs, though this can be measured by the managed expertise and the ability to make things happen.

An input is a good or a service that goes into production process. As economists refer to it, an input is simply anything which a firm buys for use in its production process.

An output on the other hand is any good or service that comes out of a production process.

Inputs are considered variable or fixed depending on how readily their usage can be changed.

Fixed input. (Ahuja 2008)

The researcher chose this theory to guide the study because in the theory of production, there is a relationship between the inputs and outputs. When prices of the inputs are high in most cases output prices would be high.

1.10 Definitions of terms

- 1.0 Load shedding: Power rationing. This is when electricity is denied to certain areas for a certain period because the demand outstrips supply.
- 2.0 Backup system : In this research a diesel generator set is more appropriate
- 3.0 Finta: A Livingstone dairy firm that produces, stores and processes milk for business
- 4.0 Dairy: a business enterprise established for the harvesting or processing of animal milk – mostly from cows or goats, but also from buffaloes, sheep, horses, or camels
- 5.0 Production cost: the cost incurred by a business when manufacturing a good or service.
- 6.0 Profit: the monetary surplus left to a producer or employer after deducting wages, rent, cost of raw materials.

1.11 Summary

This section discussed background of the study where a dairy was introduced as an enterprise that is established for harvesting or processing of animal milk for consumption. The chapter talked about how electricity demand outstripped electricity supply which resulted in load shedding of electricity which brought about the need to assess whether that load shedding affected the firm in terms of milk harvested per day, whether the alternative source of supply affected the profits of the firm.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Literature review has discussed general information on milk production, effects of load shedding in the world a case of Austria, effects of load shedding in the region a case of South Africa and Uganda, effects of load shedding in Zambia Africa and Uganda were, effects of load shedding on profitability of firms and lastly effects of using alternative back up power to mitigate load shedding and production costs.

Many parts of the world today are faced with the challenge of generating enough electricity to meet the demand. The increase in electricity demand in Zambia has been largely attributed to rapid rise in activity in a number of sectors including agriculture, mining, manufacturing and many new townships that have mushroomed in the recent past. (Malambo and Kabubi, 2017)

As economies grow, the demand for electrical energy grows in line with rising populations, industrialization, and rising incomes. Typically, for the developing world, investments in electricity generation capacity fail to keep up with the rapid demand growth, and this triggers power shortages and rationing or load shedding. Therefore, it's not surprising that some countries like Zambia still continue to struggle with major power deficits. While a reduction in future power deficits are expected in Africa, the problem will still persist because growth in power generation capacity is unlikely to keep up with the rising demand for power as economies grow (IEA 2014). More recently, several countries in Sub-Saharan Africa (SSA) have experienced power shortages, with the regional shortage estimated at 8,247 mega-Watts (MW) (SADC 2015).

2.1 General information on milk Production

Effects of load shedding on the quantity of milk harvested per day.

For commercial dairy farmers, the effect of load-shedding is two-fold; first it works indirectly through key intermediate inputs such as animals feed. Animals feed on hay grass and banana leaves which are grown in farms and irrigated and all these need electricity. Secondly load shedding has direct effects on additional costs for pumping water, cooling milk, and milking cows as firms acquire and operate back-up power sources. A lack of feed or water (resulting from load-shedding) also causes cows to lose potential on their peak production (i.e., during early lactation). This causes them to continue on a downward trend in milk production, further reducing on milk output.

(Samboko P et al 2016)

2.2 Effects of load shedding on dairy industry in the world

Many parts of the world today are faced with the challenge of generating enough electricity to meet the demand. The demand of power for the rapid growth of industries out strips the supply of power generated in many counties and Australia faced some outages of power that affected its agriculture industry in general and dairy milk production industry in particular.

www.advocacypanel.com.au

2.2.1 A case of USA California

The California dairy industry experienced blackouts in the summer of 2001 due to the hot weather which resulted in high demand and short supplies of electricity, which forced rolling blackouts from San Diego to Sacramento. According to Francesconi (2001), the state faced a 34

days of rolling blackouts during the summer months. The outages and rate increases for electricity had an immediate impact on the dairy industry in California, the largest milk producing state in the nation. California is also the largest producer of powdered milk and second largest in cheese manufacturing. These two commodities, especially powder, use substantial amounts of natural gas in the manufacturing process. So far, it has been the high prices and limited supplies of natural gas that has hurt agriculture in California. Relatively flat utility prices was expected to change. In June 2001, all Californian was hit with an increase in electrical rates that had been approved by the California Public Utilities Commission (CPUC). On May 15, the CPUC voted to approve a plan that changed how customers of the state's largest utility companies, Southern California Edison (SCE) and Pacific Gas and Electric (PG&E), were to pay for power. According to Francesconi (2001), the Dairy Marketing Branch, headquartered in Sacramento, had the responsibility of administrating the formulas that establish minimum prices for the five separate classes of milk. To monitor what was happening in the dairy industry, the Dairy Marketing Branch employed a "Cost of Production Unit" which performed audits on dairy farms. This audit provided necessary information to CDFA in determining whether to change the pricing formulas that establishes minimum farm level milk prices. The studies were used frequently to establish reasonable manufacturing cost (make) allowances through the public hearing process. (Francesconi, 2001)

2.2.2 A case of Australia

In Australia dairy farmers use electricity on a lot of things such that a day without power would affect production of milk and huge sums loss of revenue. According to economics consulting group (2013) electricity usage for agricultural production purposes is on a daily basis.

www.advocacypanel.com.au . Major requirements are for: the milking machinery, which is used twice, sometimes three times per day, the chillers for the raw milk before it is picked up , refrigerators for animal health products, such as vaccines , hot water systems for cleaning equipment in the dairy, computers and other electronic data and sensory systems for quality control and recording purposes, irrigation pumps for some farms and other farm workshop requirements These requirements demonstrate the crucial nature of reliability of supply for dairy farmers. Load shedding of electricity would be very significant. One farmer lost over \$30,000 due to continuous load shedding of electricity for 3 days. The farmer lost milk production for those three days and subsequent losses were felt as they did not own a backup generator. That farmer was forced to procure a standby diesel generator to avoid such losses but that again brought in extra costs. www.advocacypanel.com.au

The researcher interviewed farmers and came out with findings of different areas where cost came from. The Respondents provided statistics on the categories of losses from power outages in their operations. There were fewer responses providing detailed estimates of the actual costs that have been or could be incurred from power outages. Estimating average costs for farmers from power outages would be difficult statistically, because of the low number of responses. But the indicative numbers are provided for the costs of individual categories of losses from power

failures. www.advocacypanel.com.au . Indicative costs have been provided for the following categories:

Costs of operating backup electrical equipment 55 farmers out of 60 farmers were affected which is 92%

Loss of production of milk- 18 farmers out of 60 farmers said they were affected and this came to 30%.

Farmers who registered the complaint of Overtime labor costs to make up lost production were 20 out of 60 and in percentage form it was 33%

Those who complained about damage to equipment due to load shedding were 52 out of 60 farmers which translated to 87%.

Loss of water from pump failure due to load shedding, 25 farmers complained and in percentage form it came to 42%.

Some of the costs could not be estimated due to the impact being of a cumulative nature and in other cases due to inconvenience rather than actual financial cost. More than three quarters of all farmers stated that they had on farm generators. The importance of this for self-insurance is further investigated in the case studies for poultry and dairying. www.advocacypanel.com.au

2.3 Effects of load shedding on dairy farming in the region

2.3.1 A case of South Africa

Load shedding has proved crippling to South Africans with the agricultural sector being hit hard. This sector operates in critical time windows in which irrigation, harvesting, packing and so forth must take place. These time windows can range from weeks to months and unforeseen load

shedding in any one of these windows can lead to a loss of quantity and quality of produce and therefore financial loss. (Dawie Kriel, 2015)

Dairy Farmers highly dependent on electricity for key processes such as irrigation, milking and cooling of the products. As soon as the milk leaves the cow it has to be kept cold. The dairy product has to be kept at four degrees. It can't freeze or be too warm and load shedding can be disastrous. Most dairy producers have backup energy generating systems but these are extremely expensive.

Load shedding is having a severe financial impact on South African food production, according to Dawie Kriel, the head of heating, ventilation, air conditioning and refrigeration at Energy Partners. Dawie reported that load shedding affected not only primary food production, but also post-harvest handling and the retail sector. The interrupted electricity supply is costing the dairy production industry millions every month and could be depriving South Africa of quality nutrition. (Kriel, 2015)

Dairy animals require enough clean water and feed for maximum production of milk. Growing the dairy feed like hay grass require extensive irrigation during the day. Unfortunately, because of the intense South African sun during the summer, irrigation can't take place two hours before or after noon because of water evaporation. Dairy cows require a good feed for milk production. Although hay grass is good for dairy cows, about 70 to 80 per cent of this fodder is composed of water, which means that the animals gets only 20 to 30 per cent dry matter (Potter and Hotchkiss,1995). Feeding dairy cows only on fodder (like hay grass), banana leaves and stems and yellow maize is not sufficient. The animals should have adequate water at all times so the animal can take as much as it needs. No dairy cow, no matter how good the breed, can remain productive without proper management, especially feeding. The quantity and quality of milk

produced by the animal is largely affected by what it is fed on and how feeding is done. If the cow is grazed in a farm with little pasture and water and housed in dirty sheds littered with cow dung and urine, the result is poor milk yield and incidences of diseases. In addition to selecting good breeds, proper feeding, housing and handling of dairy cows are sure ways of getting good yields and income. A good breed that receives good feed and clean water, proper housing and friendly and gentle care gives more milk and money. A poorly managed one gives less milk and the farmer incurs huge veterinary expenses that reduce profits (Potter and Hotchkiss, 1995).

2.3.2 A case of Kenya

In the recent past few years Kenya has been faced with load shedding forcing dairy farmers and processors to look for alternative energy sources in order to keep their operations running round the clock. A five-hour power blackout in the country saw many milk firms which were not prepared for such long outages incur huge losses.

In a bid to address this recurrent problem, dairy farmers and processors are invested in sustainable energy sources. Some of the big milk industry invested heavily in green energy and have installed solar panels in their cooling stations. <https://citibusinessnews.com/index.php/2017>

The New Kenya Cooperative Creameries (KCC) installed steam generation engines which they hoped would cut the cost of power as they sought to make sure the energy usage was manageable. The company had set up a dairy demonstration farm at Rongai in Nakuru County where farmers were taught how to optimize the use of biogas on the farms using cow dung.

The Energy Regulatory Commission, in its renewable energy report for 2015 – 2035, recommend dairy farmers to turn to the use of solar panels as Kenya was endowed with natural

sun light where solar panels would do well and they require little maintenance after installation and that they were very reliable, besides having low environmental impact compared to conventional energy sources. However, optimum performance of solar panels is affected by increased cloud cover in a project area. Brookside Dairy is one of the top very large consumers in the country and their effort to conserve the energy has been recognized for its efforts by the government.

According to the report, new KCC has invested heavily and has installed massive generators for back up in all its industries and cooling stations across the country.

<https://citibusinessnews.com/index.php/2017>

Another giant in the industry, Brookside has adopted the use of solar powered water heating systems at its Sabatia raw milk cooling centre in Eldama Ravine and at the Sotik and Kitale bulk milk stations in a project that will eventually see all its 55 cooling stations adopt the use of alternative renewable energy. The processor is also pushing for the adoption of biogas by all its 145,000 farmers across Kenya as a cheap source of energy for rural households. Brookside's director of milk procurement. Brookside has a daily intake of over 2 million litres of raw milk at peak, which ought to be chilled at source before transportation to the processing factory in Ruiru. The adoption of solar energy assisted significantly in reducing the processor's dependence on external power supply, besides cutting costs of running generators to power its cooling stations during electricity outages.

The outage increased its overall cost of doing business for the day, but its operations were not disrupted as it relied on a power back-up contingency plan for all its milk cooling plants and at the Ruiru processing hub.

The five-hour outage did not disrupt operations at their 55 cooling plants and at the Ruiru processing house as their generators picked up on a real-time basis, relative to the time external supply went off. <https://citibusinessnews.com/index.php/2017>

Their operational risk analysis and contingency plan, which was a key component of uninterrupted power supply, was handy there. According to the report, they had to increase their back up system to 750 KVA during the outage period in order to meet the demand.

He however added that the company incurred increased cost of fuel for running the generators. The adoption of solar energy was expected to help the firm rationalize its power costs, besides acting as a power back-up contingency plan for its milk cooling plants.

The report added that Brookside was working with its contracted raw milk suppliers on adoption of biogas, used for heating water in homes. Biogas generated from solid waste on the farms is a cheap source of energy for farming households and farmers were encouraged to that type of energy as it was cheaper than the other alternatives. <https://citibusinessnews.com/index.php/2017>

According to the report the company had set up a dairy demonstration farm at Rongai in Nakuru County where farmers were taught how to optimize the use of biogas on the farms using cow dung.

The use of solar panels was also an option as solar panels require little maintenance. After installation and optimization they prove to be very reliable, besides having low environmental impact compared to conventional energy sources. <https://citibusinessnews.com/index.php/2017>

2.3.3 A case of Zimbabwe

Zimbabwe's milk supplies have dwindled over the past few years mainly because of two reasons. Erratic power supplies and the depletion of national dairy herd, resulting in dairies producing only 30 million litres in 2009 as compared to 180 million litres of milk at independence. <https://www.newsday.co.zw/2011/06/2011/06>

The erratic power supplies affected the refrigeration of dairy products resulting in some losses incurred over and above the losses incurred through lack of production due to load shedding. The dairy industry lost \$190,000 per month to the impact of power outages. The report said that the dairy industry also had challenges in quality, availability and cost of raw materials for dairy products as well as the state of the plant and equipment which needed repair and maintenance. . <https://www.newsday.co.zw/2011/06/2011/06>

2.3.4 A case of Uganda

Uganda has been facing an unprecedented energy crisis since the last few years and affected the milk industry. (Uganda Business and finance Report, 2008)

Uganda Business and finance Report (2008) reported that each time UMENE electricity Distribution Company carried out load shedding Lyantonde milk vendors lost 200 liters of milk. Umeme electricity Distribution Company has been carrying out load shedding without announcing or giving notices to the stakeholders affected. Umeme has been disconnecting power to some towns like Owino and Nakawa on a daily basis without prior notice. In Nakawa, the traders hired or bought generators and inverters to mitigate for losses. This caused the price

of a litre of milk to go up to sh1, 300. However, in Nakasero market which was not affected by severe load shedding, a litre of milk still went for sh1, 000.

2.4 Effects of load shedding on the dairy milk production in Zambia

Load shedding had negatively affected the dairy milk production industry in Zambia. To get a sense of load shedding's effect on the dairy milk industry; some farmers were interviewed on an integrated dairy farm operating at a processing capacity of 10,500 liters of milk per day. The interview revealed that a combination of power rationing, currency devaluation and inflation has increased operational costs for the dairy firm by about 30%. Mainly because cows have to be milked twice a day, with no possibility of altering shifts as is the case in crop production. Costs incurred involve the acquisition of a 5,000 kVA generator at £15,000 or ZMW 241,129 at an exchange rate of ZMW 16.08 per £(excludes shipping and duty), maintenance costs for the generator amounting to ZMW 3,000, and ZMW 25,000 of diesel per week . Unlike in milling, the increased production costs have not been passed on to consumers as milk prices have remained constant; such producer profitability has been eroded with firms barely breaking even. Firm strategy given the current situation is to at least break even by altering feed formulations with hope that the situation will normalize soon enough.

A report by Zambia National Farmers Union (2015) of what happened in Monze indicated that farmers in Monze lost over K23, 800 due to load shedding.

Zambia national farmers union, (2015) reported that load-shedding had led to a huge revenue losses and increased production costs for farmers in the sub-sector. According to Dairy association of Zambia two major dairy producers were contemplating of quitting the industry because of continued losses and lack of profitability. Famers in Monze lost about 7,000 litres of

milk in the in one week alone due to load-shedding. The lost milk of 7,000 litres times K3.40, totaled to K23, 800 loss. Load-shedding had also added towards increasing the cost of production because famers had to use diesel and the price of diesel had just gone up to K9.81 per litre and that caused milk production declining during the first half of the year on account of high costs of production. The major driving factor is the high cost of production because, generally, Zambia is already a high cost of production area.

The raw milk price compared with Tanzania was at US\$0.33 [per litre], and Zambia stood at US\$0.48; Malawi was at US \$0.24, and South Africa sold at about US \$0.30. (ZNFU, 2015) because of the increasing production costs, two commercial dairy farmers reported losses and were contemplating leaving the industry due to non-profitability.

The impact was serious because these large-scale farmers employed a lot of people. Farmers at that time needed a raw milk price of between K3.80 and K4.00 just to stay afloat. But the problem was that the processor were unable to meet that kind of money unless they had improved the regulation of imports, and also measures should have been taken to bring down the cost of production. According to ZNFU, (2015), production of fresh milk declined by 7.7 per cent in the second quarter of 2015 as the power outages, among other factors, hit the sub-sector.

2.5 Effects of load shedding on profitability of firms-Zambia.

Profitability is the surplus amount of income that is realized when costs are deducted from revenue received from the sale of a specified number of units of a given product. It is a measure of a firm's performance. With reduced productivity and/or increased production costs, a firm's profitability is expected to reduce. (Siangádu, 2007)

According to Siangáandu (2009) production costs are costs that go into the production of goods. They include material, labor and overhead costs. In this study, production costs also included costs arising from disrupted operations which led to wastages of raw materials (work in progress) and man-hours. The disruptions arose from unexpected electricity outages. Production costs also included costs associated with resetting, and warming up equipment and making trial runs before it can be used for production of acceptable products. Production costs further included additional costs that arose from the use of alternative sources of energy and other measures such as over time.

The study conducted by Samboko on the impact of power rationing on Zambia's agriculture sector established that all large commercial farms procured as big as 5,000KVA diesel generator capacities at a cost of K241, 129 which would consume K25, 000 worth of diesel per week. Samboko et al concluded that the increased production costs were not passed on to consumers as milk prices had remained constant and as such reduced profitability.

According to Samboko et al (2016) the effect of having alternative sources of supply on large firms/processors operating in the dairy industry was expected to work through additional costs. The small dairy farmers appear to have reduced milk production and subsequent supply to milk collection centers. Samboko et al interviewed an integrated dairy farmers operating at a processing capacity of 10,500 liters of milk per day and the interview revealed that a combination of power rationing, currency devaluation and inflation has increased operational costs for the dairy firm by about 30%. (Samboko et al 2016). Mainly because cows were milked twice a day, with no possibility of altering shifts as was the case in crop production. Costs incurred involved the acquisition of a 5,000 kVA generator at £15,000 or ZMW 241,129 at an exchange rate of ZMW 16.08 per £(excludes shipping and duty), maintenance costs for the

generator amounting to ZMW 3,000, and ZMW 25,000 of diesel per week . These production costs negatively affected profitability of the firm.

2.6 Situation of Finta before, during and after load shedding, 2013 -2016.

Research Objectives	Situation of Finta before load shedding	Situation of Finta During load shedding	Situation of Finta after load shedding
Effects of load shedding on the quantities of milk harvested per day	Finta farms collected milk from farmers of 2,500 litre/day	2,000 litres per day Finta farms had a reduction as they could not offload and process milk at the plant due to power outage (Now collected 10,000 litres per week)	2,500litres per day Finta farms collected milk from small scale farmers who were not affected by load shedding hence the constant quantity of 2,500 litre /day
Effects of load shedding on the company profits	a) Only 5% over time cost recorded	b) Over time cost went up to 11% c) K2,354.40 money spent on fuel daily d) Maintenance cost All these affected negatively the profit of the company.	a) Over time cost dropped to 6% b) No fuel cost c) Periodical maintenance of generator at negligible amounts.
Alternative back up power installed	No alternative was put in place	385KVA generator was procured at a cost of K353,866.709	Periodical maintenance of warming up of the generator set.
Production cost	a) Over time cost was at 5% b) Average bill of electricity for production stood at K21,000/month	a) Overtime expense increased to 11% b) The machine consumed 30litres of diesel/hour for 8 hours x K9.81 diesel at the time amounted to K2,354.40/day c) Electricity bills reduced to K16,000	d) Over time expense reduced to 5% b)Negligible cost of running the generator set incurred

(Source field data 2017)

2.7 Critique of the literature reviewed.

The Australian case gave a report of an outage that went on for 3 days which may have been a merely fault that brought in that outage, however this research is looking at load shedding that went on for a long period of time. The Australian farmers highly depended on use of electricity for everything ranging from cultivation of the animal feed, irrigation of the hay, milking of the animals, pumping, heating and processing of milk therefore the impact of loss for power or damage of one equipment may explain the loss of \$30,000 because it's highly mechanized with over dependency on electricity.

The report by Dawie Kriel of South Africa on the effects of load shedding on dairy farmers did not provide information on the actual loss in monetary form or percentage of loss therefore it is difficult to know the actual loss. The report would have been useful had it provided the actual loss farmers incurred.

The report in the case of Uganda highlighted the as being the cause to the loss of 200litres of milk each time there was load shedding in the area because the power company Umeme failed to give the people the switching time table as they owned generators. The report should have provided the other scenario of the company informing them of times of load shedding to see whether that loss would have been occurring.

The report on the effects of load shedding by Siang'andu was too broad as it covered the whole agriculture sector

Despite the above critique, the literature reviewed did provide information of the negative impact of electricity shortages in different parts of the world.

2.8 Summary

This chapter discussed the general information of milk production and then gave a brief information on the effects of load shedding in the world. A case of Australia was given whereby one dairy farmer lost \$30,000 when his farm experienced power interruption for 3 continuous days. The other case cited was Uganda and Zambia. An analysis of effects of load shedding before and after was illustrated. The chapter closed with a critique of literature reviewed.

CHAPTER THREE: METHODOLOGY OF THE STUDY

3.0 Introduction

This chapter discusses the research design, target population, sample size and sampling procedures, data collection procedure, data collection instruments, data analysis methods and ethical consideration. The facets of research methodology are of paramount importance as they lead to a logical flow of the research issues and most probable provide answers to the research questions

3.1 Research Design

A survey of Finta dairy farm was conducted. Survey study was employed because it tends to be a reliable method of inquiry. This is because surveys are standardized in that the same questions are phrased in exactly the same way, are posed to participants. A survey was conducted by the use of a self-administered questionnaire which was closed ended. According to Creswell (2003), a research design involves a plan outlining how information is to be gathered for an assessment or evaluation that includes identifying the data gathering methods,

3.2 Target Population

The target population of this research refer to all members of dairy industries in Zambia.

But because the researcher could not go to each and every dairy industry community in all districts due to time factor and inadequate resources, Finta dairy community was selected.

The term "target population" is commonly used to refer to the group of people or entities (the "universe") to which the findings of the sample are to be generalized (Bryman, 2004). Creswell (2003, p. 13) defines a population as "a complete set of all the items and possible observations of the type which is to be investigated or within". Statisticians use the word sample to describe a

portion chosen from the population. This means that a finite subset of statistical individuals defined in a population is called a sample

3.3 Sample and Sampling Procedure

A total of 50 workers from Finta farms limited formed the sample size of the research.

Fifty (50) questionnaires were distributed as follows: administration was given 5 and 5 questions were returned representing 5%, Accounts department were given 5 questionnaires and 5 were returned giving a percentage of 10%, sales and marketing department returned 17 out of 20 questionnaires, representing 34% and production department were handed 20 questionnaires of which 19 came back which gave 38%. The total number of questionnaires which were returned recorded 46 giving the return rate of 92%.

Table 3:4 Distribution of questionnaire according to participants.

Variable	No of questionnaires	No. returned	Percentage (%)
Production department	20	19	38
Administration department	5	5	10
Accounts department	5	5	10
Sales & marketing department	20	17	34
Total	50	46	92

Source (field data, 2016)

In order to choose a sample from a population of Finta farms limited, a non-probability purposive sampling approach was used, in particular, the judgment sampling technique was used because it satisfied the sampling objective, for example, all workers for Finta farms, and all use electricity and as such are affected by load shedding. In Purposive Sampling, according to Barnes (2001), the researcher uses his/her own judgment to choose which people would constitute the sample. This method relies, or is based, upon the personal judgment of the researcher regarding the required characteristics in a sample. The sample is chosen on the basis of what the researcher considers to

be typical of' the group or population under study. The researcher chooses beforehand, the main characteristics to be considered in the sample.

Another sampling method which was used was a stratified method. A stratified sample divides the population into distinct none overlapping subgroups (strata) according to some important characteristics and then a random sample is selected within each subgroup (Denzin et al, 1998). Further, Denzin et al (1998) say that this method is used to ensure that each subgroup of interest is represented in the sample because this method generally produces more precise estimates of the characteristics of the target population, unless very small numbers of units are selected within individual strata.

3.4 Data Collection Procedure

In order to achieve the objectives of the research, two types of data was used, i.e. primary data and secondary data were collected and used in this research. Secondary data was sourced from Zesco, Finta Farms and the internet. Primary data was collected by using a self-administered questionnaire. The questionnaire contained structured questions. (Closed ended). Questionnaires were distributed to participants of Finta farms by this researcher.

This study used qualitative and quantitative methods for data collections. The questionnaire had two (2) sections namely, “demographic information” and “the assessment of the effects of load shedding on dairy industry”. Demographic information had five (5) questions based on personal details of participants, e. g. gender, age range, current position, work experience and highest level of qualification. Section two (2) had four (4) questions based on the “the assessment of the effects of load shedding on dairy industry”. The questionnaire had nine (9) questions in total. All the questions in the questionnaire were closed-ended, demanding the respondents a tick for scoring. The questionnaire was self-administered. The questionnaire had a section at the end called “any comment” The “any comment” section allowed respondents to express themselves on issues not covered by the questionnaire. The questionnaire was distributed to respondents by the researcher himself. The issue of confidentiality was tackled by not writing the names of participants on the questionnaires.

3.2 Data Collection Instruments

This study used questionnaire and structured interviews for data collection.

According to Neuman (2007) the questionnaire is a series of questions asked to respondents to obtain variable information about a given topic. It consists of a number of questions on a paper that respondents read and answer. Neuman (2007) contends that questionnaires are frequently used in quantitative marketing and social research. They are a valuable method of collecting a wide range of information from a large number of individuals, often referred to as participant. Good questionnaire construction is critical to the success of a survey. Inappropriate questions, incorrect ordering of questions, incorrect scaling, or bad questionnaire format can make the survey valueless.

3.6 Data Analysis Methods

Data collected was both quantitative and qualitative. Responses from the participants were grouped together to assist further analysis and data presentation. Tables, graphs and charts were used to present the findings. The tables and figures were followed by analysis of data presented. Findings were drawn from the analyzed data and from Finta firm.

3.7 Ethical Considerations

The population in this study will refer to members of staff of Finta Dairy Industry in Livingstone. Before data was collected, ethical issues were considered. The ethical principles for any research refer to the general judgment that serve as a basic justification for many ethical prescriptions and evaluations of human actors.

The National Commission for Protection of Human Subjects of Biological and Behavioral Research (NCPHSBBR) (1999) reveals that the term persons indicates that individuals should be treated as autonomous agents and secondly persons with diminishing autonomy are entitled to protection.

In all research that involved human subjects demands that they enter into research voluntarily and whether or not to participate in research. They have the right to withdraw from the research at the time. In addition, the Commission indicates the principle of beneficence believes that persons involved were treated in an ethical manner. On the principle of Justice NCPHSBBR (1999) emphasis fairness for election of participants, and should be given good treatment and should be given the right to privacy. To apply the three ethical considerations of respect and confidentiality, beneficence and justice, informed consent is implied. The subjects of this study were respected to a degree that they were capable of providing the right and much needed information and given an opportunity to choose either to be respondents or not. This opportunity

was provided as adequate standards to obtain informed consent. The researcher also considered the confidentiality with the information given by the respondent, the information could not be supplied to anyone, and therefore results from findings were produced as aggregated.

3.8 Summary

In research design a survey was conducted by the use of a self-administered questionnaire which was closed ended. Research population of the study were members of dairy industries however a sample from Finta dairy farm represented the industry and 50 workers were sampled. The chapter further discussed sampling procedures, data collection procedures, data collection instruments, and data analysis procedures. The chapter ended with discussion on ethical considerations.

CHAPTER FOUR: FINDINGS OF THE STUDY

4.0 Introductions

This study is a situational analysis of the effects of load shedding on dairy milk production Industry in Zambia: A Case of Finta Dairy Farms limited. The situation covered a period before and after load shedding from 2013-2016. The study focuses on economic and national development.

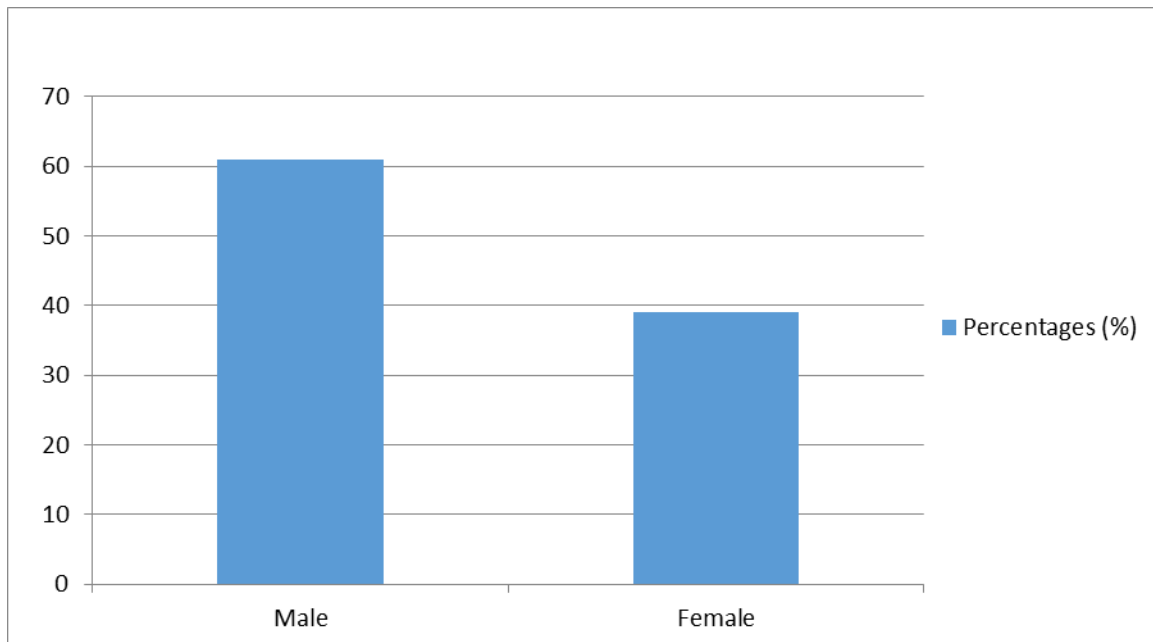
The study was guided by the following objectives:

- 1** To establish the quantity of milk harvested per day before and after load shedding.
- 2** To ascertain alternative back up power system to being used by dairy Industries.
- 3** To find out the correlation between the use of alternative power supply System and production cost.
- 4** To determine relationship between the quantities of milk collected per day and profitability of Finta farms.

4.1 Participants according to gender

Drawing from this study, 61% of participants were male, while 39% were female. The findings reveal that women who participated in the study were less than men. Like in many other businesses, running a dairy farm or industry requires diverse skills, cooperation, and commitment. Women and men can complement each other to offer these skills to foster productivity of the dairy industry. See Figure 4:2 below.

Figure 4:1 Participants according to gender

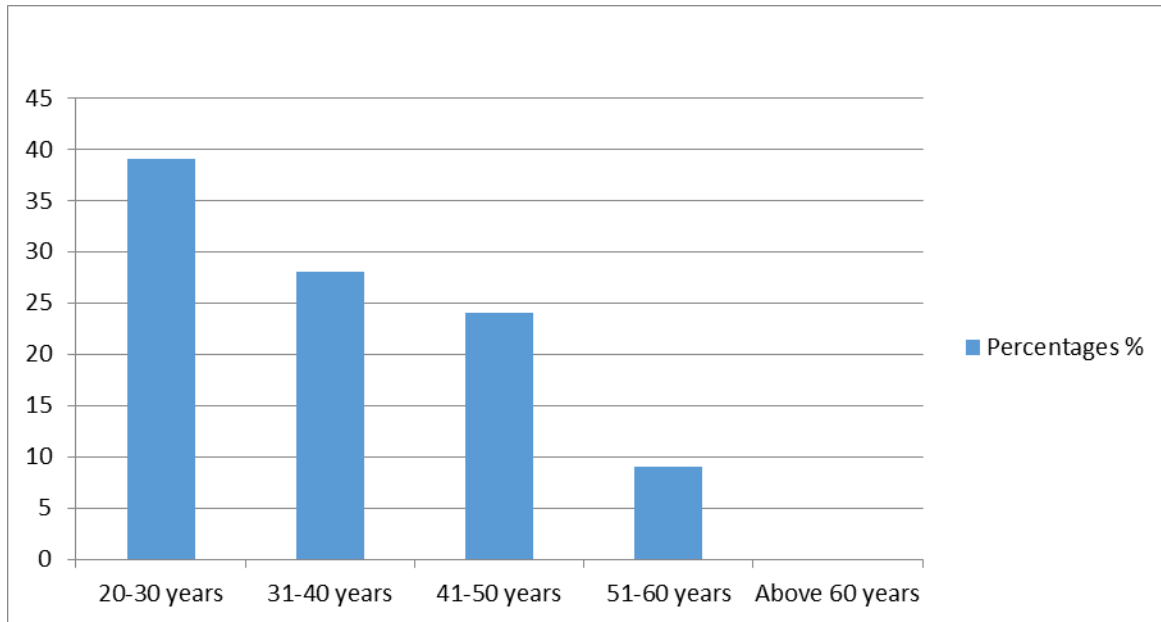


(Source field data 2016)

4.2 Distribution of participants according to age

According to the field findings age range between 20-30 years stood at highest with 39% followed by the range group 31-40 which was at 28 %. Age range 41 – 50years were next at 24 % and lastly those whose age range of 51-60 were at 9%. See figure below.

Figure 4:2 Distributions of participants according to age



(Source: field data 2016)

4.3 Distribution of participants according to position

Drawing from the findings of this study, majority of the participants who took place in this study were unionized FINTA Farms employees who were at 43%, followed by simple workers who recorded 42%, middle management recorded 13% and top management 2%. This is seen in the table below.

Table 4.3 Distribution of participants according to position.

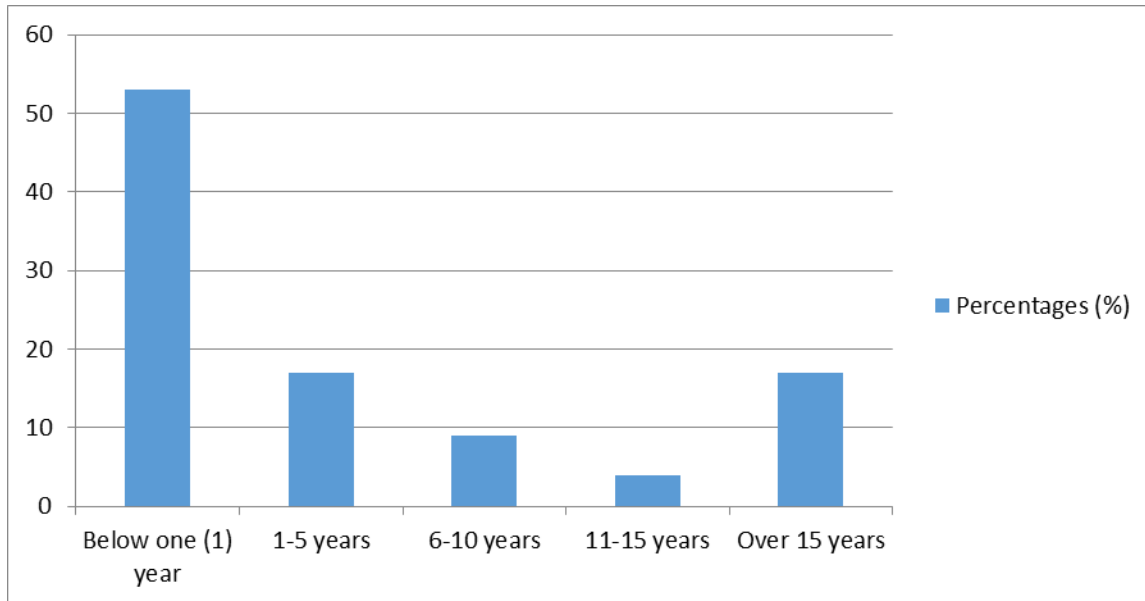
variable	No. of respondents	Percentages (%)
Top management	1	2
Middle management	6	13
Unionized	20	43
Simple Worker	19	42
Total	46	100

(Source field data 2016)

4.4 Distributions of participants according to experience

According to Cole (2004) experience is a good teacher. Majority of the participants who responded in this study were in the group of “below one year “which recorded 53%. This group was followed by group 1 – 5 years and over 15 years which supported this item with 17% respectively, followed by those with experience 6 – 10 years at 9 %. The least supported in this item came from those with range of 11-15 years which noted 4%. We need to understand that there is correlation between years of experience and development like productivity. Experience therefore should assist in the role it plays in coming up with strategies in sustaining the dairy industries amidst load shedding. According to Carnall (2007) learning is based on personal experience and experimentation.

Figure 4:4 Distributions of participants according to experience



(Source field data)

4.5 Distribution of participants according education

Header (1993) states that there is a common agreement that education is the most effective weapon in which society confront challenges, 35% of participants were certificate holders and diploma holders respectively, followed by grade 12 with 20%, grade 7 and undergraduate recorded 4%. The least support in this item came from grade 9 with 2%. Education and training is important in creating capacity and equip individuals with adequate skills and more knowledge about load shedding and its effects to national development. See table 4.7 and figure 4.6 below.

Table 4:5 Distribution of participants according education

variable	No. of respondents	Percentages (%)
Grade 7	2	4
Grade 9	16	32
Grade 12	16	32
certificate	9	18
Diploma	2	4
Under graduate degree	1	2
other	0	0
total	46	92

(Source field data, 2016)

4.6 Presentation and analysis of load shedding information

Table 4:6 Load shedding reduces the quantity of milk harvested per day

The data obtained from the field survey shows on the item that read “load shedding reduces the quantity of milk harvested per day” came up with the following results. 54% disagreed to the item while 46% agreed. See table 4.6 below.

Table 4:6 load shedding reduces the quantity of milk harvested per day.

variable	No. of participants	Percentages (%)
Strongly disagree	0	0
Disagree	21	46
Neutral	0	0
Agree	25	54
Strongly agree	0	0
Total	46	100

(Source field data 2016)

4.7 Dairy industries would go for alternative power supply to mitigate for load shedding

According to the field findings, 67 % of participants strongly agreed to the item which read “dairy industries would go for alternative power supply to mitigate for load shedding, only 20% agreed with the item while 13% of the participants stood at neutral grounds. See table below.

Table 4:7 Dairy industries would seek for alternative supply during load shedding.

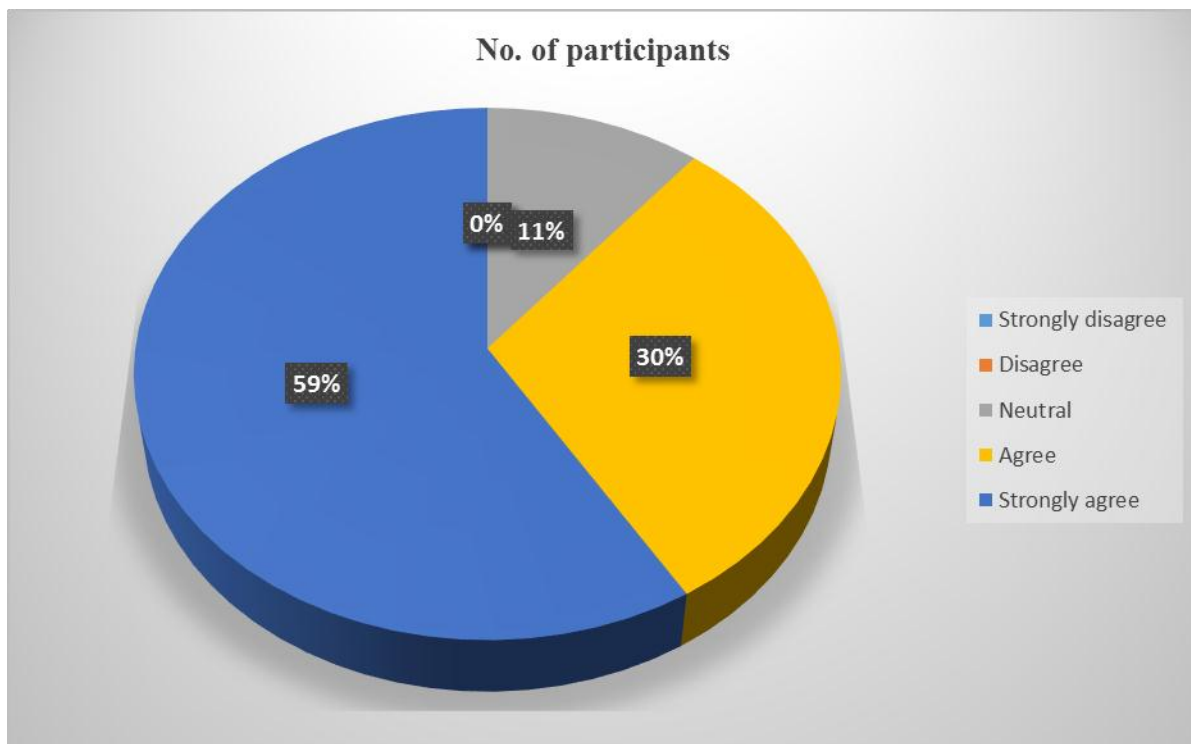
variable	No. of participants	Percentages (%)
Strongly disagree	0	0
Disagree	0	0
Neutral	6	13
Agree	9	20
Strongly agree	31	67
Total	46	100

Source field data, 2016

4.8 Dairy industries that use alternative power system experiences an increase in production cost

According to the field findings, 59% of participants strongly agreed and 30% of the participants merely agreed, however 11% of the participants remained neutral to the question “dairy industry that use alternative power system experiences an increase in production costs.” see table below.

Figure 4:8 Alternative source of supply increases production costs

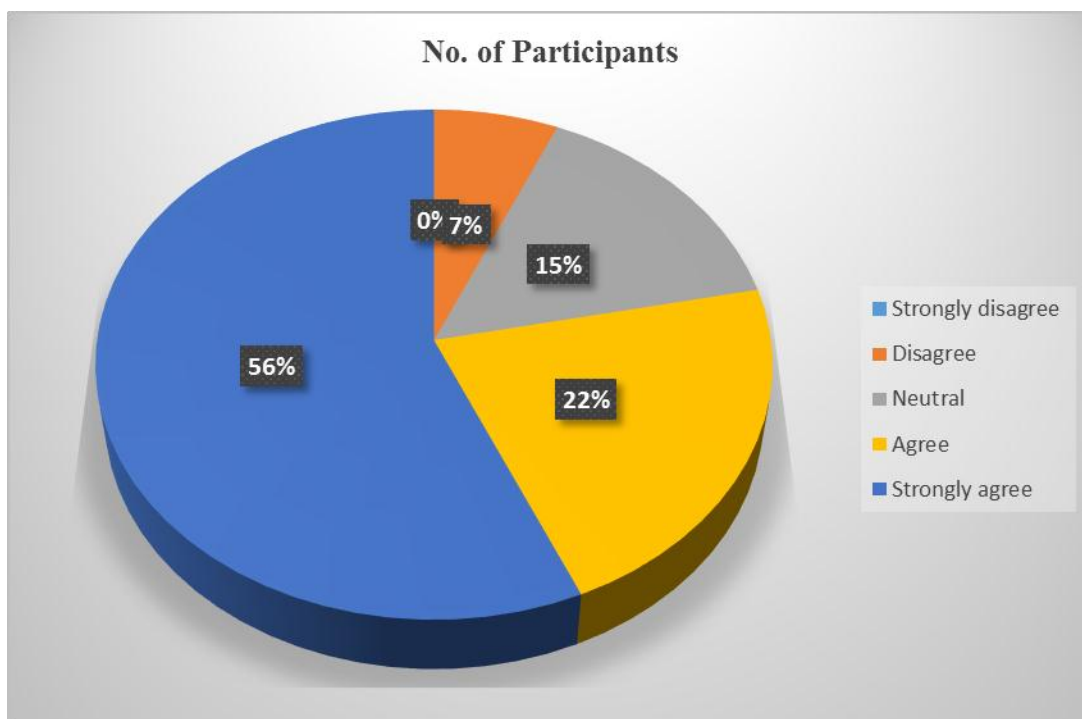


(Source field data, 2016)

4.9: Dairy industry is business enterprise processing milk and is not profitable in Zambia today due to load shedding

The questionnaire read “dairy industry is a business enterprise processing milk and is not profitable in Zambia today due to load shedding”. 56% of the participants strongly agreed, 22% merely agreed, 15% were neutral and 7% disagreed.

Figure 4:9 Dairy industries not profitable due to load shedding



(Source, field data 2016)

CHAPTER FIVE: DISCUSSIONS

5.0 Introduction

This chapter discusses the relationship between the research findings and the problem statement, in terms of providing some answers to the research questions. This will be done by interpreting the research findings in light of the research problem and research questions.

It is no secret that electricity plays a major in put to the growth of any economy because most goods and services depend on electricity to be produced.

5.1 Research questions

- What is the quantity of milk harvested per day before and after load shedding?
- What is the alternative back up power system being used by dairy industry?
- What is the correlation between the use of alternative power supply systems and production cost?
- What is the relationship between the quantities of milk collected per day and profitability of Finta farms?

5.2 Discussions

The first objective wanted to establish the quantity of milk harvested per day before and after load shedding. The findings of the research confirms that Finta collected 2500 liters of milk from small scale farmers daily before load shedding but it started collecting 2,000 litres during load shedding due to power challenges, representing a drop of 20%. (Source: Field data 2016).

In most developing countries, like Zambia, milk is produced by smallholders, and milk production contributes to household livelihoods, food security and nutrition. (Kamanga 1992).

The small scale farmers depend on the natural grass for grazing of animals and the river water for animal to drink and in that case load shedding was not a threat to the production of milk. Approximately 150million households around the globe are in milk production and in most developing countries, milk production is done by a smallholder who contributes to household livelihoods, food security and nutrition and these are the households in turn which sells their milk to companies like Finta on a daily basis.

Big dairy commercial farmers on the other hand depend on electricity for almost anything. At a dairy commercial farm animals are fed on grown grass that is irrigated. Hay, banana leaves and is grown cone where by persistent load shedding of electricity for a longer period would disturb irrigation and reduce the feed for the animals which would negatively affect production of milk. Dairy cows require a good feed for milk production. Although hay grass is good for dairy cows, about 70 to 80 % of this fodder is composed of water, which means that the animals get only 20 to 30% dry matter (Potter and Hotchkiss, 1995). Feeding dairy cows only on fodder like hay grass, banana leaves and stems and yellow maize is not sufficient. The animals should have adequate water at all times so the animal can take as much as it needs the quantity and quality of milk produced by the animals is largely affected by what it is feed on and how it feeding is done. A poorly managed one gives less milk and the farmer incurs losses both in milk and other expenses like the case of Zimbabwe in the literature reviewed.

In the production theory raw material is needed as an input for produce to be there (Ahuja, 2008)

Commercial farmers use electricity to milk animals and if on that day there is power interruption no harvesting of milk will take place like seen in the literature reviewed of an Australian farmer who lost \$30,000 because of not having electricity for 3 days on a dairy farm (www.advocacypanel.com.au). The major contrast with the Australian scenario and that of Finta is that the Australian dairy farmer depended on electricity to milk animals unlike Finta who collected milk from small scale farmers although they had to reduce milk collected per day due to power challenges, Load shedding had an effect on the quantities of milk harvested per day because processors had challenges in collecting milk from milk collection centres (MCCs) as they could not offload and process milk already at the plant due to power challenges.

The second objective sought to ascertain alternative back up power system to being used by dairy industries. What is an alternative source of electrical supply? An alternative power supply is an emergency power system is which from independent source of electrical power that supports important electrical systems on loss of normal power supply. A standby power system may include a standby generator, batteries, solar panels and many others. https://en.wikipedia.org/wiki/Emergency_power_system The field findings revealed that Finta farms had procured a generator set to mitigate load shedding so that during the hours the company is load shed, production should not stop. This came with a cost, firstly the generator had to be bought and also maintained as it broke down and also the question of over time came in. The findings were that one stand by diesel generator with a capacity of 385KVA was procured at a cost of K 353,866.709. The report of Californian farmers is silent on the use of alternative source of supply. The Australian farmer in case of the literature reviewed was different because the farmer did not have an alternative source of supply and as a result the

farmer lost colossal amounts of money in 3 days. (www.advocacypanel.com.au). There was no input and therefore no output. (Ahuja, 2008). South African farmers according to the literature reviewed had put in place alternative source of supply although they complained of being expensive to operate (Kriel, 2015). In the region a case of Uganda which was reviewed showed that traders in Nakawa who were affected by load shedding had to hire a generator set and the case of Kenya was the same as they bought generator sets and installed solar panels. The case of South Africa, Uganda and Kenya is in tandem with the research investigation of whether Finta farm turned to the use of alternative source of supply, they did. (Field data, 2016)

The third objective sought to find out the correlation between the use of alternative power supply system and production cost. According to Ahuja (2008) production is basically an activity of transformation which connects factor inputs and outputs. These include the relationship between the prices of commodities and the prices (or wages or rents) of the productive factors used to produce them and also the relationships between the prices of commodities and productive factors that are produced. When factor inputs are high, in most cases the firms would pass on the cost by increasing the cost of output (products) and if that company doesn't increase prices then profits gets affected.

According to Field findings, the use of alternative sources of energy and measures put in place were more expensive than electricity because Finta used 30litres of diesel per hour and if load shedding went for eight hours they would spend $K9.41 \times 30 \times 8$ totaling to K2, 258.40 per day. The average consumption of Finta dairy industry for electricity in a month was K25, 0000 and with additional costs of diesel and over time the company was negatively affected. The firm also stated that it incurred 7% per month in overtime in trying to mitigate for load shedding. Workers had to report for work early and knock off late. (Source Field data2016). Despite the increase in

production costs, the firm in discussion still employed mitigating measures to safeguard against further reduction in production and processes. The use of generator implied huge consumption of fuel such as diesel and would only serve to increase the production costs of the firm in question.

The literature reviewed also supports these findings as seen from Nakawa traders of Uganda who increased the price of milk because of hiring a generator which was their backup source of supply whenever they experienced load shedding. (Uganda business and finance report, 2008).

The fourth objective was to determine the relationship between the quantities of milk collected per day and the profitability of Finta farms.

The primary purpose of most businesses is to maximize profits for its owners. Equally Finta was established for profits. When a firm is not producing but maintaining the same numbers of labor who demand for the same fixed salary at the end of the month, such a firm is likely to go under.

The research established that Finta collected 2,000 litres of milk every day from farmers dropping from the earlier 2,500 litres hence there is a direct relationship with the quantities of milk harvested per day and profitability of Finta, because a 500 litre drop translates into loss of revenue.

According to the field data 2016, Finta used 30litres of diesel per hour and if load shedding went for eight hours they would spend $K9.41 \times 30 \times 8$ totaling to K2, 258.40 per day. The average consumption of Finta dairy industry for electricity in a month was K16, 0000 and with additional costs of diesel and over time the company profits reduced. The firm also stated that it incurred 11% per month in overtime in trying to mitigate for load shedding. Workers had to report for work early and knock off late. (Source field data, 2016). Finta did not pass the production cost to its customers by hiking the price of its products during the period of load shedding hence

affecting the profit of the firm. The quantities of milk did not reduce and no profit loss from that angle, however the indirect costs of production stated above reduced profitability.

4.2.2 A case of Uganda in the literature reviewed brings out a scenario of the Nakawa community who hired a generator during load shedding periods. The price of milk in that town was increased as compared to other town of Nakasero which did not experience load shedding. (Uganda business and finance report, 2008).

Scenario 2.3.1 a case of Australia a farmer lost \$30,000 in 3 days the farm was off because the farmer could not milk the animals 3 times per day and also that the farmer did not have a standby generator to use during the time of interruption. (www.advocacypanel.com.au). The case of Finta was different because the firm collected its milk from small scale farmers who were not affected with load shedding as opposed to daily producing its own milk.

According Kriel 2015, load shedding had a severe financial impact on South African dairy firms. The interruption of power supply costed the dairy industry millions of rand every month.

Scenario 2.3.1 a case of Australia a farmer lost \$30,000. Scenario 2.4.2 a case of Uganda farmers lost 200 litres of milk. (Uganda business finance report, 2008). Scenario 2.5 a case of Zambia, Zambia national farmers' union reported that famers in Monze lost K27, 000 due to load shedding. All the three losses sited negatively affected the profits of the famers.

5.3 Summary

This chapter presented the findings of the research based on the analysis in chapter 5. It showed that load shedding had led to reduction of milk collected per day as the collection dropped from 2,500 litres to 2,000 litres per day. The findings also established that because of load shedding

the dairy firm did resort to use of alternative source of supply which increased production costs and a combination of these led to a profit loss.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

The research was about a situational analysis of the effects of load shedding on dairy milk production in Zambia: a case of Finta farms. The study sought to assess the effects of load shedding before and after and it was carried out in Livingstone town.

The research was guided by the following objectives.

- 1** To establish the quantity of milk harvested per day before and after load shedding.
- 2** To ascertain alternative back up power system to being used by dairy industries.
- 3** To find out the correlation between the use of alternative power supply system and production cost.
- 4** To determine relationship between the quantities of milk collected per day and profitability of Finta farms.

6.1 Conclusions

The first objective was seeking to establish the quantity of milk harvested per day before and after load shedding. 54 % of Finta farms staff who participated in the survey agreed to the item that read “load shedding reduces the quantities of milk collected per day. The field survey established that Finta farms collected 2000 litres of milk every day during load shedding whilst it used to collect 2,500 litres before load shedding.

Load shedding had an effect on milk harvested as Finta had to reduce the collection of milk from farmers due to power challenges.

The second objective was to ascertain whether the dairy industry turned to the use of alternative back up system. The field findings were that 67% of participants who took place in the field survey strongly agreed. In order to mitigate the impact of load shedding.

Apart from the Australian farmers who did not have an alternative source of supply all the other famers had other sources of supply. Ugandan famers hired a generator set to mitigate for load shedding (Ugandan Business finance report, 2008).In Kenya the dairy farmers used a combination of generator and solar panels as alternative supply source.

According to the field survey findings 2016, Finta farms resorted to the use of alternative sources of energy and hence procured a diesel machine costing K353, 866.709.

The third objective was to find out the correlation between the use of alternative power system and production cost. The findings are that 59% of participants strongly felt that that procuring and running any alternative source of supply would increase the production costs. The hire of a generator set in the case of Uganda increased the production cost which was passed on to consumers. (Uganda Business and Finance Report, 2008)

According to the survey findings, 2016 operation of the 385 KVA diesel generator which Finta farms procured, increased the production cost. The generator set consumed 30litres of diesel per hour for eight hours they would spend $K9.41 \times 30 \times 8$ totaling to K2, 258.40 per day. Another cost was a cost of maintenance of the generator set which needed to be serviced from time to time. During the time of load shedding over time cost had increased to 11% and a combination of these expenses increased the cost of production.

Fourth and last objective was to determine the relationship between the quantities of milk collected per day and profitability of Finta Farms. Data collected from the field showed that majority of the participants felt that there was a relationship between the quantities of milk

collected per day and profitability of Finta farms. According to the field findings, 2016, the quantity of milk collected everyday had directly affected the company profits as the company dropped the quantities from collecting 2,500 litres, to 2,000 litres per day. Additionally a combination of procuring, running of alternative source of supply, maintenance of the same resulted in high production cost and this too had a negative effect on profits.

6.2 Recommendations

6.2.1 Short term solutions to load shedding include

The government of the republic of Zambia should encourage small scale farmers by constructing of dams in rural areas to help the small scale farmers with water for their animals as dairy animals require a lot water for production of milk.

Dairy cows to stay health need vaccines for animals to keep the animals in good health and the government through veterinary departments should carry out these tasks to rural small scale farmers to encourage milk production because it is these small scale farmers who provide the country with milk and the research established that peasant farmers were not affected by load shedding. Whenever there is shortage of power in the country, the government should remove duty on imported generators to cushion on the expenses of firms.

To reduce the burden of high production cost during load shedding, the government should subsidize on the high cost of fuel to dairy farmer avoid companies pass on costs to consumers.

6.2.2 Long term solutions to load shedding include

The government should consider to bring in investors who will invest in making big diesel generators. These investors should be encouraged to build manufacturing plants of these machines so that these alternative source of power would be available and affordable in Zambia. This move would not only be beneficial during times of power difficulties but will create employment to the Zambian citizen. The diesel generators also would help small scale farmers who are far away from electricity grid to have power at their farms for critical operations.

REFERENCES

- Ahuja H.L (2008), **Managerial economics**, New Delhi.
- Bessel J E and Daplyn M G. 1976. **Dairying in Zambia**: The commercial sector.
- Barnes, D. (2001) “**Research Methods for the empirical invention of the process of formation** of operations strategy international journey of operations and production **management**, Vol. 21 no, 8, pp. 1076 – 1095. Brooks I (2007) **Organizational behavior** (2nd Ed), London: Prentice Hall
- Bwalya, G. M., 1990, ‘**Dairy development in Zambia**’ (research, 1990)
- Bryman A. (2004) **Social Research Methods**, UK, Oxford University Press.
- Cohen, L & Manion, J. L (1990), **Research methods in education, London**. Routledge
- Coetzee et al (2016) **Impact of load shedding on the construction industry in South Africa**
- Creswell, J. W. (2003) **Research Design: Qualitative, Quantitative and Mixed Methods Approaches**, London: Sage Publication.
- Daka D E. 1992. **Dairy cattle breeding policy for Zambia**. Paper presented at the National Dairy Workshop. Siavonga, Zambia.
- Denzine, N & Lincoln, Y (1998) **Handbook of quantitative research**, London: Dublin, Ireland: Blackhall Publishing, 2001. **International Operations Management**. Copenhagen, Denmark: Copenhagen Business School Press, 2002.
- Emongor, R. A. and J. F. Kirsten, 2006, ‘**Supermarkets in the food supply systems in Southern African Development Community**: A case study of Zambia’, Vol. 6 (4):

800- 809. Plenert, Gerhard. *The eManager: Value Chain Management in an e-commerce World*.

Flick, V. (2002) **An introduction to Qualitative Research**, London, Sage Publication.

Hines, T. (2000) **an evaluation of two qualitative methods** – focus group, interviews and cognitive maps, for conducting research into entrepreneurial decision making qualitative market research, Vol, 3, No. 1, pp. 7-16 Science, Vol. 26, No. 4pp. 257-273

https://en.wikipedia.org/wiki/Emergency_power_system

<https://citibusinessnews.com/index.php/2017>

Jay, J. M. (1992). **Modern Food Microbiology**; 4th edition. New York: Chapman & Hall. pp. 237–9.

Kamanga A. 1992. **Smallholder dairy development project**. Paper presented at the National Dairy workshop. Siavonga, Zambia. Larry Malambo and Marvin Kabubi, (2017) Challenges in the energy sector of Zambia. A case study of effects on manufacturing industry.

Mike Francesconi, **Cost of Production Unit, Dairy Marketing Branch**, California Department of Food and Agriculture. Western Dairy News June/July 2001 Volume 1, No. 2

Mwenya J. 1992. **Milk production patterns in southern province**. Paper presented at the National Dairy Workshop. Siavonga, Zambia.

Neuman, W.L, (2007), **Social research methods: Qualitative and quantitative approaches**, (6 ed) Boston, Allyn & MA Boston.

Patton, MQ (2002) **Qualitative Research and Evaluation Methods**, London: Sage Publication.

Phiri G B M. 1992. **The broad overview of the current dairy production patterns.** and the National Dairy Policy. Paper presented at a National dairy workshop. Siavonga, Zambia

Potter, N. N. & J. H. Hotchkiss. (1995). **Food Science**; 5th Edition. New York: Chapman & Hall. pp. 279–315.

Report on preliminary investigation relating to electricity load Shedding implemented by ESKOM Holding limited.

UNGZAMI **Bulletin No. 1**. University of Nottingham, Nottingham, UK.

Vora, Jay A. "**Productivity and Performance Measures: Who Uses Them.**" Production and Inventory Management Journal 33, no. 1 (1992): 46-49

Samboko P, et al. (2016) the impact of power rationing on Zambia's agriculture sector Shu –J.

Huang and C. C. Huang (2000). **An adaptive load shedding method with time-based design for isolated power systems.** International Journal of Electrical Power and Energy Systems. 41(2), 51-58.

Siang'andu N (2009) **an assessment of the impact of zesco's power rationing on firm Productivity: a case of Lusaka selected based manufacturing firms.**

Swasigood, H. E. (1985). "**Characteristics of Edible Fluids of Animal Origin: Milk.**" In Food Chemistry; 2nd edition. Revised and Expanded.

Tomaz Tomsic, Verbic, G., and Gubina, F. (2005). **Revision of the under frequency load shedding scheme of the Slovenian power system**. IEEE PES General

USAID NEPAL: (Nov 2009) **Impact assessment of load shedding on media and access to information in Nepal**.

Wolfson, D. J. (1996). "**Beyond the law: Agribusiness and the systemic abuse of animals raised for food or food production**". Animal Law. 2: 123.

www.zesco.co.zm

www.mining.weekly.com

www.advocacypanel.com.au

ZESCO (Zambia Electricity Supply Corporation). 2015a. **Power Crisis Management. Presentation at the economic association of Zambia Public Debate**, 20 August, 2015. Lusaka: Zambia.

ZESCO. (2015b). **Retrieved February 2016, from Zambia Electricity Supply Corporation:**
<http://www.zesco.co.zm/projects/generation>.

ZIPAR. 2015. **Electricity Sub-sector Brief. In Quarterly Pull Out, Issue 1**, October. Lusaka: Zambia Institute of Policy Analysis and Research.

ZNFU. 2015a. Article by the Administrator of the Zambia National Farmers'

Union website. **Load Shedding Affects Milk Processors. Retrieved November 2015**
<http://www.znfu.org.zm/article/load-shedding-affects>

8.0 APPENDIX ONE: QUESTIONNAIRE

Dairy Industries Load Shedding Questionnaire

Section A: Demographic Information:

Please read and answer the questions by ticking in the box of the correct response for each question. It is important that you respond to all questions. All responses to the questions remain confidential.

1. Please indicate your gender

Male Female

2. Please indicate your age.

20 – 30 years

31 – 40 years

41 – 50 years

51 – 60 years

Above 60 years

3. Please indicate your position in Finta Dairy Community.

Top Management

Middle Management

Simple Worker`

Resident of Livingstone

4. Please indicate years of experience in Finta Dairy community.

Below one (1) year

1 – 5 years

6 – 10 years

11 – 15 years

Over 15 years

Other

Please indicate your highest level of education.

Grade 7

Grade 9

Grade 12

Certificate

Diploma

Under graduate degree

Other

Section Two: assessment of load shedding on dairy industry information:

Rating scale:

1. Strongly disagree

2. Disagree

3. Neutral

4. Agree

5. Strongly agree

1. Load shedding affects reduces the quantity of milk harvested per day

SD	D	N	A	SA

2. Dairy industry is a business enterprise processing milk and is not profitable in Zambia today due to load shedding

SD	D	N	A	SA

3. Dairy industries like Finta would go for alternative power supply to mitigate load shedding

SD	D	N	A	SA

4. Dairy industries that use alternative power supply system experiences an increase in production cost.

SD	D	N	A	SA

Any “Comment”