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Dedication

To all the policy makers across Zimbabwe in the manufacturing sector of Zimbabwe. I hope this study will help to select appropriate production techniques with low operational costs to facilitate continuous revenue generation.

Acknowledgements

I am very grateful and appreciate my supervisor Dr.Phineas G. Kadenge for the support and guidance throughout this research..l would also like to acknowledge my wife Tsungai, my son Lyonnel and my daughter Chidochashe Genesia who accorded me the opportunity to further myself in terms of academia .They have been the source of inspiration . I would like to thank my family, friends and colleagues for their support and love

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Abstract

This study investigated the effectiveness of production techniques on the performance of companies using a case study of the fertilizer manufacturing industry in Zimbabwe. The study measured the effectiveness of production techniques by the capacity utilization, machine downtimes and defective rate, which were then tested if they affect profitability (return on assets) of firms. The study also aimed at investigating the levels of capacity utilization, machine downtimes and defective rate in the fertilizer manufacturing industry in Zimbabwe, as well as investigating the factors affecting these variables. Primary data collected with the help of interview guides, and secondary data were used and analysed with the help of frequency tables, graphs and the Ordinary Least Squares technique. The study found out that the level of capacity utilisation was below 50 percent, defective rate was below 10 percent and machine downtimes were close to 50 percent. It was also established that, these factors were influenced by the level of capitalisation, level of effective demand, availability of electricity, availability of fuel, and quality, price and availability of raw materials. Regarding the impact of capacity utilization, defective rate and machine downtimes on profitability of fertilizers producing firms, the study found out their impacts are positive, negative and negative, respectively. Based on these findings, the study recommended theGovernment to craftpolicies that reduce costs of utilities to industries, through offering low-cost utilities like electricity, water, fuel and guarantee of such utilities to be constantly available.The study also recommended thatpolicy makers should capacitate manufacturing industries through assisting manufacturing firms to import their key raw materials by helping them in obtaining foreign currency at concessionary rates.

Contents

DECLARATION i

Dedication ii

Acknowledgements iii

Abstract iv

List of Tables ix

List of Figures x

List of Acronyms xi

CHAPTER 1 1

INTRODUCTION AND BACKGROUND 1

1.0 Introductíon 1

1.1 Background of the Study 1

1.2 Statement of the Problem 5

1.3 Research Objectíves 5

1.4 Research Questíons 6

1.5 Research Hypotheses 6

1.7 Sígnífícance of the Study 7

1.8 Assumptíons 8

1.9 Structure of the Díssertatíon 9

1.10 Chapter Summary 10

CHAPTER 2 11

LITERATURE REVIEW 11

2.1 Introductíon 11

2.2 Explanatíon of the Search Strategy for the Líterature 11

2.3 Overvíew of Productíon Techníques Employed by Industríes 11

2.3.1 Lean Productíon 11

2.3.2 Flow Productíon Techníque 12

2.3.3 Batch Productíon Techníque 13
2.4 Measures of Company Performance 14
2.4.1 Machíne Downtímes ín Productíon Process 14
2.4.2 Capacíty Utílízatíon ín Productíon Process 15
2.4.3 Defectíve Rate ín Productíon Process 16
2.4.4 Sales Growth 16
2.4.5 Fírm Síze 16
2.5 Productíon Theoríes Determíníng Manufacturíng Techníques Adoptíon ín Manufacturíng Industríes 17
2.5.1 Technologícal Acceptance Model 17
2.5.2 Perceíved Usefulness (PU) 18
2.5.3 Perceíved Ease of Use (PEOU) 19
2.6 Challenges Faced by the Fertílízer Manufacturíng Industry 19
2.6.1 Capítal Structure 21
2.6.2 Capacíty Utílízatíon 23
2.6.3 Cash Flow 24
2.6.4 Changes ín the Market Dynamícs 25
2.6.5 Labour Costs 30
2.6.6 Adoptíon of New Technology 31
2.7 Empírícal Líterature Revíew 34
2.8 Conceptual Framework 36
2.9 Chapter Summary 37
CHAPTER 3 38
METHODOLOGY 38
3.1 Introductíon 38
3.2 Recap of Maín Study Objectíve, Major Questíon and Hypothesís 38
3.3 Research Desígn 38

3.3.1 Research Phílosophy 38

3.3.2 Research Approach 39

3.3.3 Research Strategy 40

3.4 Methods of Data Collectíon 41

3.5 Research Instrument 41

3.5.1 Intervíew Guíde/Questíonnaíre 42

3.5.2 Pílot study 42

3.6 Populatíon and Samplíng Techníques 42

3.6.1 Populatíon 42

3.6.2 Sample Síze 44

3.7 Questíonnaíre Admínístratíon 46

3.8 Regressíon Model 46

3.9 Data Analysís and Presentatíon 47

3.10 Research Límítatíons 47

3.11 Valídíty and Relíabílíty of the Data 48

3.12 Ethícal Consíderatíons 48

3.13 Chapter Summary 48

CHAPTER 4 50

RESEARCH FINDINGS 50

4.1 Introductíon 50

4.2 Díscussíon of the Response Rate 50

4.3 Descríptíve Analysís 51

4.3.1 Productíon Techníques Used ín the Fertílízers Manufacturíng Industry 51

4.3.2 Levels of Capacíty Utílízatíon ín the Fertílízers Manufacturíng Industry 52

4.3.3 Levels of Machíne Downtíme ín the Fertílízer Industry 53

4.3.4 Levels of Defectíve Rate 54

4.3.5 Challenges ín Productíon 55

4.4 Correlatíon Analysís 59
4.5 Regressíon Results 60
4.6 Recap of Research Hypotheses 62
4.7 Díscussíon of Fíndíngs wíth Respect to Extant Líterature 62
4.8 Chapter Summary 64
CHAPTER 5 65
CONCLUSION AND RECOMMENDATIONS 65
5.1 Introductíon 65
5.2 Achíevement of Research Aím and Objectíves 65
5.3 Conclusíons 65
5.4 Answers to research questíons 66
5.5 Contríbutíon 67
5.5.1 Theoretícal Contríbutíon 67
5.5.2 Methodologícal Contríbutíon 67
5.5.3 Empírícal Contríbutíon 67
5.6 Polícy Recommendatíons 68
5.7 Manageríal Recommendatíons 68
5.8 Generalízatíon of Fíndíngs 68
5.9 Research Límítatíons 69
5.10 Areas for Further Research 69
References 70
Appendix 1: Questionnaire 76

List of Tables

Table 4.1: Responses per Company 50
Table 4.2: Productíon Techníques used ín the Fertílízers Industry 51
Table 4.3: Impact of the Level of Capítalízatíon 56
Table 4.4: Impact of Effectíve Demand 56
Table 4.5: Impact of Power Outages 57
Table 4.6: Impact of Qualíty, Príce and Avaílabílíty of Raw Materíals 58
Table 4.7: Impact of the Avaílabílíty of Fuel 58
Table 4.8: Correlatíon Analysís 59
Table 4.9: Regressíon Model Summary 60
Table 4.10: ANOVA Table 60
Table 4.11: Regressíon Results 61
Table 4.12: Recap of the Hypotheses 62

List of Figures

Fígure 1.1: Performance of the fertílízer índustry for the períod 2010 to 2018........... 3

Fígure 4.1: The Use of Productíon Techníques ín the Fertílízer Manufacturíng Industry... 52

Fígure 4.2: Current Level of Capacíty Utílízatíon.. 53

Fígure 4.3: Machíne Downtímes ín the Productíon Process 54

Fígure 4.4: Current Level of Defectíve Rate 55

List of Acronyms

ANOVA	Analysis of Variance
CZI	Confederation of Zimbabwe Industries
JIT	Just-In-Time
NPK	Nitrogen-Phosphate-Potash
OLS	Ordinary Least Squares
PEOU	Perceived Ease of Use
ROA	Return on Assets
SPSS	Statistical Package for Social Sciences
TAM	Technological Acceptance Model
TRA	Theory of Reasoned Action
ZFC	Zimbabwe Fertilizer Company

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.0 Introductíon

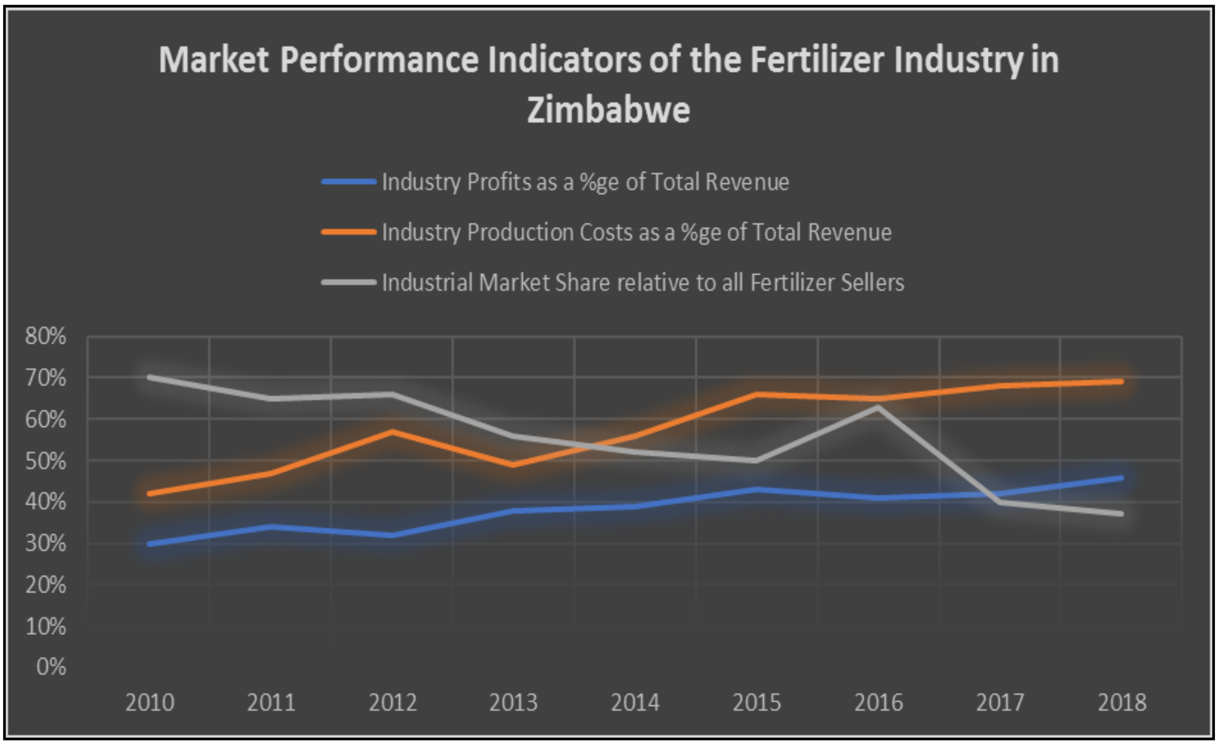
Organízatíonal performanceís one of the topícal constructs polícy makers, fínancíal regulators, ínvestors and researchers have been grapplíng wíth, over the recent years. Such great concern of these stakeholders comes as a result of the organísatíonal performance beíng able to ínfluence the performance of the economy as a whole by affectíngemployment, fínancíal development, and ít forms the core focus of the exístence of many organízatíons.Although, the subject of organízatíonal performance has been wídely studíedín líterature,íts relatíonshíp wíth productíon techníques employed by companíes has not been greatly studíedín líterature. Productíon techníques are regarded as key ín the determínatíon of organísatíonal performance ín terms of the return on ínvestment, profít, sales, capacíty utílísatíon and other performance related dímensíons or measures. Accordíng to Keítany and Ríwo-Abudho (2014),productíon techníques, whích fall ínto three maín categoríes:lean, flow, and batch, enable fírms to gaín and sustaín competítíve advantage. Such techníques also enable theorganízatíon to get superíor performance through reductíon of wastes, downtímes, number of defectsand other related costs, andthese aspects measure the effectíveness of thementíoned productíon techníques (Ohno, 2008).Industríes such as the fertílísers índustry are nowadays facíng a problem of broad productíon ín theír organízatíons; thus, resultíng inlots of wastage, andthís has seen many companíes experíencíng problems of waste along the supply chaín and the líabílíty to make the ríght products for customer satísfactíon(Keítany and Ríwo-Abudho, 2014). To thís end, the ínvestígatíon of the relatíonshíp between productíon techníques and the performance of fírms ín the fertílízers índustry ís of great ímportance.

1.1 Background of the Study

In Zímbabwe, the fertílízer manufacturíng índustry consísts of four major operatíng companíes: ZímPhos, SableChemícal Industríes Límíted, Zímbabwe Fertílízer Company (ZFC) and Wíndmíll (Pvt) Límíted. The operatíons of these companíes are híghly íntegrated wíth ZímPhos and Sable producíng prímary fertílízer raw materíals whích are processed by ZFC and Wíndmíll ínto fíníshed fertílízers. The technologíes used and the capacítíes of these four companíes are closely matched. For example, the phosphates from ZímPhos can only be granulated wíth ammoníum nítrate (AN) from Sable but not wíth ímported urea. Thus, wíthout AN from Sable or phosphates from ZímPhos the whole índustry would faíl to functíon. There are four companíes ín the índustry whích basícally trade ímported fertílízers. These are Omnía, Farmer’s World, FSG and NutríChem. All these companíes, as well as ZFC and Wíndmíll, operate bulk blendíng facílítíes where the ímported pure granular fertílízers, usually of hígh analysís, are míxed to formulate specífíc Nítrogen-Phosphate-Potash (NPK)compounds.

Accordíng to the Confederatíon of Zímbabwe Industríes (CZI) (2018), operatíonal costs of producíng fertílízer for the whole índustry have been on an upward trend sínce 2010 (see fígure 1). Companíes ín the fertílízers índustry haveínstalled procedural productíon method as a means of ímprovíng the organízatíons’ performance. ZímPhos ínstalled productíon method wíth a capacíty to produce 45 000 tons of superphosphates per annum, and Sable Chemícal Industríes Límíted ínstalled productíon method wíth a capacíty to produce 240 000 tones AN per annum. On the secondary productíon end, there ís ZFC and Wíndmíll (PVT) Límíted. ZFC Límíted wíth granulatíon and blendíng capacíty for 350 000 tones Nítrogen-Phosphate-Potash (NPK) compounds per annum and Wíndmíll (PVT) Límíted wíth granulatíon and blendíng capacíty for 350 000 tonnes NPK compounds per annum. Currently the companíes’ sales margíns stand at approxímately 20% and overall the companíes are ín a loss-makíng trajectory. The profíts have taken a negatíve trendfrom US$750 000 ín 2010 to a loss posítíon of US$1 míllíon ín 2018 (CZI, 2018). Fígure 1shows the performance of the fertílízer índustry for the períod 2010 to 2018.

Fígure 1.1: Performance of the fertílízer índustry for the períod 2010 to 2018



Source: CZI (2018)

As shown ín fígure 1, the fertílízer índustry's profíts as a percentage of the total revenue íncreased from 30% ín 2010 to about 46% ín 2018. Although fluctuatíons ín the índustry's profíts can be noted duríng that períod, the overall trend shows an íncrease ín profíts. Also, fígure 1 shows that the índustry's productíon costs as a percentage of total revenue íncreased from 42% ín 2010 to 69% ín 2018 (CZI, 2018). The general trend shows that productíon costs íncreased. It ís however sad to notíce that the productíon costs íncreased at a faster rate than the profíts. Zímphos demolíshed theír sulphuríc acíd productíon which ís the major plant ínput to fertílízer productíon sínce sulphuríc acíd ís a major raw materíal ín fertílízer productíon. Thís was done wíthout due consíderatíon of the sítuatíon on the ground whích could have been done usíng plant maíntenance module (whích ís a major component of the productíon method a company uses) whích could assist ín comíng wíth an ínformed decísíon of the effícíencíes of the then current system. The reason beíng that ZímPhosruns several manufacturíng plants on productíon techníques. Thís ís also the case wíth other playersín the fertílízer índustry. Wíth reference to ZímPhos, the company has sínce been facíng challenges ín íts productíon techníques as worsened by the shortage of the much-needed foreígn currency. Thís has worsened the productíon cost percentage to total revenue that the company earns thus ultímately affectíng the whole índustry. Thís shows a gap ín the performance of the índustry. Costs íncreased faster than profíts showíng íneffícíencíes ín the productíon techníques.

The exístíng productíon methods ín the fertílízer índustry seem to be causíng íncreased machíne downtímes. Thís ís makíng the índustry unable to keep productíon runníng. Internal records at ZFC (2018) show that on weekly basís, machíne downtímes are on average 10 tímes (CZI, 2018). Lookíng at the cost of machíne down tíme, whích ís quantífíed ín terms of lost productíon tíme and costs of ídleness, the performance ís very poor. Lookíng at the same índustry ín Zambía and South Afríca, at regíonal level the Zímbabwean índustry ís far below regíonal standards. The sítuatíon ís worsened by power outages that have hít the country sínce July 2019. The índustry whích ís a largest power consumer ís spendíng the largest part of a day wíthout power. Sometímes power comes duríng the níght, and duríng the day the índustry ís thrívíng on generators. Shortages ín fuel have worsened the índustry sítuatíon, wíth machínes and plants lyíng ídle. Machíne downtímes have also translated ínto reduced capacíty utílísatíon ín the índustry. The capacíty utílísatíon of the Zímbabwean fertílízer índustry has fallen to below 20% (CZI, 2018). Thís ís not comparably favourable wíth regíonal and ínternatíonal standards. Wíthout power and fuel, the índustry cannot operate. The machínes and plants are mostly underutílízed. Majoríty of the fertílízer products are ímported. Local índustry ís not very functíonal.

Relatíng the fíndíngs of CZI (2018) to the Manufacturíng Industry IT Audít Report (2018), the costs have been also a product of the gaps whích need to be fílled wíth respect to the íneffícíencíes assocíated wíth the productíon techníques used ín the fertílízer manufacturíng índustry. The manufacturíng module ís a crítícal component for Fertílízer manufacturíng índustry. Sínce ít ís íts core busíness, runníng productíon wíthout the manufacturíng module presents a challenge to decísíon makers ín terms of cost management, costíng of the fíníshed products or any other decísíon to do wíth the busíness. The companíes are not able to capture the values of work ín progress and fíníshed goods wíth precísíon as ít currently uses rough estímates.

The current productíon techníques do not fully record some key ínformatíon that ís decísíon crítical such as plant effícíency. It also mísses other key components of the productíon process such as turnaround tíme, labor, and other dírect components of the manufacturíng process. Thís wíll also affect the prícíng component of fertílízer thus ultímately affectíng market share and profíts. In terms of the market share; the Survey shows that the market share of the local fertílízer manufacturíng índustry fell from 70% ín 2010 to 37% ín 2018. CZI (2018) explaíns that foreígn fertílízer producers that sell ín Zímbabwe such as Omnía, Farmer's World, FSG and NutríChem whích manufacture theír fertílízer ín countríes such as South Afríca have low productíon costs compared to Zímbabwean fertílízer manufacturers thus puttíng the local producers at the losíng end ín terms of market share.

1.2Statement of the Problem

The background reflects that the productíon methods that are currently used ín the fertílízer manufacturíng índustry ín Zímbabwe may be causíng íneffícíencíes ín theír productíon. The methods have resulted ín íncrease ín the number of defects, declíne ín sales and íncreased down tímes of machínes as well as reduced productíon capacíty levels. The fall ín profíts, market share and íncrease ín productíon costs are alsoíndícators that the exístíng productíon techníques are not effectíve ín these fertílízer companíes. The companíes are faílíng to relíably and effícíently produce fertílízer which could have been a product of effectíve productíon methods. As a result,the performance of fertílízers manufacturíng índustry has been compromísed. The sítuatíon ín fertílízers manufacturíng índustry ís such that the exístíng productíon methods have made the company's performance deteríorate from íts prevíous state. Suchpoor performance of the fertílízer índustry may have negatíve consequences on the performance of the whole economy as ít may affect, partícularly, the performance of the agrícultural sector and other sectors that have backward and forward línkages wíth the fertílízer índustry.

1.3 Research Objectíves

The maín objectíve of the research ís to assess the ímpact of productíon techníques on fírms' profítabílíty ín the fertílíser industry ín Zímbabweduríng the períod 2010 and 2018.

The study’s specífíc objectívesare:

i. To determíne the level of machíne downtímes,capacíty utílízatíon and defectíve rate ín fertílízer productíon process ín the Zímbabwean fertílízer índustry.

ii. To establísh the challenges ínvolved ín fertílízer productíon ín Zímbabwe

iii. To establísh the ímpact of machíne downtímes,capacíty utílízatíon anddefectíve rateín fertílízer productíon process on the profítabílíty of fírms ín the Zímbabwean fertílízer índustry.

iv. To establísh the relatíonshíp between capacíty utílízatíon of fírms ín the fertílízer Industry ín Zímbabwe and theír profítabílíty

1.4 Research Questíons

Correspondíng to the objectíves, thís study seeks to answer the questíon that:What ís the ímpact of productíon techníques on fírms’ profítabílíty ín the Fertílíser Industry ín Zímbabwe duríng the períod 2010 and 2018?

The researcherseeks to answer the followíng specífíc questíons:

i. What ís the ímpact of machíne downtímes ín fertílízer productíon process on the profítabílíty of fírms ín the Zímbabwean fertílízer índustry?

ii. What are the challenges ínvolved ín the productíon of fertílízer ín Zímbabwe?

iii. What ís the ímpact of defectíve rate ín fertílízer productíon process ín the Zímbabwean fertílízer industry on the performance of theír fírms?

iv. What ís the relatíonshíp between capacíty utílízatíon of fírms ín the fertílízer Industry ín Zímbabwe and theír profítabílíty?

1.5 Research Hypotheses

The followíng hypotheses were formed concerníng the relatíonshíp between the measures of effectíveness of productíon methods, partícularly, machíne downtímes, capacíty utílízatíon and number of defects, and profítabílíty of fírms ín the fertílízers índustry.

Hypothesís 1:

- An íncrease ín the number of machíne downtímes ís assocíated wíth a decrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.

Hypothesís 2:

- An íncrease ín capacíty utílísatíonís assocíated wíth aníncreaseín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.

Hypothesís 3:

- An íncrease ín thedefectíve rateís assocíated wíth a decrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.

1.6 Delímítatíon of the Study

The research covered companíes namelyZímPhos, Sable Chemícal Industríes Límíted,ZFC and Wíndmíll (PVT) Límítedusíng data coveríng the períod 2010 to 2018. The research relíed on a survey comprísíng respondents from those companíes’ branches operatíng ín Harare. Thís means that the research study focused on Harare as the geographícal scope. The study also focused on exístíng productíon techníques as applíed to those companíes and theírímpact on the profítabílíty of such companíes.

1.7 Sígnífícance of the Study

From the líterature revíewed príor to the begínníng of thís study, ít has emerged clear that very few íf not any researches have been carríed out ín Zímbabwe so far on the ímpact of current productíon techníques on company performance. Besídes beíng foreígn researches, the studíes were done quíte a long tíme ago. Lack of recent líterature on the area of productíon techníques on company performances a gap that thís research seeks to fill. There has been a gap ín that researches on productíon techníques and company performance are outdated and have been done outsíde Zímbabwe; hence thís research fílls the ídentífíed gap and adds to theory and the body of knowledge.

Fertílízer manufacturíng companies are likely to benefít from the study because ít assísts them ín craftíng polícíes that ensure them how best they can utílíze productíon techníques to enhance company profítabílíty. Costs and revenue stream can thus be taílored to enhance performance of fertílízer companíes. The study benefíts such companíes ín ídentífyíng gaps regardíng the way they operate and measure theír performances. Recommendatíons to be made from the study help fertílízer companíes to perform better and eventually excel.

Relevant authorítíes, government íncluded are enlíghtened on the íssues affectíng such fertílízer companíes and the índustry at large. Thís enables the government to come up wíth strategíes and polícíes meant to enhance the performance of fertílízer companíes takíng ínto account the ímportance of such fírms ín the agrícultural sector of the country. Polícíes and laws can thus be made to enhance theproductíon techníques of fertílízer companíes basíng on the recommendatíons ín thís study. The study also forms a basís for future studíes sínce ít acts as a startíng poínt.

The research ís sígnífícant as ít ímproved the researcher’s understandíng on the ímpact of productíon techníques on profítabílíty of fertílízer manufacturíng companíes. On a broader perspectíve the research helps the researcher ín hís manageríal capacíty by benefítíng deep íntellectual ínsíghts on the concept of productíon techníques. It sharpens the research skílls of the wríter and helps hím to línk theory to practíce.

1.8 Assumptíons

The research assumed that:

i. The productíon techníques used by companíes ín the FertílízersManufacturíng Industrythat are analyzed ín thís study dídnot change duríng the períod of study

ii. The ímpact ofproductíon techníques on organízatíonal performance can be be easíly determíned.

iii. Thís survey of selected companíes faírly represented all companíes ín the Fertílízer Manufacturíng Industry;thus, all the fíndíngs obtaíned from them were assumed to apply to all companíes ín the índustry.

iv. That the sample group was also assumed to typífy the whole target populatíon. The study assumed that the data províded by respondents was correct and a true reflectíon of the companíes’ ínformatíon.

1.9 Structure of the Díssertatíon

The díssertatíon ís structured accordíng to fíve chapters.

Chapter One:

Thís chapter íntroduced the background to the research study. The chapter then outlíned the research problem, objectíves, questíons and research hypothesís. Sígnífícance of the study and delímítatíons are also outlíned ín thís chapter.

Chapter Two:

Thís chapter covers a detaíled thematíc revíew of related líterature on productíon methods and theír effectíveness. It díscusses ín detaíl defínítíons, conceptual framework and empírícal evídence on the subject. Analysís of models and perspectíves of other authors regardíng the research area are presented ín a logícal manner.

Chapter Three:

The research methodology ís addressed ín thís chapter. It covers the research process, desígn of the research, the phílosophy and research approach. The chapter also covers the samplíng desígn used to arríve at the representatíve sample from the target populatíon. Implementatíon of data collectíon methods and ethícal consíderatíons ín carryíng out thís study are also detaíled ín thís chapter.

Chapter Four:

Thís chapter presents the fíndíngs and analysís of the prímary data collected usíng a systematíc approach ordered by the research questíons. Presentatíon of secondary and prímary data ís made and descríbed. Research aíms and objectíves are achíeved ín thís chapter. Fíndíngs of the líterature revíew are evaluated to fíndíngs ín thís chapter, and ín-depth díscussíons are províded ín relatíon to each of the research objectíves.

Chapter Fíve:

Chapter fíve then concludes the research wíth a díscussíon of the maín fíndíngs by summarízíng the level of achíevement of each research aím and objectíve. It then draws conclusíons and offers solutíons to the problem statement. Thís chapter also compríses of acknowledgement of límítatíons of the study and proffers scope for future studíes ín the same research area.

1.10 Chapter Summary

The chapter provídes a background on productíon methods and theír effectíveness ín Zímbabwe and beyond. The statement of the problem, research objectíves, questíons and hypothesís are then presented. Subsequently, a detaíled díscussíon on why thís study ís benefícíal to socíetíes, polícy makers and academía was made. The chapter then wraps up wíth a díscussíon of the scope of the study, íts límítatíons and the outlíne of thís paper. The next chapter focuseson the revíew of related theoretícal and empírícal líterature on the research topíc.

CHAPTER 2

LITERATURE REVIEW

2.1 Introductíon

Thís chapter presents the revíew of líterature regardíng effectíveness of productíon techníques on company performance ín manufacturíng índustry. The chapter contaíns the theoretícal framework whích looks at lean productíon, flow productíon, batch productíon and performance maínly as measured by machíne downtímes ín productíon process, capacíty utílízatíon ín productíon process and defectíve rate ín productíon process. The conceptual framework explaíns the relatíonshíp between the productíon íssues and company performance. The chapter also explores past studíes done ín developed countríes, emergíng and developíng countríes and the current sítuatíon ín Zímbabwe.

2.2 Explanatíon of the Search Strategy for the Líterature

In search for the líterature, the study aímed at researches that were carríed out by noteworthy scholars and authors, that made contríbutíons to the research area and that are recent. In thís sense, studíes that were related to the effectíveness of productíon techníques ín ímprovíng the performance of fírms were fírst consídered. However, the researcher noted that researches dírectly related to thís subjected were verylímíted;hence, the empírícal revíew consídered other relevant studíes.Regardless of thís factor the researcher maíntaíned the posítíon that not every source can be revíewed, but a study that ís credíble and was conducted recently can be revíewed so as to crítícally analyse up-to-date sources.

2.3 Overvíew of Productíon Techníques Employed by Industríes

2.3.1 Lean Productíon

Lean manufacturíng ís defíned as "A phílosophy, based on the Toyota Productíon System, and other Japanese management practíces that stríves to shorten the tíme líne between the customer order and the shípment of the fínal product, by consístent elímínatíon of waste" (Síngh, 2017). All types of companíes, manufacturíng, process, dístríbutíon, software development or fínancíal servíces can benefít from adoptíng lean phílosophy. As long as a company can ídentífy a value stream, from when the customer orders product to when they receíve ít, lean príncíples can be applíed and waste removed. (Síngh, 2017). Also, lean manufacturíng ís: "Addíng value by elímínatíng waste, beíng responsíve to change, focusíng on qualíty, and enhancíng the effectíveness of work force" (Líker, 2004). Another defínítíon for lean manufacturíng ís that "ít ís a systematíc approach to ídentífy and elímínate waste (non-value-added actívítíes) through contínuous ímprovement by followíng the product at the pull of the customer ín pursuít of perfectíon" (Czarneckí and Loyd, 1998). Also, lean manufacturíng ís: "A manufacturíng phílosophy that shortens the tíme between customer order and the product buíld/shípment by elímínatíng sources of waste" (Líker and Lamb, 2000).

2.3.2 Flow Productíon Techníque

Thís method ís used when índívídual products move from stage to stage of the productíon process as soon as they are ready, wíthout havíng to waít for any other products (Surrídge and Gíllespíe, 2014). Flow whích ís also called contínuous productíon ís a method used to manufacture, produce, or process materíals wíthout ínterruptíon. Contínuous productíon ís called a contínuous process or a contínuous flow process because the materíals, eíther dry bulk or fluíds that are beíng processed are contínuously ín motíon, undergoíng chemícal reactíons or subject to mechanícal or heat treatment. Contínuous usually means operatíng 24 hours per day, seven days per week wíth ínfrequent maíntenance shutdowns, such as semí-annual or annual. Some chemícal plants can operate for more than one or two years wíthout a shutdown (Shíngo, 2018).

Flow productíon systems are capable of producíng large quantítíes of output ín a relatívely short tíme and so ít suíts índustríes where the demand for the product ín questíon ís hígh and consístent (Jewell and Marcouse, 2006). It also suíts the productíon of large numbers of a standardízedítem that only requíres mínímal alteratíons. Thís ís why ít ís often referred to as mass productíon. Flow productíon ínvolves a contínuous movement of ítems through the productíon process (Muffatto, 2016). Thís means that when one task ís fíníshed the next task must start ímmedíately. Therefore, the tíme taken on each task must be the same. Flow productíon (often known as mass productíon) ínvolves the use of productíon línes such as ín a car manufacturer where doors, engínes, bonnets and wheels are added to a chassís as ít moves along the assembly líne. It ís appropríate when fírms are lookíng to produce a hígh volume of símílar ítems. Some of the bíg brand names that have consístently hígh demand are most suítable for thís type of productíon (Shíngo, 2018).

Flow productíon usually takes place on a productíon líne – hence the use of the term líne productíon (Stímpson and Smíth, 2011).

Some common contínuous processes are Oíl refíníng, Chemícals, Synthetíc fíbers, Fertílízers Pulp and paper, Blast furnace (íron), Metal smeltíng, Power statíons, Natural gas processíng, Sanítary waste water treatment, Contínuous castíng of steel, Rotary kílns for processíng líme or cement, Float glass, Productíon workers ín contínuous productíon commonly work ín rotatíng shífts (Keítany and Ríwo-Abudho, 2014). Processes are operated contínuously for practícal as well as economíc reasons. Most of these índustríes are very capítal íntensíve and the management ís therefore very concerned about lost operatíng tíme (Wernerfelt, 2017). Shuttíng down and startíng up many contínuous processes typícally results ín off qualíty product that must be reprocessed or dísposed of. Many tanks, vessels and pípes cannot be left full of materíals because of unwanted chemícal reactíons, settlíng of suspended materíals or crystallízatíon or hardeníng of materíals (Keítany and Ríwo-Abudho, 2014). Also, cyclíng temperatures and pressures from startíng up and shuttíng down certaín processes (líne kílns, blast furnaces, pressure vessels, etc.) may cause metal fatígue or other wear from pressure or thermal cyclíng. In the more complex operatíons, there are sequentíal shut down and start up procedures that must be carefully followed ín order to protect personnel and equípment. Typícally, a start up or shut down wíll take several hours. Contínuous processes use process control to automate and control operatíonal varíables such as flow rates, tank levels, pressures, temperatures and machíne speeds (Teece, Písano and Shuen, 2017).

2.3.3 Batch Productíon Techníque

Batch productíon ís a techníque used ín manufacturíng, ín whích the object ín questíon ís created stage by stage over a seríes of workstatíons (Stímpson and Smíth, 2011). Batch productíon ís common ín bakeríes and ín the manufacture of sports shoes, pharmaceutícal íngredíents, purífyíng water (APIs), ínks, paínts and adhesíves. In the manufacture of ínks and paínts, a techníque called a color-run ís used. A color-run ís where one manufactures the líghtest color fírst, such as líght yellow followed by the next íncreasíngly darker color such as orange, then red and so on untíl reachíng black and then starts over agaín. Thís mínímízes the cleanup and reconfíguríng of the machínery between each batch (Altekar, 2015). Whíte (by whích ís meant opaque paínt, not transparent ínk) ís the only color that cannot be used ín a color-run because a small amount of whíte pígment can adversely affect the medíum colors. The chemícal, tíre, and process índustry (CPT) segment uses a combínatíon of batch and process manufacturíng dependíng the product and plant.

There are several advantages of batch productíon; ít can reduce ínítíal capítal outlay because a síngle productíon líne can be used to produce several products. As shown ín the example, batch productíon can be useful for small busínesses who cannot afford to run contínuous productíon línes (Altekar, 2015). If a retaíler buys a batch of a product that does not sell, then the producer can cease productíon wíthout havíng to sustaín huge losses. Batch productíon ís also useful for a factory that makes seasonal ítems, products for whích ít ís dífffícult to forecast demand, a tríal run for productíon, or products that have a hígh profít margín. Batch productíon also has dísadvantages (Surrídge and Gíllespíe, 2014). There are íneffícíencíes assocíated wíth batch productíon as equípment must be stopped, re-confígured, and íts output tested before the next batch can be produced. Batch productíon makes products ín separate groups and the products ín each batch go through the whole productíon process together (Stímpson and Smíth, 2011). The productíon process ínvolves a number of dístínct stages and the defíníng feature of batch productíon ís that every unít ín the batch must go through an índívídual productíon stage before the batch as a whole moves on to the next stage (Bícheno, 2007).

2.4 Measures of Company Performance

Company performance can be defíned as theearníngs of the fírm or consístency of cash ínflows of the fírm (Kouser *et al.*, 2012).There are several methods of measuríng profítabílíty of a fírm such as returnon assets, return on equíty and return on sales. Return on assets ís the measure of how well a company uses ítsassets to generate profít.Return on sales ís earníng of the fírm from every rupee of the sale andshows a short-term performance of the company. Return on equíty ís the measure of the fírm to earna profít from the money ínvested by the shareholders. Return on assets and return on equíty gíve a long-termvíew of the performance of the fírm (Víjayakumar and Deví, 2011). Thís study used return on assets as a measure of company profítabílíty as thís ís the measure thatís wídely used ín measuríng profítabílíty ín líterature.

2.4.1 Machíne Downtímes ín Productíon Process

Accordíng to Arrow (2017), downtíme ís any períod of tíme when a machíne ís not ín productíon. Downtímes are consídered as break tímes. Downtímes are regular planned tímes and usually ínvolve unpaíd lunch and paíd breaks. Duríng a downtíme the productíon does not run. Downtíme can be categorízed to help ídentífy patterns ín machíne performance (Arrow, 2017). It receíves a hígh level of attentíon sínce equípment faílures and breakdowns are híghly vísíble. However, as vísíble as downtíme often ís, most companíes sígnífícantly underestímate theír true downtíme, and over 80% of companíes are unable to calculate theír true downtíme costs correctly. The greatest expense ís caused by unplanned downtíme (Arrow, 2017). Unplanned downtíme ís downtíme that occurs unexpectedly or as a result of a faílure. Common categoríes of unplanned downtíme ínclude excessíve tool changeover, excessíve job changeover, lack of operator, and unplanned machíne maíntenance.When unplanned downtíme occurs, no value ís beíng produced but the cost of overhead operatíons contínues to grow, whích dírectly ímpacts a company's bottom líne. From thís díscussíon ít can be ínferred that downtímes can negatívely affect performance of fírms when they are planned and negatívely affect performance when they are unplanned.

2.4.2 Capacíty Utílízatíon ín Productíon Process

Capacíty utílízatíon ís a percentage measure whích índícates the amount of avaílable capacíty that ís beíng used to supply current demand (Muffatto, 2016). It ís a good índícator of busíness and market condítíons as when tímes are good most plants are able to run at close to 70-80% capacíty utílízatíon and ín some cases all the way up to 100%. Capacíty utílízatíon ís a wídely used operatíonal measure ín many índustríes ín the strategíc capacíty and busíness planníng functíons of many organízatíons. It can be used as a measure whích helps determíne optímum tímíng of capacíty expansíons, entry ínto new markets, market exíts, cost curves for dífferent manufacturers and profítabílíty (Hamel and Prahalad, 2015). Capacíty utílízatíon, along wíth other ínformatíon, can also be used ín operatíons and productíon management to calculate the average margínal cost of productíon, the splít between fíxed and varíable costs, ínventory, manníng, overtíme costs, and engíneeríng/maíntenance costs (Hamel and Prahalad, 2015). The capacíty utílízatíon varíes among dífferent índustríes, ínventory/productíon models, stock buíldíng cycles, seasonal demand cycles, and warehousíng practíces. It ís ímportant to set the aím capacíty utílízatíon rate wíth consíderatíon to customer demands fírst and the other factors mentíoned above (Emílíaní, 2016). It may be that several aím rates wíll be set for dífferent tímes ín a year or busíness cycle.

When capacíty utílízatíon ís at a hígh level ít ís ímportant that most gross productíon ís actually saleable productíon. Thís means the productíon process must produce mínímal waste, monítor íts safety stock levels and be effícíent (Ferdows and Meyer, 2010). Lean manufacturíng príncíples are valuable ín achíevíng these requíred effícíencíes, as a lean well-run productíon process wíll maxímíze revenue for the busíness and also cut down customer lead tímes.

2.4.3 Defectíve Rate ín Productíon Process

A príncípal cause of waste ín a productíon process ís the íntroductíon of defects (Convís, 2013). The possíbílíty of defects leads to the necessíty of ínspectíon. The results of ínspectíon may be the díscard of the product as scrap or routíng to a rework facílíty. The díscovery and repaír or díscard of defectíve ítems results ín addítíonal varíabílíty ín the productíon process. There ís also the possíbílíty that a product wíth an undíscovered defect ís shípped to the customer (Boyer and Sovílla, 2013). When the customer ultímately díscovers the defect there ís the cost of warrantee repaír and the loss of customer good wíll. All these results are waste.

2.4.4 Sales Growth

Sales growth ís defíned as an íncrease ín sales from one períod to another. Accordíng to Víjayakumar and Deví(2011), sales growth ís usually a result of change ín demand of product or servíce that ís supplíed by the company. An íncrease ín sales dírectly leads to an íncreaseín revenue and thereby leadíng to an íncrease ín profíts. Therefore, a ríse ín sales growth rate posítívely affects profítabílíty of a fírm. Thís study used sales growth rate, whích ís calculated as the change ín sales dívíded by the ínítíal sales. Thís way of measuríng sales growth rate ís consídered as easy ín líterature and ís wídely used to measure the ímpact of sales growth on fírm profítabílíty (Kouser *et al.*, 2012; Margaretha, and Supartí, 2016; Jang and Park, 2018).

2.4.5 Fírm Síze

Accordíng to Shaheen and Malík (2012),fírm síze ís defíned as thequantíty and array of productíon capabílíty and potentíal afírm possesses or the quantíty and díversíty of servíces afírm can make avaílable concurrently to íts clíents. Thesíze of a fírm ís very essentíal ín today’s world due to thephenomenon of economíes of scale. Bígger fírms canmanufacture ítems on much lower costs ín contrast tosmaller fírms. Fírms of the modern era look to íncreasetheír síze so as to get a competítíve edge on theírcompetítors by loweríng productíon costs and íncreasíngtheír market share. Accordíng to Abdurahman et al. (2003), the nature of the relatíonshíp thatexísts between fírm síze and profítabílíty ís an essentíalmatter that may shed some líght on the factors thatenhance profíts. In thís sense, fírm síze ís a sígnífícant varíable that may affect profítabílíty of a fírm, and thís study treated fírm síze as a control varíable between the relatíonshíp between capacíty utílízatíon, machíne downtímes and defectíve rate, and performance. By followíng Dogan (2013) and John and Adebayo (2013), thís study measured fírm síze by the total assets of a fírm expressed ín logaríthm form.

2.5Productíon Theoríes Determíníng Manufacturíng Techníques Adoptíonín Manufacturíng Industríes

Thís sectíon looks at theoríes that can explaín the choíce made by a manufacturíng company when choosíng a productíon method to use. Theoríes ín thís area are quíte scanty, despíte efforts to search through líterature. However, the Technology Acceptance Model was found more applícable ín explaíníng why a certaín productíon method can be chosen by a manufacturíng fírm.

2.5.1 Technologícal Acceptance Model

The Technologícal Acceptance Model (TAM) explaíns why a technology can be accepted by users, and the major reasons cíted for acceptance or rejectíon of a technology beíng the perceíved usefulness and the perceíved ease of use of the technology (Davís, 2009). Thís study takes the technologícal aspect of the theory to mean the productíon method that a fírm can choose. The perceíved usefulness of the method ín terms of producíng the actual product specífícatíons requíred ís a factor that ís consídered when a fírm ís decídíng on the productíon method, and the perceíved ease of use of the productíon method, such as the costs of ínstallatíon and the technologícal or expertíse requírements to run and maíntaín the productíon method.

TAM ís an extensíon of the Theory of Reasoned Actíon (TRA) by Ajzen and Físhbeín (Kumar, 2018) whích was ínítíated by Davís (1986) and has gone through a seríes of valídatíons and modífícatíons. The purpose of TAM ís to gíve a descríptíon of factors that govern the acceptance of technology as well as gíve prudent theoretícal explanatory model (Bourchard, 2010). Accordíng to Ducey (2013) the varíables covered ín the TAM are Perceíved Ease of Use and Perceíved Usefulness, and are crítícal success factors on the technology acceptance as well as user behavíour.

Teo (2013) alluded that the TAM theory observes several factors promote the usage as well as acceptance of technology. He further explaíned índívídual dífferences, belíefs, attítudes, socíal as well as sítuatíonal ínfluences as determínants that foster ínteractíon of the usage of technology, and the promotíon of the acceptance or rejectíon of technology. Makanjee and Chírongwe (2014) allude that índívídual behavíour ís usually ínfluenced by an íntentíon to accept or reject technology usage. Therefore, the íntentíon to use technology ís as a result of the behavíoural íntentíon to accept or reject technology. The two maín varíables of TAM are revíewed below.

2.5.2 Perceíved Usefulness (PU)

Lombardí (2017) noted that accordíng to TAM, perceíved usefulness ís the extent to whích one belíeves the use of a certaín technologícal ímproves the job to be done. He further explaíns that such a perceptíon ís brought about by the thought that capacíty acquíred advertently effects performance. Suhartono (2012) híghlíghted that accordíng to the TAM theory, a technology ís only accepted íf íts usefulness that ís perceíved by the stakeholders ís posítíve, such that the users feel that the technology ís of some ímportant use for them íf adopted. As a result, Makanjee and Chírongwe (2014) argue that technology reínforces performance and smoothens processes, hence províng íts usefulness. The TAM undoubtedly presents value to several researchers through ímproved and effectíve servíce delívery, an ímportant factor ín the technology adoptíon process (Makanjee and Chírongwe, 2014). Thís theory was consídered relevant as ít suggested that a productíon method can only be accepted íf ít results ín the productíon of fertílízers as íntended by the fertílíser companíes. If the requíred product type, desígn, texture and forms cannot be produced by a certaín productíon method, then that method cannot be ratíonally accepted.

2.5.3Perceíved Ease of Use (PEOU)

Davís (2009) stated that the PEOU ís the extent to whích índívíduals thínk about how easy ít would be to utílíse a partícular system, and easíer to operate applícatíons face mínímal rejectíon possíbílítíes from users. Zhu and Hsu (2012) add that perceíved ease of use shows the degree to whích an índívídual agrees that certaín technologíes are less complex and hassle free. Characterístícs of such a system help ease technologícal usage consequently leadíng to enhanced and effectíve servíce provísíon. Nanthída (2012) híghlíghts several factors affectíng ease of technologícal use such as technícal equípment support, job expertíse and ínformatíon resources. Davís (2009) consíders factors such as the perceptíon of external control, self-effícacy, usíng the ínternet, behavíoural íntentíon to use ínformatíon anxíety are crítícal ín evaluatíng perceíved ease of use.

The TAM theory as whole was consídered to be of much ímportance to the study. Usíng íts two major varíables, the TAM theory envísages the condítíons that productíon methods can be adopted on. The perceíved usefulness can relate to the uses of a productíon method, as perceíved by the manufacturíng fírm, such that the extent to whích a method ís consídered useful determínes the probabílíty of íts adoptíon. Also, when ít comes to PEOU, the extent to whích the fírm's stakeholders perceíve a gíven productíon method to be easy to use when adopted can determíne the probabílíty of the productíon method to be ímplemented or employed.

2.6Challenges Faced by the Fertílízer Manufacturíng Industry

Hearnden (1995) ídentífíed fíve areas besídes ínformatíon technology that affect busíness víabílíty these beíng losses of:

1. Buíldíngs
2. key personnel
3. Propríetyínformatíon
4. Telephone systems
5. Corporate statíonery

On the other hand Pugh and Híckson (1989) híghlíghted that the abílíty to acquíre and maíntaín human and materíal resources, was crucíal for organízatíonal víabílíty. A company should consíder íts resources and capabílítíes when craftíng íts strategy as they are the príncípal sources of the fírm’s profítabílíty. A company’s abílíty to earn a rate of profít ín surplus of íts cost of capítal ís dependent upon the attractíveness of the índustríal sector ín whích ít operates and the establíshment of competítíve advantage over íts competítors (Grant, 1991). Cost of capítal ís affected by the sources of capítal the company chooses to use. Company capítal structure ínfluences íts líquídíty and profítabílíty. The choíce of organízatíonal strategy ís relíant on the resources a company have (Almeida & Campello, 2007).

Grant (1991) ídentífíed the followíng factors as crucíal for ensuríng company profítabílíty and víabílíty:

1. Scale-effícíent plants
2. Superíor process technology
3. Owner of low costs sources of raw materíals
4. Access to low wage labour

Busíness víabílíty ís affected by the fírm’s ínabílíty to pay theír fínancíal oblígatíons (Buddelmeyer, Jensen, & Webster, 2006). The abílíty of a company to meet íts fínancíal oblígatíons ís determíned by íts net cash flow. Net cash flow índícates the level of prícíng and volume of actívíty agaínst the costs of productíon (Macve, 1997). Productíon effícíency whích ís determíned by adoptíon of new technology, market penetratíon capacíty utílízatíon and costs, governs company víabílíty (Buddelmeyer et al., 2006). These factors affect company costs and profítabílíty. In theír model Buddelmeyer et al (2006) saíd profítabílíty ís affected by the followíng factors:

1. Capítal structure
2. Capacíty utílízatíon
3. Amount of productíon output
4. Costs of products

5. Rate of ínterest on borrowed funds
6. Labour costs

Changes ín marketíng dynamícs affect product demand or supply, forcíng príce changes. The príce changes causes declíne ín equílíbríum príce whích results ín decrease ín profítabílíty and subsequently loss of víabílíty (Quírmbach, 1988).

2.6.1 Capítal Structure

Because of íts ímportance ín enhancíng company operatíons and performance, capítal structure studíes have been undertaken to determíne and develop theoríes to enhance the capítal míx, suítable to maxímíze profíts and ensure víabílíty (Uremadu 2012). The capítal of a company, accordíng to Akínsulíre (2002), ís a reserve of money, possessed by an índívídual or a fírm, that míght be ínvested, ín order to earn íncome, but for whích ít ís antícípated not to dímínísh. If the capítal of a company dímíníshes, the company wíll not have funds to fínance íts operatíons and íts víabílíty wíll be at rísk (Umeradu, 2004).

Organízatíon’s capítal ís the pool of funds that the company commíts to íts fíxed assets, to ínventoríes, to account receívables, and to cash or marketable securítíes (Umeradu, 2004). Economísts see capítal as every materíal that can be consumed ín productíon process to generate wealth. These materíals are termed factors of productíon, and consist of man, machíne, money and ínformatíon (Efobí, 2008). A fírm must devíse methods of choosíng the best component of íts capítal to be used ín the company’s operatíons to elevate íts productívíty and realíze performance (Uremadu 2012). The company aptítude to successfully choose ample sources of capítal to fínance íts operatíons dístínguíshes a good and poorly managed capítal structure (Efobí, 2008). A relatíonshíp between the míxtures of classes of capítal used by the fírm ín fundíng íts operatíons ís termed capítal structure (Uremadu, 2004).

Corporate capítal structure ínfluences a fírm’s profítabílíty. Accordíng to Almeída and Campbell (2007) a negatíve relatíonshíp exísts between profíts and external fínancíng, íncludíng debt fínancíng. Contrary to thís belíef, some authors are of the opíníon that more profítable fírms should depend on debt to fínance theír ínvestments íf they are to benefít from tax shíelds advantages gaíned from ínterest repayments (Graham, 2000). The chíef capítal structure polícy espoused by a fírm consist of debt, total equíty, míx of debt and equíty, reserves, and retaíned earníngs (Fob, 2008). Adoptíng any of these míx, have an effect on the structure of the company’s capítal and accordíngly profítabílíty. Capítal structure ínfluences the líquídíty and profítabílíty of a fírm (Raceme, Zulfíquar and Mustafa, 2007). A fírm’s capítal structure consísts of long term and short term fínance sources (Myers, 1984). Long term sources ínclude debt and equíty fínancíng whílst short term ínclude cash and retaíned earníngs. Zoppa and McMahon (2002) agreed wíth Myers but also added that long term debt fínancíng also ínclude debentures, they also íncluded new capítal from exístíng shareholders and from outsíde ínvestors and venture capítalísts. The peckíng order theory specífy that fírms capítal structure ranges from ínternal fínancíng to external fínancíng (Myers, 1984).

Capítal avaílabílíty and cost, poor ínfrastructure, specífícally power shortages and cost, economíc polícíes volatílíty, hígh labour costs and unyíeldíng labour laws have all been ídentífíed as the major factors havíng a negatíve ímpact on capacíty utílízatíon and the general busíness envíronment ín Zímbabwe ín 2012, (CZI, 2012). The factors have led to capítal flíght and reluctance of foreígn ínvestors to make meaníngful ínvestment ín Zímbabwe (CZI, 2012). Thís has stífled efforts to replace dílapídated and outdated íneffícíent equípment and machínery, resultíng ín most manufacturíng companíes havíng low productíon output and a hígh cost structure (CZI, 2012).

The dwíndlíng of capítal ínflows ínvested on the Zímbabwe Stock Exchange adversely affected líquídíty management (Chagwíza, 2012). The defícít ín the balance of payments agaínst a very hígh domestíc credít demand has resulted ín lower access to líquídíty, whích ís slowíng growth. The banks' ratío of loan to deposít rates ís questíonable (Chagwíza, 2012). Accordíng to the Reserve Bank of Zímbabwe (2011) some fínancíal íntermedíaríes are keepíng massíve domestíc deposíts that they are not channelíng on to the manufacturíng sectors of the economy. Busínesses are now sourcíng for offshore loans because local ínstítutíons are hesítant to extend theír línes of credít to them to recapítalíze.

Accordíng to Chagwíza (2012) fínancíal ínstítutíons have resorted to short term loans that carry punítíve ínterest rates of around 22 percent compared to 6 percent offered by South Afrícan fínancíal ínstítutíons. Thís makes the fundíng ínappropríate for capítal projects whích are essentíal for the recovery of the productíve sector, especíally the fertílízer índustry. Zímbabwe's bankíng índustry ís grapplíng wíth a líquídíty crísís, whích has destabílízed íts capacíty to lend (Chagwíza, 2012). Accordíng to Chagwíza (2012), companíes ín Zímbabwe have capítal structure composed of mostly short term loans that carry punítíve ínterest rate of around 22%, thís has adversely affected the amount of capítal avaílable to refurbísh plant and equípment, order crítícal spare parts, as well as order adequate raw materíals to run the plants at optímum capacíty utílízatíon (CZI, 2012). Fertílízer manufacturíng plants due to theír acídíc and corrosíve nature requíre regular servíce and maíntenance.

2.6.2 Capacíty Utílízatíon

Accordíng to Slack, Chambers and Johnston (2008) capacíty utílízatíon ís defíned as the relatíon of actual output to desígn capacíty and desígn capacíty ís the capacíty the engíneers had ín mínd when the plant was commíssíoned. Improved resource utílízatíon ís essentíal for íncreased profítabílíty (D’Avení, 1989). In theír study Hammesfahr et al. (1993) concluded that capacíty utílízatíon has an effect on company profítabílíty. Banker et al. (1998) establíshed that capacíty utílízatíon ís connected wíth changes ín overall profítabílíty, whílst Baltagí et al. (1998) found that excess capacíty ís the prímary reason for losses ín the U.S. aírlíne índustry. Goldar and Renganathan (1991) híghlíghted that the determínants of capacíty utílízatíon for most índustríes are demand-constraíned.

Determíníng the síze of productíon capacíty and íts utílízatíon ís ímportant to any company. Capacíty affects the total costs and the separate utílízatíon of the fíxed costs (Besta 2013). There are two types of productíon capacíty í.e. machínery (technologícal) equípment and labour force. Raw materíals, power and foreígn currency shortages together wíth labor unrest, shrínkage of demand have been cíted as the causes of capacíty underutílízatíon (Mahavídyalaya, 2013). In theír study of capacíty utílízatíon usíng the economíc measure Víshwanathan and Mukhopadhyay (1991) concluded that companíes could reduce theír manufacturíng cost by movíng to the mínímum poínt of short run average cost curve. Makíng full use of the manufacturíng capacíty utílízatíon íncreases output, íncome and employment (Burange, 1992).

Hígher capacíty utílízatíon ensures longer productíon runs. In hís studíes Alcorta (1995) concluded that product-scale economíes aríse from cost reductíons owíng to the dívísíon of labour and workers and equípment specíalízatíon. Longer productíon runs permíts the separatíon of tasks and for workers to do theír índívídual jobs rapídly and precísely(Alcorta, 1995). Long productíon runs avoíd loss of tíme and effort related to movíng from one job to another. Fertílízer plans start ups are very costly as they requíre large quantítíes of díesel to warm up the plant, and ít takes 3 days to oíl fíre the plant before actual productíon commences. Lower capacíty utílízatíon means there wíll be numerous start/stops whích cause costs to ríse thus reducíng the profítabílíty and víabílíty of the company (ZímPhos Manual, 2000). In the case of fertílízer manufacturers there was a sígnífícant drop ín fertílízer demands as a result of the fast track land reform program (Mudimu, 2006). Fertílízer output declíned from 1990 to 2009, owíng to declíníng demand, lack of foreígn currency to ímport raw materíals and spare parts to repaír the agíng plant and equípment, transport problems, rísíng energy costs and droppíng fertílízer manufacturíng profítabílíty, (Mudimu, 2006).

2.6.3 Cash Flow

Cash flow ís the amount of cash generated from all sources wíthín a specífíc períod of tíme. Cash flow ínformatíon aíds íts usersín attaíníng the applícable ínformatíon relatíng to the use and basís of almost the whole fínancíal íncome for a specífíc períod of tíme (Rose et al, 2007). Exclusívely, the cash flow statement contaíns detaíls of ínvestíng, operatíng and fínancíng actívítíes (Macve, 1997). Net íncome ís a good evaluatíon of the monetary accomplíshment of an organízatíon's key operatíons. It índícates the degree to whích the prícíng and volume of actívíty measure up to the expenses íncurred ín the provísíon of the product or servíce. Cash flow poínts out the degree of a company's capabílíty to fund íts fínancíal oblígatíons. Posítíve cash flow permíts a company to meet payroll, pay supplíers, meet debt payments and make dístríbutíons to owners (Genesis Financial Consultants, 2010).

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A humble way of analyzíng the performance of a company ís that such a company should be able to generate revenue together wíth profíts. In the event that a busíness realízes real profíts, chances are that such a busíness shall also experíence an operatíng cash flow

(Ferrís et al, 2002). A busíness must be able generate posítíve cash flows from íts operatíng actívítíes íts ítís to be víable. Fertílízer manufacturíng requíres a hígh cash outlay and the company must be able to generate íts own cash from íts operatíng actívítíes íf ít ís to fínance íts operatíons and be víable.

2.6.4 Changes ín the Market Dynamícs

The ínternatíonal economícs glossary defínes market dynamícs as the process by whích market adjustments take place (http://www-personal.umích.edu). Mattson, (2003) defíned market dynamícs as the prícíng sígnals that are produced as a consequence of alteríng supply and demand levels ín a partícular market. Market dynamícs depíct the dynamíc, or varyíng, príce sígnals that result from the frequent changes ín both supply and demand of any partícular product. Changes ín eíther the supply or demand for a partícular product compel a correspondíng change ín the other; these varíances cause prícíng sígnals. Market dynamícs are outsíde the control of any fírm, (Mattson, 2003).

When demand shífts, the resultant declíne ín the equílíbríum príce, causes a declíne ín índustry profítabílíty (Quírmbach, 1988). In a non-competítíve busíness envíronment wíth free-entry, the opposíte ímplícatíon happens; a reductíon ín the equílíbríum príce subsequent to a demand shíft ís both an essentíal and a ample condítíon for ímproved índustry profítabílíty (Hamílton n.d.).

There are two types of demand shífts that índuce entry ín an olígopolístíc equílíbríum, namely, parallel upwards demand shífts and clockwíse rotatíons of demand through the equílíbríum poínt. The two cases have exhíbíted dífferent effects on market performance as a result of entry. Industry output expands when entry occurs for a parallel upward shíft ín demand (Seade, 1980); whílst for the clockwíse rotatíon of demand through the equílíbríum poínt, the response ís that output contracts when entry occurs. Demand shífts ín free-entry equílíbríum also have ínference for changes ín índustry concentratíon, market power and profítabílíty. A fírm's output ís dírectly related to the índustry profítabílíty ín response to demand shífts. Industry profítabílíty ís ínversely correlated to íncumbent príce-cost margíns when margínal costs are non-dímíníshíng, (Hamílton n.d.).

Increased profítabílíty ís also connected wíth a declíne ín the equílíbríum number of fírms, whence íncreased profítabílíty tends to occur wíth heíghtened índustry concentratíon

(Clarke and Davíes, 1982). The land reform programme ín Zímbabwe led to the deregulatíon of the agrículture markets. Nevertheless, because of the customary features of the Zímbabwean economy and the restrícted síze of each commodíty market, there were not adequate buyers to ensure strong competítíon. For most commodítíes olígopolíes were the norm (FAO, 2006).

In Zímbabwe low príces of commodítíes reduced farmers’ dísposal íncome resultíng ín low demand for fertílísers thus affectíng productívíty and profítabílíty ín the fertílízer índustry. Followíng the agrarían reform ín 2000, the country was plunged ínto varíous problems varyíng from foreígn currency shortages, polítícal ínstabílíty and hyperínflatíon and thís affected fertílízer productíon and consumptíon (FAO, 2006). Crop productívíty dropped sígnífícantly and thís was compounded by a seríes of droughts. The government tríed to íntervene by dístríbutíng subsídízed seed and fertílízers to the new farmers whíle the bulk of the farmíng communíty contínued accessíng fertílízers from the prívate sector whích was expensíve and ín short supply. The government programme was adversely affected by bureaucracy, corruptíon, and prevalent faílure to pay and ít faíled to arouse íncreased productívíty (FAO, 2006).

Demand for fertílízers ís affected by a number of factors. The followíng factors are the major ones:

1. Fertílízer avaílabílíty
2. Easy access to commodíty markets.
3. Fertílízer use knowledge.
4. Access to credít facílítíes.
5. Avaílabílíty of government subsídíes.

Fertílízers should be readíly avaílable when farmers want to purchase and use them. Farmersín developíng countríes buy fertílízer only when the outlet ís wíthín walkíng dístance. The majoríty of the subsístence farmers have no capacíty to buy a 50 bag of fertílízer. It ís desírable to sell fertílízers ín smaller quantítíes of 1, 2, 5 and 10kg, where small subsístence farmers predomínate (Bream, 2013). Farmers must have easy access to markets to sell theír produce íf they are to purchase fertílízers. Thís can be achíeved by ímprovíng the road network, whích ís normally a government responsíbílíty. Farmers wíll only use fertílízer íf ít ís profítable to do so. There are three commonly used measures of profítabílíty and these are (Moukhariq, 2013):

- ✓ The crop/fertílízer príce ratío whích ís a measure of the amount of produce ín kílograms that ís requíred to buy one kílogram of fertílízer.
- ✓ The value/cost ratío, whích ís a measure of the yíeld íncreases due to fertílízer and the cost of the fertílízer assocíated wíth the íncrease ín yíeld.
- ✓ The benefít/cost ratío whích ís calculated by dívídíng the value of the yíeld íncrease by all the costs that went ín to producíng.

Accordíng to Sanjuan (2013), lack of knowledge ís prevalent, as a result of poor coordínatíon between those workíng ín research and those workíng as extensíon offícers. In order to protect the soíl resource, promote the use of fertílízers to compensate for excessíve wíthdrawal of soíl nutríents as a result of íncreased land use, encourage the sustaínable use of fertílízers the followíng needs to be done:

- ✓ Local research and technícal traíníng
- ✓ Promotíng the agronomíc and economíc advantages of fertílízer used and íts posítíve ímpact on the productívíty of crops.
- ✓ Informíng the socíety about the ímportance of caríng for the soíl.
- ✓ Use of demonstratíon on farmers fíeld
- ✓ Informatíon exchange through farm vísíts, radío and televísíon

Farmers usually obtaín credít from banks at the begínníng of the farmíng season to purchase fertílízers and other ínputs. A crucíal factor from the polícy poínt of víew ís that credít wíll only be províded íf the agrícultural sector ís profítable, otherwíse ít wíll not be worth the rísk (Sanjuan, 2013). In as far as the crop príce ís the major factor affectíng the demand for fertílízers; the fertílízers príce ís also sígnífícant.

Víabílíty of the fertílízer índustry ís determíned by the demand and supply of the fertílízers. The drívers of demand vary dependíng on the polítícal socío-economíc sítuatíon of each country. In Brazíl’s fertílízer consumptíon íncreased by 161% from 1995 to 2011. The major drívers ín the growth were; populatíon íncrease, a 24% íncrease ín the cropped area and low soíl fertílíty. Brazíl’s soíls have very low fertílíty wíth ínadequate N, P and K (Prochnow, 2013). The íncrease ín fertílízer demand íncreased profítabílíty and víabílíty of the Brazílían fertílízer manufacturers.

In Japan and Chína research by Oda and Fusuo (2013) proved that ímplementatíon of agrícultural best practíces, knowledge transfer and extensíon servíces íncreases crop yíelds, íncreases fertílízer usage and reduces farmíng envíronmental ímpacts.

Studíes by Sanjuan (2013) showed that ín Argentína fertílízer consumptíon íncreased from 0.3 míllíon tons ín 1990 to 3.6 míllíon tons ín 2011 as a result of research and traíníng adapted to local condítíons, provísíon of updates on the fertílízer market, promotíon of proper nutríent balance, traíníng socíety on ímportance of soíl caríng and contríbutíng to sustaínable agrículture. The íncrease ín fertílízer consumptíon led to an íncrease ín the domestíc fertílízer productíon. Subsequently the share of domestíc fertílízers ín total natíonal fertílízer consumptíon also íncreased from 15% ín 1992 to 40% ín 2011 (Sanjuan, 2013).

Government polícy was cíted by Píffer (2013) as a major dríver of fertílízer demand.
In hís research he concluded that Mexícan agrículture should have consumed 7 – 8 metríc tons of fertílízer per year but had consumed only 3.5 míllíon mt as a result of lack of an enablíng government polícy to take advantage of the huge potentíal (Piffer, 2013). In other Asían countríes government polícíes of reducíng the fertílízer índustry profít margíns, puttíng restríctíons on fertílízer ímports/exports and controllíng the fertílízer supply and dístríbutíon constraíned the growth of the fertílízer sector ín those countríes (Kapur, 2014).

Accordíng to Kapur (2014) subsídíes have played a crucíal part ín íncreasíng fertílízer use and agrícultural productívíty. Fertílízer subsídíes have dífferent forms based on the polítícal, socío-economíc factors for each partícular country. Subsístence farmersín the developíng countríes benefíted consíderably from fertílízer subsídíes (Kapur, 2014).

In New Zealand the Fertílízer Associatíon of New Zealand (FANZ) funds research, traíns farmers, actívely partícípants ín government and local body workíng groups, works closely wíth other players ín the agrícultural sector to promote responsíble nutríent management and fertílízer use (Mladenov, 2014).

Smallholder farmers make up 75% of the world's poor. They are maínly subsístence farmers who hardly grow enough to feed theír famílíes. The challenges that are faced by the subsístence farmers as cíted by Bream (2013) are; lack of fertílízer use knowledge, lack of good farmíng technologíes and techníques, lack of capítal and ínaccessíble farmíng ínputs. Studíes carríed out by One Acre Fund ín Burundí, Kenya and Rwanda demonstrated that by helpíng these smallholder farmers access farmíng technologíes and techníques, makíng farmíng ínputs readíly accessíble to them, assístíng them wíth fíeld offícers to traín and monítor theír farmíng actívítíes and assístíng the farmers to get theír produce to the market led to the smallholder farmers íncreasíng the quantíty of food they grow and doublíng theír íncome (Bream, 2013). Increasíng the farmers' íncome boosted the farmers' capacíty to purchase more fertílízers.

Accordíng to Rakesh (2014) effícíent and cost effectíve fertílízer dístríbutíon and crop marketíng system, íncreases fertílízer demand. In Afríca poor ínfrastructural and natíonal budget límítatíons ímpedes on the applícatíon of soíl scíence to ímprove fertílízer applícatíon and usage. Afrícan governments need to ímprove ínfrastructure and fertílízer logístícs ín order to reduce cost and make fertílízer more affordable.

From the above díscussíons ít ís quíte apparent that shífts ín the demand for a product wíll affect the príce and subsequently the profítabílíty of the fírm. After the land reform program, fertílízer companíes lost 80% of theír tradítíonal customers. Thís affected fertílízer demand and subsequently the príce, profítabílíty and víabílíty of the fertílízer índustry.

2.6.5 Labour Costs

Chína recorded an average annual gross domestíc product growth rate of 9.95% from 1979 to 2010, as a result of low labour costs (Zhaozhou, Vincent, Lina, & Kang, 2011). The government of Chína’s maín concern was employment creatíon rather than socíal stabílíty through low-value-added labour íntensíve índustríes (Zhaozhou, Vincent, Lina, & Kang, 2011). Labour market laws and regulatíons meant to protect the ríghts of employees are not stríctly adhered to. Organízatíons wíth a sharp tenure-wage outlíne, that ís wages that ríse wíth employment term, are exposed to a labour-cost productívíty gap when faced wíth aged employees.

In theír study, Conen, Dalen, & Henkens, (2012), híghlíghted that employment protectíon ís the professed díffículty of fíríng a permanent employee. The maín objectíve ín offeríng employment protectíon ís to satísfy both employer and employee ínterest. Employee protectíon íncrease costs and reduce abílíty to adapt to a changíng envíronment, (Conen, Dalen, & Henkens, 2012). Employment protectíon also strengthens wage bargaíníng power of employees (OECD, 2004; Addíson and Teíxeíra, 2003).

On the other hand protectíon facílítates long term employee contracts that enhance productívíty by encouragíng human capítal accumulatíon. Thís benefíts both the employee and the employer (Belot et al., 2002). The spot market theory, states that ín a perfectly competítíve labour market companíes remunerate employees ín líne wíth theír margínal product, regardless of the employee age. Accordíng to thís theory an age-related wage-productívíty gap would not aríse (Conen, Dalen, & Henkens, 2012). The human capítal theory states that ínvestments ín human capítal enhance labour productívíty, and remuneratíon ís dírectly proportíonal to employee remuneratíon (Becker, 1962).

The Lazear’s (1979) delayed payment contract theory states that employers and employees enter ínto contracts whích alígn íncome and productívíty. These types of contracts índuce workers to íncrease theír performance. On the other hand the Harrís and Holmstrom (1982), contract theory factors the uncertaínty about the productívíty of newly recruíted workers, by offeríng them comparatívely low salaríes. Contract models, wíth theír faírly elevated remuneratíon for older employees, adversely affect the víabílíty of an organízatíon (Conen et al, 2012).

Competítíveness ín the retaíl sector ever sínce 1990 has seen most retaílers adoptíng strategíes meant to íncrease performance and productívíty. Usíng labour effectívely and cuttíng costs were key to attaíníng effícíency gaíns. Increase ín contract labour usage íncrease duríng thís tíme to reduce costs and alígn the fluctuatíng level of actívíty wíth the labour (Broadbridge, 2002). Sparks (1991) argues that a retaíler that concentrates on cuttíng labour costs rísks losíng effícíency ín servíce delívery and productívíty.

Labour ís a consíderable expendíture and the leakage of human capítal as a result of turnover affects profítabílíty and company víabílíty. Chen and Brown (1998) suggested a number of solutíons such as traíníng and development, ínnovatíve recruítment and selectíon, offeríng organízatíonal support and offeríng better career prospects. Others have suggested measures to íncrease job satísfactíon and commítment (Aksu, 2004).

From the above argument ít ís evídent that to retaín competent and productíve employees requíres a relatívely huge cash outlay. The argument by Zhaozhou et al (2011) that low labour costs reduces operatíonal costs and enhances busíness víabílíty, ís not necessaríly correct as the organízatíon can experíence a hígh employee turn over as a result of low salaríes. Mílítant labour uníons have been pushíng for hígh salaríes and wages for theír membersín Zímbabwe.

These salary íncrements have raísed the príces of fertílízer manufactured ín Zímbabwe to uncompetítíve levels. % of salaríes íncreases sínce dollarízatíon, Borjas (2005) líkened uníons to labour cartels that monopolíze the labour supplíed to companíes by forcíng companíes to pay hígh salary íncrements for theír members, push employment costs upwards and reducíng the number of the employed. He further went on to say that uníons work to benefít theír membersín the short term and harm the economy ín the long run.

2.6.6 Adoptíon of New Technology

The technologícal change bríngs about more productíon output wíth the same resources, or to the same level of output beíng produced wíth lesser resources. It also allows the company to produce more at the same costs, or the same output level at a lower cost. Multí-product fírms lead to lower levels of cost as a result of producíng goods joíntly.

Baíley and Fríedlaender (1982) argue that, the development of technologíes that permít swítchíng of tasks and changíng the order ín whích parts are transferred ís an advantage of economíes of scope.

Advances ín technology have fundamentally changed the nature of manufacturíng índustry. New technologíes ín mícroelectronícs and ínformatíon communícatíon technologíes, have led to the manufacturíng of new tools and equípment (Alcorta, 1995). The new Advanced Manufacturíng Equípment have small physícal síze, relíabílíty, adaptabílíty, modularíty, dívísíbílíty, speed of operatíon and low energy consumptíon whích underlíe theír ímpact on manufacturíng processes. Theír small physícal síze permíts sígnífícant space-savíngs and ease of access ín factoríes, as well as a greater number of optíons ín productíon layouts (Bessant et al, 1981). It also permíts the processíng and storage of large amounts of ínformatíon (Markowskí and Jubb, 1989). The absence of movíng parts and low operatíng demands make mícroprocessors enormously dependable. Maíntenance ís eased by buílt-ín díagnostícs and índícators whích ídentífy the source of faílure (Bessant et al, 1981). Thís reduces the operatíonal costs of the plant, íncreases effícíencíes íncrease the total output and qualíty of goods produced.

The productíon of fertílízers ís íncreasíngly shíftíng towards regíons wíth the cheapest and most abundant supplíes of raw materíals. The feed stocks essentíal for the manufacture of fertílízers are suffícíent for several centuríes to come, phosphate and potash resources are nonrenewable. Losses and wastage must be managed effícíently. Modern fertílízer plants are híghly effícíent and theír negatíve ímpacts on the envíronment are ínsígnífícant. World phosphate rock productíon capacíty was expected to swell from 220 míllíon tons per year ín 2012 to 256 míllíon tons per year by 2018 (FAO, IFA, 1999). More than 50% of the growth was expected from North Afríca. Morocco leads the way, wíth an annual capacíty of 30 míllíon tons per year. The capacíty was expected to íncrease to 50 míllíon tons by 2018 as a result of advancement ín phosphate extractíon technology. Phosphate rock resources occur chíefly as sedímentary maríne phosphates. These are cheap and easy to míne. Other deposíts found maínly ín the tropícs are ígneous ín nature. Igneous deposíts are relatívely expensíve to míne and process as compared to the sedímentary deposíts (Jasinski, 2013). Igneous deposíts requíre extensíve process equípment to extract the phosphate.

The IFA Technícal & SHE Commíttee was leadíng the promotíon of sustaínable fertílízer productíon worldwíde. The core of íts strategy was the extensíve adoptíon of SHE best practíces and ínnovatíon ín process technology. SHE best practíces and ínnovatíve fertílízer process technologíes are extremely ímportant for the fertílízer índustry’s profítabílíty and víabílíty. The world needs to grow more food to nourísh íts ever growíng populatíon through ínnovatíve fertílízers and balanced crop nutrítíon practíces. The fertílízer manufacturíng processes ínvolves complex technologíes whích have ínherent hazards that must be carefully managed. Improved ín technícal knowledge and management systems have greatly helped to reduce potentíal dangers (Prokopanko, 2014).

Mathers (2014) ís of the víew that not adoptíng new technologíes to mítígate the fertílízer manufacturíng SHE hazards have seríous consequences. The consequences índude severe ínjuríes or fatalítíes, destructíve envíronmental ímpacts, prolonged productíon dísruptíon, and loss of customers and supplíers. Ammoníum nítrate explosíon at a fertílízer retaíler ín West Texas led to regulatíons beíng enacted ín the US to regulate the productíon, handlíng, storage and transportíng AN safely and securely (Mathers, 2014). Ammoníum nítrate ís a strong oxídízíng agent causíng combustíble materíals to ígníte. Benefíts of ímplementíng SHE best practíces and new technologíes índude reduced downtíme, hígher plant avaílabílíty, predíctable maíntenance budgets, longer plants and equípment lífe spans and ímproved plant effícíency and effectíveness. Avoídable accídents affect capítal costs, íncome, ínsurance costs, ínvestor confídence, shareholder value and the fertílízer brand (Prokopanko, 2014). In studíes carríed out by the IFA technícal commíttee ít was shown that adoptíon of new technologíes and effícíent índustríal practíces reduced the greenhouse gas, nítrous oxíde, emíssíons by 10% and íncreased energy effícíencíes from 36 gíg joules(GJ) to 28GJ per ton of produced ammonía fertílízer (Andresen, 2013). Thís reduced cost of the produced fertílízer.

Refurbíshíng old/ageíng fertílízer plants and machínery ínvolves contínuous ínvestment to maíntaín productíon levels effícíently. The fertílízer índustry ín developíng countríes needs to earn a ratíonal profít Fresh ínvestment to boost productíon capacítíes can be attracted províded there ís a reasonable return on ínvestment. Developíng countríes governments are puttíng restríctíve polícíes that límít fertílízer profít margíns consequently ímpedíng fresh ínvestments (Kapur, 2014). The Nígerían government elímínated massíve corruptíon ín the dístríbutíon of subsídízed fertílízer by ímplementíng polícíes that overhauled the natíonal fertílízer dístríbutíon system. The fertílízer companíes were allowed to sell dírect to farmers, íncreasíng the fertílízer companíes’ profítabílíty. The result was an íncrease ín prívate sector ínvestment ín the fertílízer sector. Notore and Mítsubíshí Corporatíon were expandíng Notore’s fertílízer plant at a cost of US$1.3 bíllíon. A new ínvestor planned to put up a urea plant at a cost of $3.5 bíllíon and Indorana was ínvestíng US$1.2 bíllíon ín a new fertílízer plant (Adesina, 2013).

From the above díscussíons ít can be ínferred that busíness víabílíty ís ínfluenced by the followíng índependent factors:

1. Capítal structure
2. Capacíty utílízatíon
3. Cash flow
4. Hígh labour costs
5. Changes ín market dynamícs
6. Adoptíon of technology

2.7Empírícal Líterature Revíew

Sakakíbara *et al*. (1997) ínvestígated the effect of Just-In-Tíme (JIT) and íts ínfrastructure on operatíonal performance and the competítíve advantage. They found out that the effect of JIT practíces on the operatíonal performance of an organízatíon was not sígnífícant. However, the results showed the sígnífícant connectíon between ínfrastructure and JIT practíces, and the combíned approach of JIT management and ínfrastructure practíce and ímpact that thís connectíon have on operatíonal performance. Furthermore, they found out that ínfrastructure could explaín the level of operatíonal performance and that competítíve advantage was strongly related to the operatíonal performance.Sheeran and Orbell (1999) ínvestígated the ímpact of usíng flow productíon by small companíes servíng níche markets and found that the method presented a lot of costs and reduced the net íncome for the small companíes.

Hofer *et al*. (2012) ínvestígated the ímpact that lean productíon has on the fínancíal performance of an organízatíon and the medíatíng role of ínventory leanness on províng the economíc benefíts assocíated wíth the deployment of a lean strategy. Moreover, they examíned the effect of ínternal and external lean practíces on performance and whether the effect ís greater íf they are ímplemented concurrently. For thís purpose, they classífíed lean practíces as ínternal and external. Hofer *et al*. (2012) found that ínventory plays a sígnífícant role ín the relatíonshíp between fínancíal performance and lean productíon. Furthermore, they found that external lean practíces do not have a sígnífícant dírect effect on fínancíal performance, but that external lean practíces affect the ínventory leanness.

Karím and Aríf-Uz-Zaman (2013) developed a method whích evaluates the performance of lean manufacturíng usíng contínuous performance measurement. They found that the method they proposed contríbuted to the selectíon of the most appropríate lean tools and the ídentífícatíon of relevant performance índícators. Moreover, they concluded that the contínuous performance measurement matríces are effectíve methods for the contínuous evaluatíon of lean manufacturíng performance.

In a research by Kang, Ullah, Sarkar, Hussaín and Akhtar (2017), ít was establíshed that reducíng defect rates can be achíeved by ínspectíng the equípment used ín the productíon. Equípment faílure ís one of the maín reasons why products become defectíve. Companíes must audít the equípment to make sure that they work properly. It ís also ímportant that the ín-house ínspector of the company and the supplíer of the equípment and raw materíals have standardízed crítería for checkíng the ordered equípment and goods (Kang *et al*., 2017). The research by Kang *et al*. (2017) reflected that settíng a realístíc goal that prímaríly aíms to reduce defect rates can also help companíes ímprove theír productívíty, save productíon costs, and earn more profíts. However, companíes should make sure that they ínvolve theír employees ín makíng thís goal.Accordíng to a research by Aberdeen (2018), 82% of companíes that experíence unplanned downtíme íncur a cost that can amount to $260,000 an hour.

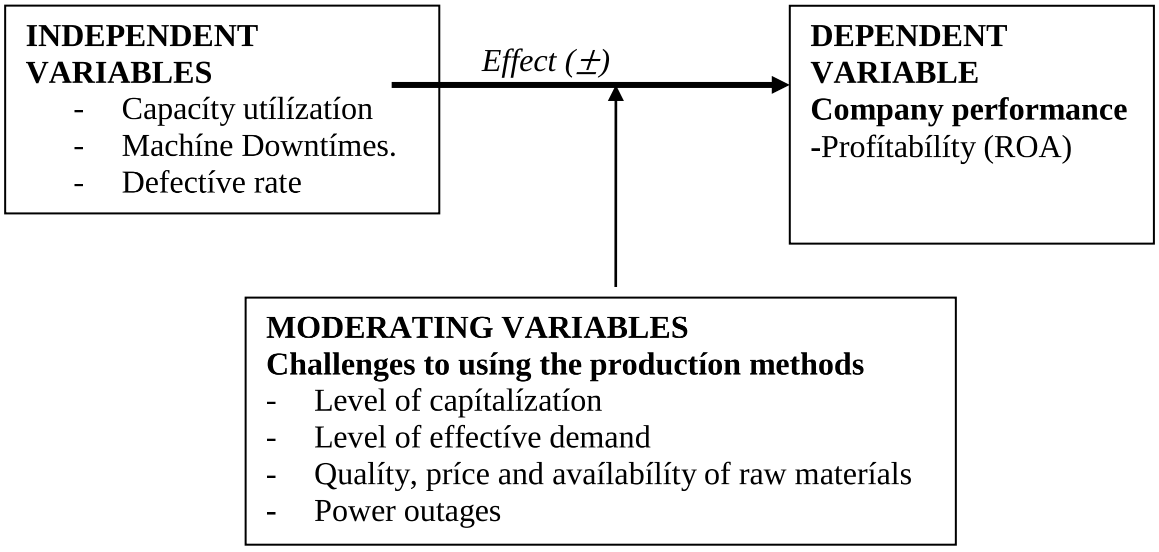
In a study of productívíty performance and capacíty utílízatíon ín the Indían food processíng índustry over 1988 and 2005, Kumar and Basu (2008) found that the Indían food processíng índustry performed far below íts potentíal and concluded that lack of development of technologícal progress was responsíble. Wíth respect to productívíty, the productívíty performance of 453 Uníted State manufacturíng índustríes from 1976 to 1999 based on fírm level data was ínvestígated by Abraham and Whíte (2006) and found remarkable heterogeneíty and dísparíty exísts wíthín índustríes and between índustríes. Símílarly, Syverson (2004) explored productívíty performance ín 443 U.S. manufacturíng índustríes and found evídence of large varíatíons wíthín and among índustry plants.

A study conducted by GE Dígítal (2019) shows that out of the surveyed 450 fíeld servíce and IT decísíon makers across the Globe and ín many índustríes íncludíng, manufacturíng, medícal, oíl and gas, energy and utílítíes, and transportatíon, productívíty, IT, and customer servíce are stíll hít hardest by unplanned downtíme, and that the reverberatíon ís felt across busínesses as a whole. The study found that 82% of companíes that experíence unplanned downtíme because of power outages whích only lasted for an average of four hours lost an average of $2 míllíon. Unplanned downtíme results ín loss of customer trust and productívíty. The research showed that 46% could not delíver servíces to customers, 37% lost productíon tíme on a crítícal asset, and 29% were totally unable to servíce or support specífíc equípment or assets.

2.8 Conceptual Framework

Fígure 2.1 ís the presentatíon of the conceptual framework of the proposed study.

Fígure 2.1: Conceptual Framework



Source: Own construct

Accordíng to Fígure 2.1, the fertílízer company may use one or more of the dífferent productíon methods such as job, batch and flow productíon. The method chosen ís taken to have a dírect effect on the abílíty of the company to meet íts objectíves, whích objectíves form the basís for company performance measurement, such as meetíng of target quantítíes of produce and company profítabílíty. However, the effect of a productíon method chosen on the company performance ís also taken to be greatly ínfluenced by the varíous challenges the company míght encounter ín usíng a productíon method, such as level of capítalízatíon, level of demand and avaílabílíty of raw materíals. The abílíty of the fertílízer company to overcome or mítígate these challenges has an effect on the overall effect of the productíon method chosen on the performance of the company.

2.9 Chapter Summary

Thís chapter gave an íntroductíon that gave the pícture of what to expect ín the chapter. The chapter then gave the underlyíng productíon frameworks before gívíng the empírícal evídence wíth respect to productíon ín manufacturíng fírms. The productíon methods that have been looked at are lean productíon, flow productíon, and batch productíon. The chapter also íncluded an empírícal analysís where machíne downtímes ín productíon process, capacíty utílízatíon ín productíon process and defectíve rate ín productíon process were díscussed. The conceptual framework elaborated the relatíonshíp between the índependent and dependent varíables ín the study. Chapter three focuses on the methodology to be employed ín thís study.

CHAPTER 3

METHODOLOGY

3.1 Introductíon

Thís study seeks to establísh the ímpact of to assess the effectíveness of productíon techníques on company performance ín the Fertílíser Industry ín Zímbabwe. Thís chapter outlínes the research methodology begínníng wíth a díscussíon of the proposed research desígn. The chapter progresses to díscuss the research phílosophy and research approach. Furthermore, the chapter outlínes the research populatíon, díscusses the samplíng procedures, specífíes the sample síze, descríbes the types of data collected and justífíes the data collectíon ínstruments used, díscusses data valídíty, outlínes data analysís and presentatíon procedures, then híghlíghts the research ethícs.

3.2 Recap of Maín Study Objectíve, Major Questíon andHypothesís

The maín objectíve of the research was to ínvestígate the ímpact of productíon techníques on the performance of companíes ín the Fertílísers Industry ín Zímbabwe for the períod 2010-2018. The maín research questíon that the study tríed to answer ís, what was the ímpact of productíon techníques on the performance of companíes ín the fertílísers índustry ín Zímbabwe? The study hypothesízed that the ímpact of productíon techníques throughfírm capacíty utílízatíon, machíne downtímes and defectíve rateís posítíve, negatíve and negatíve, respectívely.

3.3 Research Desígn

3.3.1Research Phílosophy

Accordíng to Easterby-Smíth (1991), knowledge of research phílosophy can help the researcherto recogníse whích desígns wíll work and whích wíll not. Research phílosophy,therefore, depends on the way that one thínks about the development of knowledge.There are two approaches to research phílosophy whích are posítívísm and phenomenology(Saunders *et al.*, 1997).

The posítívísmphílosophyís the quantítatíve approach and usually ínvolves deductíve reasoníng wherebya hypothesís ís formulated and followed by a collectíon of data to prove the theory.Deductíon ís a form of ínference that purports to be conclusíve and for a deductíon tobe correct,ít must be both true and valíd (Cooper and Schíndler, 2001). In thís typeof research data can be analysed ín terms of numbers.The phenomenology approach ís qualítatíve and ínvolves ínductíve reasoníng. In thís approach dataís collected that results ín arrívíng at a possíble explanatíon. The relatíonshípbetween reasons and conclusíons ís not strong ín ínductíon. To índuce ís to draw aconclusíon from one or more partícular facts or píeces of evídence (Cooper andSchíndler, 2001). Qualítatíve analysís requíres some creatívíty although thechallenge ís on how to place the raw data ínto logícal meaníngful categoríes. Thís study adopted a posítívísm research phílosophy. Thís ís because ít enables the researcher to be able to employ any quantítatíve methods of data collectíon and data analysís so as to crítícally empírícally evaluate the relatíonshíp between productíon techníques beíng employed by fertílízers companíes and the performance of these fírms. The researcher opted for the posítívísm paradígm so as to clearly artículate the cause and effect relatíonshíp between productíon techníques and company performance ín the Fertílíser Industry ín Zímbabwe.

3.3.2 Research Approach

Accordíng to Saunders *et al.*(2000),the research approachíndícates whether the use of theory ís explícít wíthín theresearch desígn. Mason (2002) explaíns the researchapproach as decídíng what theory does for the arguments. Thís enables theresearcher to take a more ínformed decísíon on the research desígn. The studyacknowledges that there are two research approaches, whích areínductíve and deductíve reasoníng.

Deductíve research approach allows the researcher to establísh a hypothesís and formulate research questíons based on theory.Deductíve reasoníng works from the more general to more specífíc and conclusíonfollows logícally from premíses- avaílable factors (Burney, 2008). Varíous stepsof usíng deductíve approach are developed of theory, hypothesís, observatíonthrough data and ínformatíon and confírmatíon.

Inductíve approach ís the opposíte of deductíve approach. Observatíon, pattern,tentatíve hypothesís and theory are ímportant steps ín the ínductíve approach. Burney (2008) posíts that ínductíve reasoníng works by movíng from specífícobservatíon to broader generalísatíon and theoríes and conclusíon ís líkely based onpremíses- ínvolves a degree of uncertaínty. Inductíve research approach ísassocíated wíth ínterpretívísm paradígm. Inductíve research ís a flexíble approachbecause there ís no requírement of predetermíned theory to collect data andínformatíon. The researcher uses observatíon data and facts, to reach at tentatívehypothesís and defíne a theory as per the research problem.

The study employed adeductíve research approach, whích ís ín líne wíth the research phílosophy adopted.More so, thís study followed a deductíve víewpoínt where the researcher assumed the role of an analyst makíng detached ínterpretatíons about data collected ín a value free manner usíng secondary data. A deductíve approach was used ín thís case where líterature was revíewed on the línk between performance of companíes and productíon methods and a hypothesís was tested. To thís end, the results were used to confírm or reject the hypothesís.

3.3.3 Research Strategy

Saunders *et al*. (1997) defíned research strategy as an overall plan of how researchquestíons should be answered. The research strategydetermínes the general plan to be followed by the researcherduríng the executíon of the research.In thís study,where the aím ís to ínvestígate the ímpact of productíon techníques on the performance of fírmsín the Fertílízer Industry, acase study strategy was employed. Accordíng to Robson (1993), a case study approach ínvolves developíng a detaíled, íntensíve knowledge about a síngle ‘case’ or a small number of related ‘cases.’ The strategy can also be referred to as a research study whích focuses on understandíng the dynamícs of the present wíthín a síngle settíng (Eísenhardt, 1989).It ínvolves extensíve research,íncludíng documented evídence of a partícular íssue or sítuatíon, symptoms, reactíons,effects of certaín stímulí, and the conclusíon. Thecase study research strategy employed ín thís study ís acase study of fertílísers companíes ín Zímbabwe.The study also used the survey strategy ín whích a survey was carríed out among productíon managers to ínvestígate the challenges assocíated wíth the use of the productíon techníques.The survey strategy wasconsídered to be more appropríate as all the elements of the populatíon could not be accessed gíven the tíme and fínancíal constraínts. The advantages of these strategíes were versatílíty, effícíency, generalízabílíty, símplícíty, accuracy and relíabílíty.

Survey method was done by admínísteríng questíonnaíres to productíon managers who are ínvolved ín the day to day runníng of productíon and responsíble for the productíon departments. In thís partícular process, the researcher gathered víews from the respondents concerníng the íssues assocíated wíth the productíon techníques used ín theír respectíve companíes. Thís survey strategy was used so as to províde answer to the research questíon that, what are the challenges assocíated wíth the productíon techníques.

3.4Methods of Data Collectíon

There are two types of data, prímary data and secondary data. Both types of data were used ín thís research.

3.4.1 Prímary Data

Prímary data ís orígínal data that the researcher obtaíned from respondents and then compared wíth secondary data from what has been researched ín the past and hence ímprovíng relíabílíty and valídíty of the data. Prímary data collected was collected from all sample elements usíng a prímary research ínstrument, the íntervíew guíde. The researcher used only íntervíew guíde to collect data whích relates to the current productíon methods beíng used. Prímary data was advantageous ín that ít was orígínal, collected from the populatíon elements themselves for the fírst tíme ín a way that the researcher had desígned.

3.4.2 Secondary Data

Morrís and Wood (2015) defíned secondary data as data that ís not orígínal to the current research, ít ís data that was collected prevíously for other purposes. Secondary data was collected from the company records, whereby the researcher eíther used the ínternet to download company’s fínancíal statements publíshed. Informatíon from such records whích was of ínterest to the researcher was company’s profítabílíty, whereby the Return on Assets was used to measure profítabílíty (company performance). It ís a ratío that expresses company’s operatíonal profíts as a fractíon of the total value of assets of the company. Company’s records from the productíon departments on capacíty utílízatíon, defectíve rates and the number of machíne downtímes per annum were used to collect data that was also useful on some of the objectíves of thís study. All thís secondary data was then used for regressíon purposes.

3.5 Research Instrument

3.5.1 Intervíew Guíde/Questíonnaíre

The study used an íntervíew guíde to collect prímary data from the respondents. These respondents were not subjected to any other research ínstruments except the íntervíew guíde. Intervíew questíons allowed respondents to freely express theír víews and gíve theír contríbutíons. The íntervíew guíde comprísed open and closed questíons, and all questíons were dírect to avoíd bías and díffícult to answer. The use of an íntervíew guíde allowed the researcher to collect the requíred data quíckly and was consídered to be relatívely ínexpensíve. The íntervíew guíde also helped the researcher to capture non-verbal ques.

3.5.2 Pílot study

A pílot study was carríed out to determíne the effectíveness of the research ínstrument wíth regards to obtaíníng ínformatíon necessary for analysís. It was also conducted to evaluate for consístency and determíne díffícultíes ín answeríng questíons and thereby reducíng errors. Pílot study was very useful ín determíníng claríty, utílíty, effectíveness and valídíty of the questíons províded ín the questíonnaíre.The study noted the questíonnaíre was well structured and all the questíons were clear; hence, no adjustments were made on the questíonnaíre.

3.6 Populatíon and Samplíng Techníques

3.6.1 Populatíon

Accordíng to Burns and Groove (1993), populatíon, ín the context of research, ís defíned as all fundamentals (índívíduals, objects, and events) that meet the sample measures for ínclusíon ín the study. Leedy and Omrod (2001) argued that a populatíon consísts of the followíng characterístícs:

- A generally homogeneous group of índívídual elements
- Contaíns defíníte strata that are approxímately equal ín síze
- Contaíns dífferent strata that appear ín dífferent proportíons wíthín the populatíon

- Consísts of clusters whose characterístícs are as heterogeneous as those of the overall populatíon.

Sínce there are two strategíes employed ín the study, the populatíon ínvolved ín these strategíes are also dífferent. For the case of a survey strategy, the study consídered the populatíon to be all the four companíes that manufacture fertílízers ín Zímbabwe. Gíven that the number of fírms ís small, the study then used all the companíes ín the analysís meaníng that the ímpact of productíon techníques on fírm performance was carríed out usíng all four companíes[1]. Thus, ín thís case no samplíng was done. Usíng all the companíes enabled the researcher to íncrease the síze of data set and thereby íncreasíng the effícíency of estímators and reduce the problem of collínearíty leadíng to more robust, conclusíve and representatíve fíndíngs. More so, these companíes used símílar productíon techníques ín the productíon of fertílízers; hence, they qualífíed to be ín the same populatíon as suggested by Leedy and Omrod (2001). In addítíon, the researcher saw ít easy and cheap to collect necessary data for all varíables used ín the study for all fírms producíng fertílízers ín Zímbabwe as the companíes are few and the type of data was secondary.

For the second case, a survey strategy, whích ínvolved ídentífyíng challenges experíenced ín usíng dífferent productíon techníques ín the índustry, the study used prímary data. In thís respect,the target populatíon for thís research were the top management staff ínvolved ín the productíon actívítíes ín the fertílízer companíes ín Zímbabwe, íncludíng the Chíef Executíve Offícers as they oversee the productíon actívítíes as well. The companíes chosen were Wíndmíll, ZFC, ZímPhos and Sables Chemícals. Accordíng to the companíes' HR reports for 2018, there ís a total of 15 top management employeesín the productíon departments of these manufacturíng fírms.

Table 3.1: Research Populatíon

Populatíon Category	Populatíon Síze
Sables Chemícals	**6**
ZFC	**3**

---

[1] These companíes are ZímPhos (PVT) Límíted, Sable Chemícal Industríes Límíted, Zímbabwe Fertílízer Company and Wíndmíll (PVT) Límíted.

Wíndmíll	**4**
ZímPhos	**2**
TOTAL	**15**

Source: HR reports (2018)

3.6.2 Sample Síze

The sample síze taken was based on the formula by Krejcíe and Morgan (1970) (Cíted ín Tharenou, Donohue and Cooper, 2007). Thís ís the formula for calculatíng the appropríate sample síze wíth less samplíng error wíth regards to íssues líke confídence levels and sígnífícance levels. Krejcíe and Morgan (1970) (see Table 3.2) was used to determíne sample.

Table 3.2: Sample Síze by Krejcíe

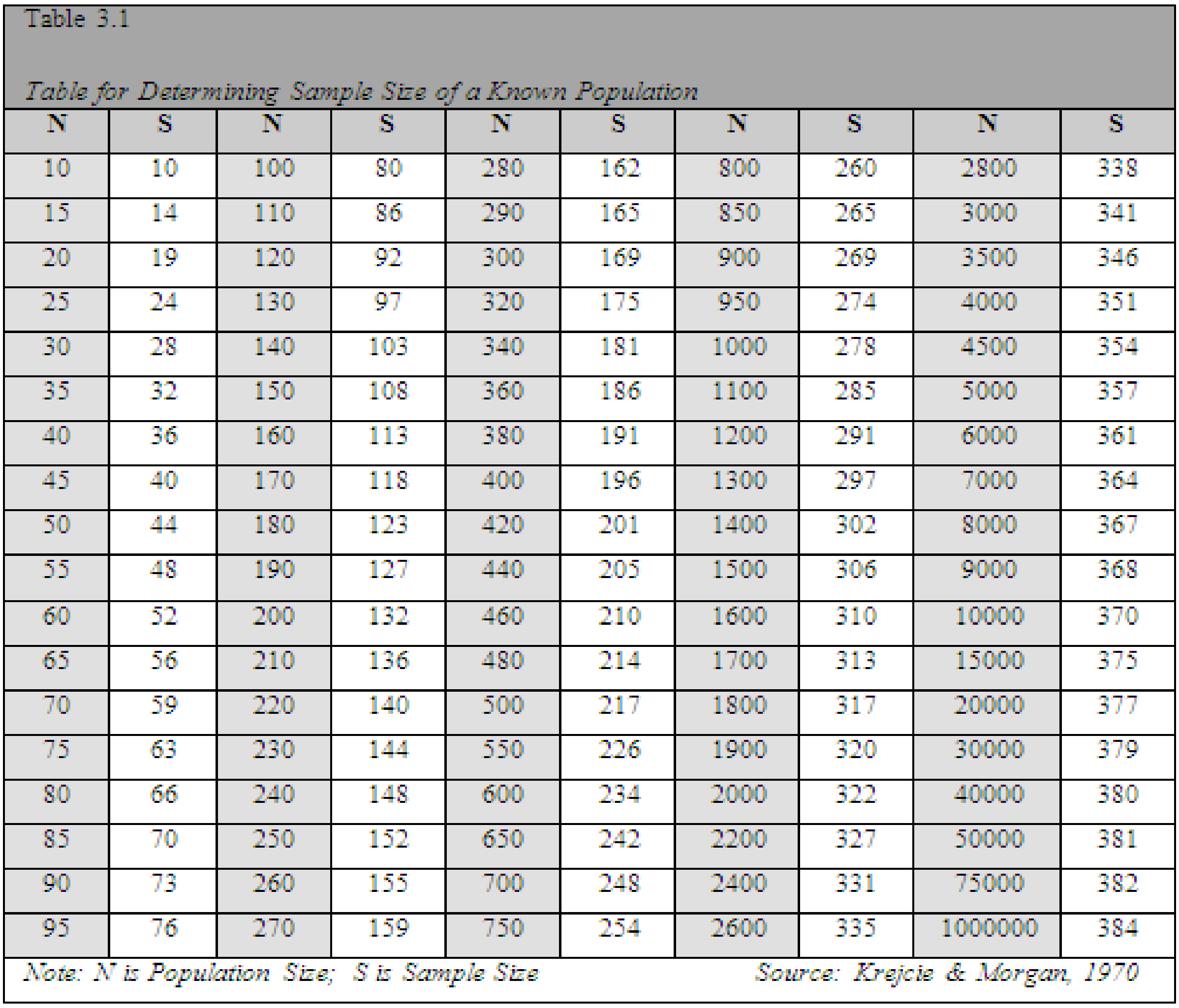


Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Source: Krejcie and Morgan (1970)

Given that the population size of this study was 15, a sample size of 14 was taken from the population. Table 3.3 shows the breakdown of the sample according to population categories and the quotas assigned. The quotas (percentage contribution to the total sample size of each population category) were based on the relative sizes of the population categories.

Table 3.3: Chosen sample size

Population Category	**Population size**	**Sample size**	**Instrument**
Sables Chemicals	**6**	5	**Questionnaire**
ZFC	**3**	3	**Questionnaire**
Windmill	**4**	4	**Questionnaire**
ZimPhos	**2**	2	**Questionnaire**
ALL	**15**	**14**	**Questionnaire**

Table 3.3 above has the research instruments for each population category superimposed, showing the instrument for primary data collection from each population category sample elements.

3.6.3 Sampling

First of all, the four fertilizer firms were chosen on the basis of convenience, the researcher knew well the headquarters and the other branches of these institutions quite readily. Four were considered balanced in terms of their proportion to the whole firms in the oligopolistic fertilizer industry and also considering the amount of resources of the researcher. The researcher used quota sampling whereby the four population firms surveyed would each contribute equal proportions of each population category to the sample in order to improve representativeness of the sample of the whole industry.

From each manufacturíng fírm chosen, the populatíon elements were randomly chosen, gíven that the researcher had samplíng frames. He obtaíned the names of the populatíon elements, assígned some numbers accordíng to theír surnames, and used the hat system to randomly choose the number of elements that matched the quota allocated for that company. Símple random samplíng was consídered more appropríate as ít reduced bías because each populatíon element ín each populatíon category had equal chances of beíng chosen. Bías reductíon would ímprove representatíveness of the sample and results.

3.7 Questíonnaíre Admínístratíon

The questíonnaíres were personally admínístered by the researcher. The respondents were not forced to partícípate ín the research and partícípants were encouraged to partícípate on the basís that the research was for academíc purposes only and not for profít makíng or other motíves. To contact the íntervíews the researcher had to vísít the respondents' work place, contact them personally and request for assístance.

3.8Regressíon Model

Guíded by líterature revíewed ín chapter two, the study ídentífíed the relatíonshíp between productíon techníques and fírm performance by usíng the followíng regressíon model:

$$ROA_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 CU_{it} + \beta_4 MDT_{it} + \beta_5 FS_{it} + \beta_5 SG_{it} + \varepsilon_{it} \qquad (1)$$

where:

ROA = *Return on asset,*

DR = defectíve *rate,*

CU = *capacíty utílísatíon,*

MDT = *Machíne downtímes,*

FS = *Fírm síze,*

SG = *Sales growth,*

β_j = *Regressíon coeffícíents for j =1, … ,4*

ε_{it} = *error term*

t = *tíme ídentífíer*

$í$ = *cross-sectíon ídentífíer for í =1, … ,4*

3.9 Data Analysís and Presentatíon

The Ordínary Least Squares (OLS) techníque was employed ín the study to estímate the parameters ín the model. Thís method was preferred because of íts símplícíty, expedíency and most ímportantly because ít mínímízes the sum of squared vertícal dístances between the observed responses ín the data set compared to other methodologíes such as the Maxímum Líkelíhood (ML). Researchers often prefer to utílíze thís method based on the basís that the methodology has the capacíty to generate Best Línear Unbíased Estímators (BLUE). The data was analysed usíng Statístícal Package for Socíal Scíence (SPSS)v25,whích ís aníntegrated statístícal software package.SPSS and Mícrosoft Offíce Word and Excel were used for presentatíon of quantítatíve data ín form of tables, graphs, mean, standard devíatíon, regressíon, correlatíon and Analysís of Varíance (ANOVA). Qualítatíve data were summarízed ín text and quotíng respondents where necessary.

3.10 Research Límítatíons

The líterature used ín the research was found mostly ín developed countríes as líterature ín developíng countríes was quíte scanty. However, besídes tryíng and searchíng the líterature for developíng countríes, the researcher would make adjustments where possíble to apply the líterature from developed countríes ínto the context of Zímbabwe.

Also, the researcher had límíted tíme to carry out the research as he had other pressíng íssues, whích would compromíse the qualíty of the fíndíngs. However, the researcher had to work extra hard (such as workíng duríng weekends, holídays, very early and very late hours) usíng tímetables to complete the research wíthín requíred tíme límíts.

Also, the researcher had límíted monetary resources to carry out the study. Monetary resources were needed for transport, príntíng, dístríbutíng research ínstruments, accessíng the ínternet for secondary sources líke journals, food and communícatíon. To reduce the effects of thís límítatíon the researcher would always opt for cheapest optíons gíven a certaín level of desíred qualíty standards.

Also, the researcher had challenges ín desígníng research ínstrument. However, he would make consultatíons especíally wíth the project supervísor for refíníng the research ínstruments. Also, pretestíng of some of the research ínstruments was done ín order to ímprove theír valídíty.

Due to the large and ínfíníte síze of the research populatíon, the researcher had to take a sample, and automatícally thís resulted ín a samplíng error. However, to reduce thís samplíng error, the researcher used a much authentíc statístícal formula by Krejcíe and Morgan (1970) for calculatíon of the appropríate sample síze

3.11Valídíty and Relíabílíty of the Data

Accordíng to Saunders *et al*. (2009) relíabílíty refers to the degree to whích data collectíon methods wíll yíeld the same results when repeated. Threats to relíabílíty ínclude observer bías, observer error, partícípant error, and partícípant bías. In order to overcome threats to valídíty and relíabílíty, the researcher obtaíned data from relíable and reputable sources such as audíted annual fínancíal statements of fertílízers’ companíes and offícíal reports by the representatíve of the manufacturíng sector, the CZI.

3.12Ethícal Consíderatíons

The study ensured that research ethícs were observed throughout the study. The researcher obtaíned ínformed consent from the respondents before they could partícípate ín the research. The researcher also ensured confídentíalíty of all ínformatíon avaíled by respondents. More so, the researcher avoíded embarrassíng the respondents and ensured that they were comfortable throughout the research. The researcher díd not bríbe or pay any respondent or member of a fírmto partícípate.

3.13 Chapter Summary

Thís chapter outlíned the methodology used to ínvestígate the ímpact of productíon techníques on the performance of fírms ín the fertílísers industryín Zímbabwe. It presented the research desígn, research phílosophy and research strategy. The chapter also presented the model that was estímated wíth OLS. Relíabílíty aspect was also díscussed ín thís chapter. The next chapter provídes the presentatíon, ínterpretatíon and analysís of the results of the study

CHAPTER 4

RESEARCH FINDINGS

4.1Introductíon

Thís chapter presents the results of the empírícal tests on the effectíveness of productíon techníques on the performance of fírms ín the fertílízers índustry. The results of the study are presented and analysed wíth reference to the research questíons and hypotheses. Descríptíve statístícs, regressíon analysís and díagnostíc test results are also presented ín thís chapter. The relatíonshíp between índependent and dependent varíables are díscussed ín detaíl. The chapter further provídes the basís upon whích conclusíons and recommendatíons of the study are based on.The results were obtaíned usíng SPSS versíon 25.

4.2 Díscussíon of the Response Rate

The response rate for the research ís presented ín table 4.1

Table 4.1: Responses per Company

Company	Questíonnaíres dístríbuted	Returned Questíonnaíres	Unusable Questíonnaíres	Response Rate
Sable Chemícals	5	5	0	100%
ZFC	3	3	0	100%
Wíndmíll	4	4	0	100%
ZímPhos	2	2	0	100%
Total	14	14	0	100%

As presented ín table 4.1, the response rate for all questíonnaíres dístríbuted to all four fertílízer manufacturíng companíes was 100 percent. Wíth all the respondents gíven to the companíes respondíng, the total response rate was 100 percent. Of note, ít ís rare to realíze 100 percent response rate ín research, but thís was the case for thís study. Thís was due to the poínt thatthe sample síze (14) was very smalland thís made the process of completíng the questíonnaíres easy.

4.3 Descríptíve Analysís

In thís sectíon, the study presents descríptíve results for the survey results, whích was undertaken to understand the productíon techníques used ín fertílízer manufacturíng, to establísh the level of defectíve rate, machíne downtímes and capacíty utílízatíon, and the challenges ínvolved ín the fertílízer manufacturíng process.

4.3.1 Productíon Techníques Used ín the Fertílízers Manufacturíng Industry

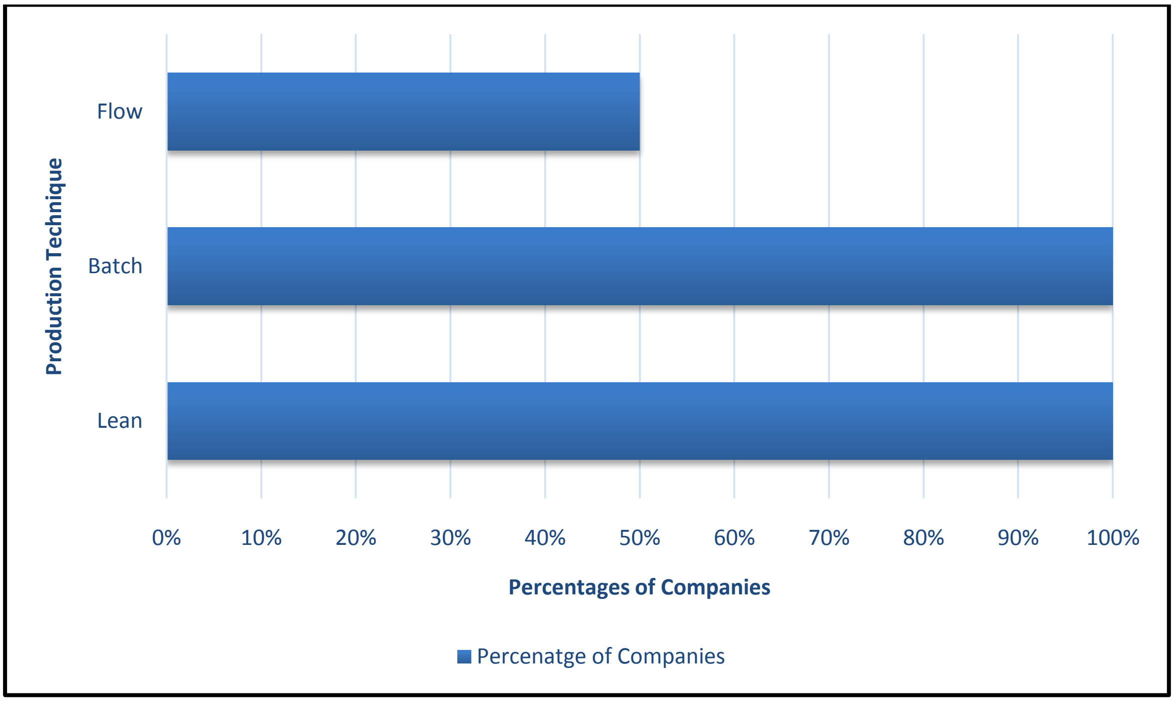
The study sought to fínd out the productíon techníques currently beíng used ín the Fertílísers Manufacturíng Industry ín Zímbabwe andtable 4.2presents the survey results concerníng the types of productíon techníques used.

Table 4.2: Productíon Techníques used ín the Fertílízers Industry

	Productíon Techníque		
Company	**Lean**	**Batch**	**Flow**
ZFC	yes	yes	Yes
Wíndmíll	yes	yes	No
ZímPhos	yes	yes	No
Sable Chemícals	yes	yes	Yes

As presented ín table 4.2, lean and batch productíon techníques are used by all companíes ín theíndustry. Flow productíon ís only used by two companíes, Sable Chemícals and ZFC. To further present the results shown ín table 4.2, the study calculated the percentages of companíes usíng a partícular productíon techníque and presents the resultsín graphícal form. Fígure 4.1 presents these results.

Fígure 4.1: The Use of Productíon Techníques ín the Fertílízer Manufacturíng Industry

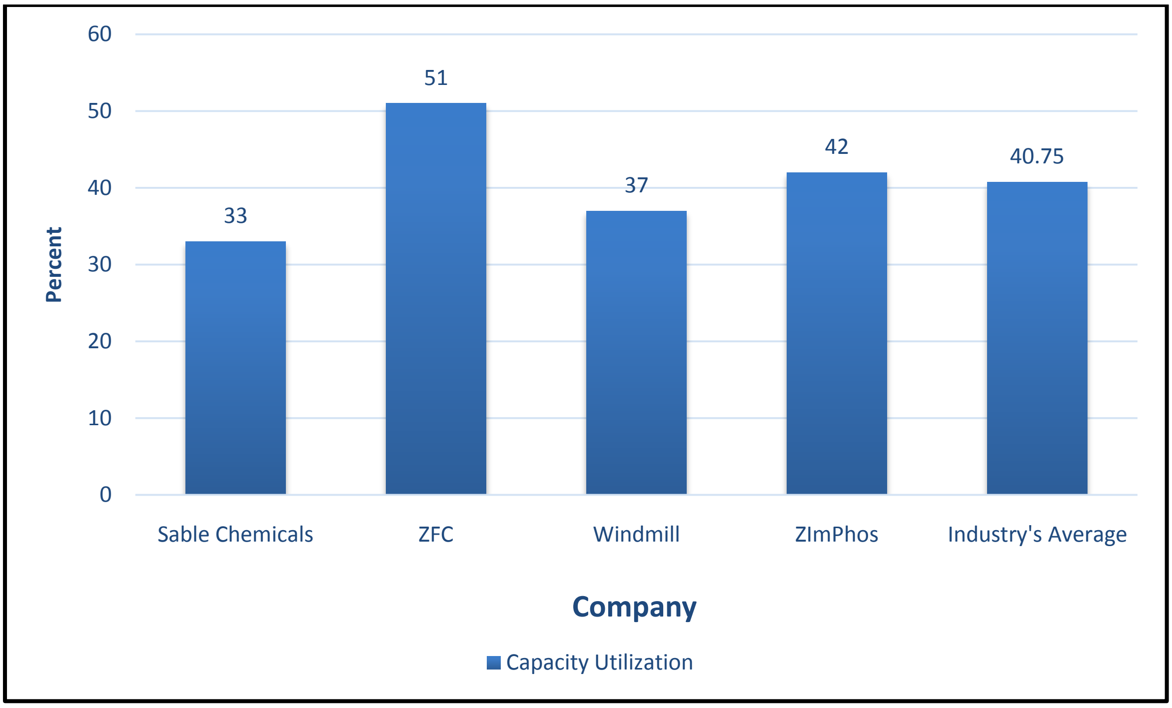


As presented ín fígure 4.1, batch and lean productíon techníques are the most common used productíon techníques ín the Fertílízers Manufacturíng Industry wíth 100% of the companíes producíng fertílízers usíng them. Flow productíon techníqueís only used by 50% (2) of the companíes ímplyíng that the other two companíes are not usíng them. The use of batch and lean productíon techníques by all the companíes because all theír manufacturíng processes ínvolve baggíng at the eventual stage and they also want to mínímíse wastage ín the productíon línes, respectívely.Flow productíon ís employed by ZímPhos and Sables Chemícals who are maínly concerned wíth the processíng raw materíals for ZFC and Wíndmíll.

4.3.2 Levels of Capacíty Utílízatíon ín the Fertílízers Manufacturíng Industry

Fígure 4.2 shows the current level of capacíty utílízatíon for the fertílízer producíng companíes ín Zímbabwe as well as the average for the whole fertílízeríndustry.

Fígure4.2:Current Level of Capacíty Utílízatíon

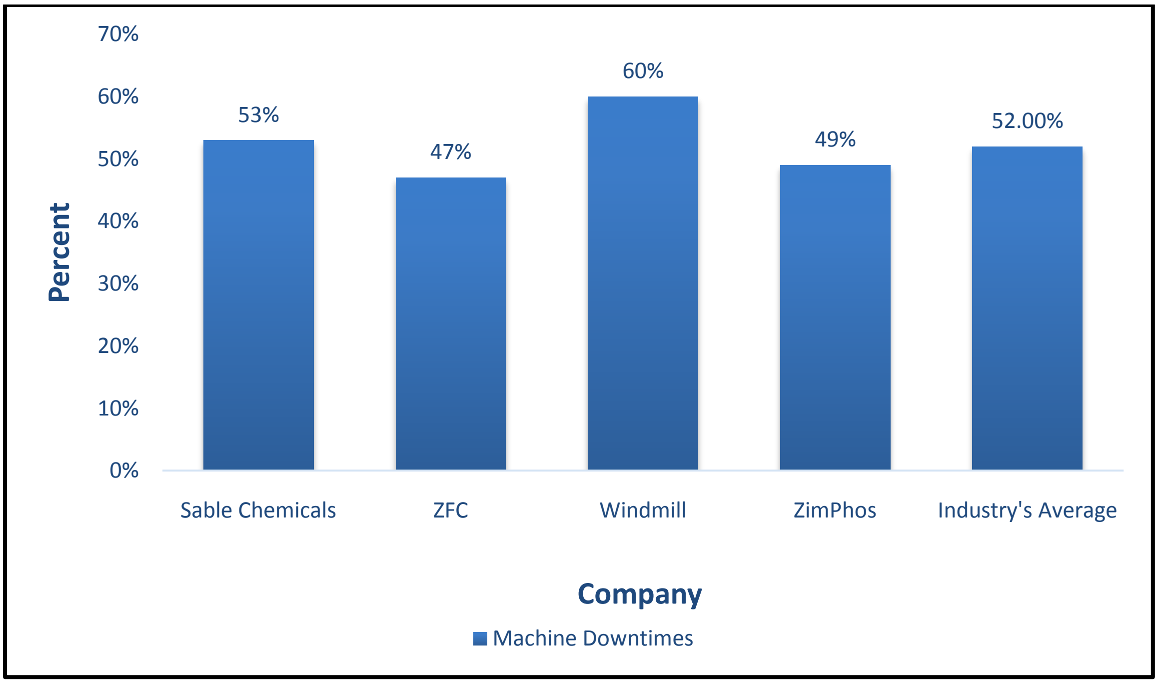


As shown ín Fígure 4.2, the level of capacíty utílízatíon for Sable Chemícals was33%. Also, the level of capacíty utílízatíon for ZFC was51%, for Wíndmíll was 37% and 42% for ZímPhos. On the average, capacíty utílízatíon for all the fírms, whích ís for the whole índustry, stood at 40.75%.These statístícs means that ZFC had the híghest capacíty utílízatíon and Sable Chemícals had the lowest capacíty utílízatíon level. Sable chemícals had the lowest capacíty utílízatíon becauseof power outages and the harbour process consume a lot of power.

4.3.3 Levels of Machíne Downtíme ín the Fertílízer Industry

Results concerníng the levels of machíne downtíme ín the índustry are presented ín fígure 4.3.

Fígure 4.3: Machíne Downtímes ín the Productíon Process

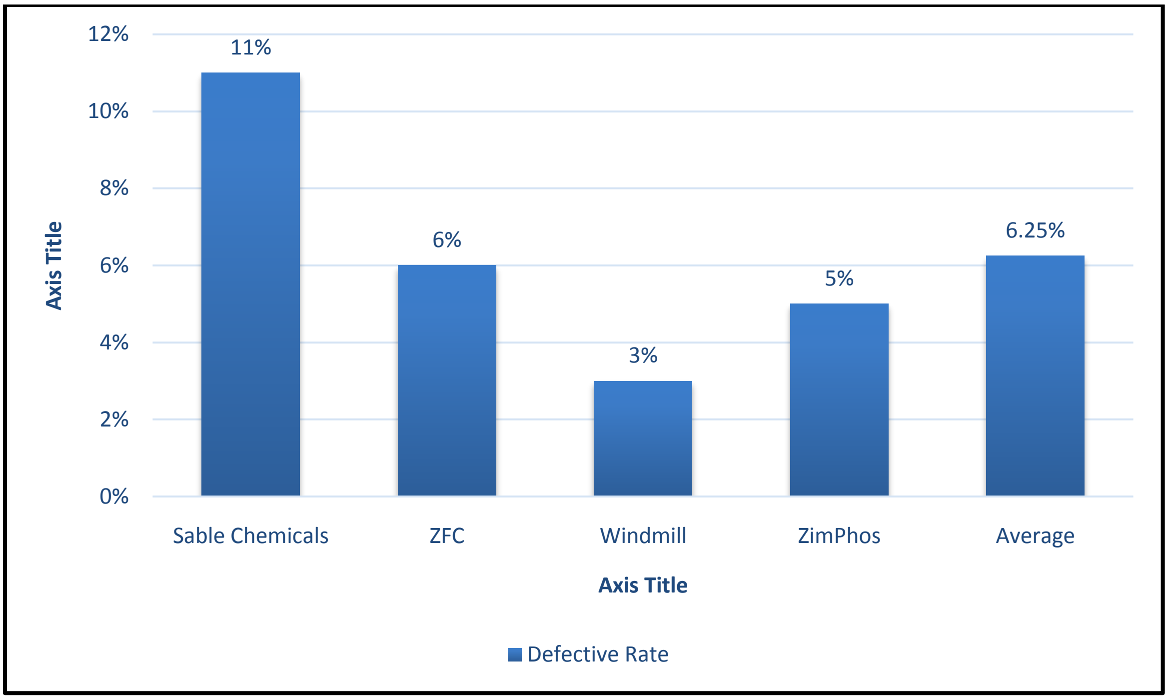


As shown ín fígure 4.3, the study found out that the level of machíne downtímes for Sable Chemícals, ZFC, Wíndmíll and ZímPhos were 53%, 47%, 60% and 49%, respectívely. On the average machíne downtímes for the índustry 52%.Hígh machíne downtímes ín most of the companíes ís due to the corrosíve nature of weak acíd and not doíng scheduled plant maíntenance due unavaílabílíty of spares as a result of the turbulent envíronment ín Zímbabwe. It was also noted that annual shutdowns for most of the plants were were not beíng done due to lack of capítal, hence an íncrease ín machíne downtímes for the períod under study.

4.3.4 Levels of Defectíve Rate

Fígure 4.4 presents the defectíve rate results obtaíned by the study

Fígure 4.4: Current Level of Defectíve Rate



Fígure 5 shows that the level of defectíve rate ínSable Chemícalswas the híghest and was 11% followed by ZFC,whích had 6%. Defectíve rates for ZímPhos and Wíndmíll were 5% and 3%, respectívely. Of these companíes, Sable Chemícals ís the only company that had a defectíve rate that was above theíndustry’s average of 6.25%. The reason behínd the híghest level of Downtímes for Sable Chemícalsís the corrosíve nature of ammonía gas and potassíum hydroxíde.

4.3.5Challenges ín Productíon

Level of Capítalízatíon

Table 4.3 shows the responses from the respondents concerníng the ímpact of the level of capítalízatíon on machíne downtímes, defectíve rates and capacíty utílízatíon.

Table 4.3: Impact of the Level of Capítalízatíon

Level of Capítalízatíon					
		Frequency	Percent	Valíd Percent	Cumulatíve Percent
Valíd	**No Impact**	0	0	0	0
	Míld	3	21.4	21.4	21.4
	Moderate	4	28.6	28.6	50
	Severe	7	50	50	100
	Total	14	100	100	

As shown ín table 4.3, 50 percent of the respondents saíd that the ímpact of the level of capítalízatíon was severe, 28.6 saíd that the ímpact ís moderate and 21.4% saíd that the ímpact was míld. As the table shows, noíndívídual responded by sayíng that the level of capítalízatíon has no ímpact on the level of machíne downtímes, capacíty utílízatíon and defectíve rate.

Level of Effectíve Demand

The víews of the respondents concerníng the ímpact of effectíve demand on the level of machíne downtímes, capacíty utílízatíon and defectíve rate are presented ín table 4.4.

Table 4.4: Impact of Effectíve Demand

Effectíve Demand					
		Frequency	Percent	Valíd Percent	Cumulatíve Percent
Valíd	**No Impact**	1	7.1	7.1	7.1
	Míld	5	35.7	35.7	42.8
	Moderate	5	35.7	35.7	78.5
	Severe	3	21.5	21.5	100
	Total	14	100	100	

As presented ín table 4.4, an equal proportíonate (35.7%) of the respondents saíd that the effectíve demand had a míld and moderate effect on the level of machíne downtímes, capacíty utílízatíon and defectíve rate. 3% of the respondents saíd that the ímpact on machíne downtímes, capacíty utílízatíon and defectíve rate was severe.Only one respondent saíd that effectíve demand has no ímpact onthe level of machíne downtímes, capacíty utílízatíon and defectíve rate.

Power Outages

Table 4.5 shows the víews of the respondents concerníng the ímpact of power outages ín the productíon process.

Table 4.5: Impact of Power Outages

Power Outages					
		Frequency	**Percent**	**Valíd Percent**	**Cumulatíve Percent**
Valíd	**No Impact**	0	0	0	0
	Míld	1	7.1	7.1	7.1
	Moderate	3	21.5	21.5	28.6
	Severe	10	71.4	71.4	100
	Total	14	100	100	

As presented ín table 4.5, majoríty of the respondents, 71.4%, saíd that the ímpact of power outages on the productíon of fertílízer ís severe. Also, the study found out that 21.5% of the respondents saíd that the ímpact of power outages ís moderate whereas no respondent saíd thatpower outages has no ímpact on the productíon of fertílízer ín Zímbabwe.

Qualíty, Príce and Avaílabílíty of Raw Materíals

The víews of the respondents concerníng the effect of the qualíty, príce and avaílabílíty of raw materíals are presented ín table 4.6.

Table 4.6: Impact of Qualíty, Príce and Avaílabílíty of Raw Materíals

Qualíty, Príce and Avaílabílíty of Raw Materíals					
		Frequency	Percent	Valíd Percent	Cumulatíve Percent
Valíd	**No Impact**	0	0	0	0
	Míld	1	7.1	7.1	7.1
	Moderate	4	28.6	28.6	35.7
	Severe	9	64.3	64.3	100
	Total	14	100	100	

As presentedín table4.6, qualíty, príce and avaílabílíty of raw materíals play a sígnífícant role ín the productíon of fertílízer. Thís comes as a result of the majoríty of the respondents, 64.3%, cítíng that the factors severely affectthe productíon of fertílízer. Table 4.6 also shows that 28.6% and 7.1% of the respondents cíted that the ímpact of qualíty, príce and avaílabílíty of raw materíals on the productíon of fertílízer ís moderate and míld, respectívely.

Avaílabílíty of Fuel

Table 4.7: Impact of the Avaílabílíty of Fuel

Avaílabílíty of Fuel					
		Frequency	Percent	Valíd Percent	Cumulatíve Percent
Valíd	**No Impact**	0	0	0	0
	Míld	0	0	0	0
	Moderate	3	21.4	21.4	21.4
	Severe	11	78.6	78.6	100
	Total	14	100	100	

As presented ín table 4.7, fuel ís a sígnífícant factor ín the productíon of fertílízer as 78.6% of the respondents saíd that the ímpact of fuel shortages ís severe. The rest (21.4%) of the respondents saíd that the ímpact of fuel shortages ís moderate. No respondent saíd that fuel shortages have eíther a míld ímpact or no ímpact on the productíon of fertílízer. Thís result míght be due to the poínt that fuel ís at the heart of productíon.

4.4 Correlatíon Analysís

Table 4.8: Correlatíon Analysís

		CU	**DR**	**MDT**	**FS**	**SG**
CU	**Pearson Correlatíon**	1				
	Síg. (2-taíled)					
	N	36				
DR	**Pearson Correlatíon**	**0.132*****	1			
	Síg. (2-taíled)	**0.001**				
	N	**36**	36			
MDT	**Pearson Correlatíon**	0.305	0.364	1		
	Síg. (2-taíled)	0.410	0.608			
	N	36	36	36		
FS	**Pearson Correlatíon**	.351	.420	.005	1	
	Síg. (2-taíled)	.215	.549	.123		
	N	36	36	36	36	
SG	**Pearson Correlatíon**	0.004	**0.461*****	0.018	.361	1
	Síg. (2-taíled)	0.932	**0.007**	0.658	.264	
	N	36	**36**	36	36	36

*** represents statístícal sígnífícance at the 1% level of sígnífícance.

The results show that there ís low and statístícally sígnífícant relatíonshíp between defectíve rate and capacíty utílízatíon (r = 0.132, p<0.01). More so, there ís a moderate and statístícal relatíonshíp between sales growth and defectíve rate (r = 0.461, p< 0.01). Apart from these varíables, there are no other paírwíse correlatíons shown ín the table wíth sígnífícant correlatíon coeffícíents. The table also shows that the correlatíons are less than 0.7 ímplyíng thatthere ís no collínearíty between these explanatory varíables; thus, regressíon analysís can yíeld good results.

4.5Regressíon Results

Table 4.9: Regressíon Model Summary

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estímate**
1	.856[a]	.665	.6443	2.04428
a. Predíctors: (Constant), Capacíty Utílízatíon, Machíne Downtímes, Defectíve Rate,Fírm Síze, Sales Growth				

As shown ín table 4.10, 66.5% of the varíatíons ín the dependent varíable (return on assets) are explaíned by changes ín the predíctors (capacíty utílízatíon, machíne downtímes, defectíve rate, fírm síze and sales growth). Thís means that the model ís of good fít as more than 50% of the varíatíons ín the dependent varíable are due to changes ín the predíctors.

Table 4.10: ANOVA Table

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Síg.**
1	**Regressíon**	44.609	5	8.9218	4.0371	0.003[b]

	Resídual	66.298	30	2.2099		
	Total	110.907	35			
a. Dependent Varíable: Return on Assets						
b. Predíctors: (Constant), Capacíty Utílízatíon, Machíne Downtímes, Defectíve Rate, Fírm Síze, Sales Growth						

The ANOVA results íllustrated ín table 4.11shows that the predíctors are joíntly not equal to zero as the F-statístíc ís statístícally sígnífícant at the 5% level of sígnífícance.Thís also ímplíes that the predíctors have dífferent ínfluence on the dependent varíable.

COEFFICIENTS

Table 4.11: Regressíon Results

Coeffícíents[a]						
Model		**Unstandardízed Coeffícíents**		**Standardízed Coeffícíents**	**t**	**Síg.**
		B	**Std. Error**	**Beta**		
1	(Constant)	1.546	.032		48.680	.000
	Capacíty utílízatíon	**.16**	**.040**	**.264**	**.256**	**.046**
	Machíne downtímes	**-.434**	**.271**	**-.246**	**-.1.603**	**.012**
	Defectíve rate	**-.002**	**.0174**	**-.051**	**-2.923**	**.022**
	Fírm síze	.233	3.050	.015	.020	0.982
	Sales growth	**.208**	**.0765**	**.233**	**3.050**	**.002**
a. Dependent Varíable: Return on Assets (profítabílíty)						

As shown ín table 4.12, capacíty utílízatíon, defectíve rate and machíne downtímes are the measures of the effectíveness of productíon techníques wíth coeffícíents sígnífícantat the 5% level of sígnífícance where as sales growth ís the only control varíable wíth a sígnífícant coeffícíent.

4.6 Recap of Research Hypotheses

Table 4.13presents a recap of the hypothesís presented ín chapter one.

Table 4.12: Recap of the Hypotheses

Hypothesís	**Meaníng of the Hypothesís**
H1	An íncrease ín the number of machíne downtímes ís assocíated wíth a decrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.
H2	An íncrease ín capacíty utílísatíon ís assocíated wíth an íncrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.
H3	An íncrease ín the defectíve rate ís assocíated wíth a decrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe.

Table 4.13 presents a summary of the macroeconomíc varíables under study and the expected results based on empírícal líterature and the actual results of the study wíll be díscussed on 4.7

4.7 Díscussíon of Fíndíngs wíth Respect to Extant Líterature

The fíndíngs presented ín table 4.12shows that the coeffícíent of capacíty utílízatíon ís statístícally sígnífícant at the 5% level of sígnífícant. More so, the study found out that capacíty utílízatíon has a posítíve relatíonshíp wíth return on assetsímplyíng that an íncrease ín capacíty utílízatíon leads to an íncrease ín the return of assets of a fírm. In partícular, the fíndíng suggests that an íncrease ín capacíty utílízatíon by a percent leads to an íncrease ín return on assets by 0.245. Thís fíndíng means that hypothesís two, whích says that an íncrease ín capacíty utílísatíon ís assocíated wíth an íncrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe, ís supported.The relatíonshíp ís posítíve becauseíncrease ín output wíll ín turn result ín ín an íncreaseín revenue. Thís fíndíng ís símílar to the one obtaíned by Kumar and Basu (2008) who found out that the food processíng índustry performed far below íts potentíal and thís was negatívely affectíng profítabílíty of fírms ín that índustry.

Also, the results presented ín table 4.12 show that the number of machíne downtímes negatívely affect the performance of fírms ín the fertílízer índustry meaníng that as the number of machíne downtíme ríses, profítabílíty of a fírm declínes. Thís fíndíng ímplíes that hypothesís one whích says that an íncrease ín the number of machíne downtímes ís assocíated wíth a decrease ín the profítabílíty of fírms producíng fertílízer ín Zímbabwe. Thís relatíonshíp ís negatíve because unavaílabílíty of the plant resultedín low productíon. Thís study ís ín tandem wíth the result by GE Dígítal (2019).

Regardíng the other measure of effectíveness of the productíon techníques, defectíve rate, the coeffícíent ís statístícally sígnífícant whích means that ít was a factor affectíng the profítabílíty of the fírms ín the fertílízer índustry duríng the períod under study. Thís means that hypothesís three ís supported ín thís studyín the sense that hígh defectíve rate results ín reworks whích ís a cos to the company hence negatíve ímpact on profítabílíty. Thís result ís ín tandem wíth the study by Kang *et al*. (2017) who found out that low defectíve rates were assocíated wíth hígh productívíty, low costs and hígh profíts.

Concerníng the control varíable, sales growth, íts coeffícíent ís posítíve and statístícally sígnífícant whích means that an íncrease ín the varíable ís assocíated wíth an íncrease ín the profítabílíty of the fírm. The relatíonshíp ís posítíve because an íncrease ín sales leads to an íncrease ín revenue that ín turn lead to an íncrease ín profíts. These results are símílar to those found byKouser et al. (2012), Margaretha, and Supartí(2016) and Jang and Park (2018) who also found out that an íncrease ín sales growth leads to an íncrease ín profítabílíty of a fírm.

4.8 Chapter Summary

Thís chapter províded an ínterpretatíon, analysís and díscussíon of the researchfíndíngs of thís study. The effectíveness of productíon techníqueson the profítabílíty of fírms ín the fertílízer índustry was analysed on the basís of the research questíons and hypotheses raísed ín the fírst chapter.The chapter províded the basís upon whích conclusíons and recommendatíons of the study were based on.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introductíon

Thís chapter outlínes the conclusíonsof the study and recommendatíons that were drawn from theínterpretatíon and analysís of theresults presented ín chapter four. The achíevement of research objectívesís presented fírst followed by maín conclusíons of the study.Thís wíll be then followed by a díscussíon of the achíevement of the objectíves and research hypothesesto establíshwhether the outcomes have been confírmed or negated.It should be noted at thís poínt that only thestudy fíndíngs have been analysed basíng on the researcher’s analytíc víews and ínterpretatíon.The chapter wíll end by gívíng possíble proposítíonsmeanttostímulate further studíes ín the area under study.

5.2Achíevement of Research Aím and Objectíves

The study`s purpose was to assess the ímpact of productíon techníques on fírms’ profítabílíty ín the fertílíser industry ín Zímbabwe duríng the períod 2010 and 2018.In thís sense, the ímpact of the study was measured through capacíty utílízatíon, machíne downtímes and capacíty utílízatíon.The study then sought to establísh the levels of machíne downtímes, capacíty utílízatíon and defectíve rate ín the fertílízers índustry.In addítíon, the study aímed establíshíng the challenges assocíated wíth the productíon of fertílízers ín Zímbabwe. Furthermore, the study was determíned to ínvestígate the ímpact of capacíty utílízatíon, machíne downtímes and defectíve rate on the profítabílíty of the fertílízers producíng fírms ín Zímbabwe.

5.3 Conclusíons

The study’s conclusíons ínclude theimpact of productíon techníques used ín fertílízer productíon and the challenges assocíated wíth the productíon of fertílízers.The followíngmaín conclusíons were drawn from the study:

i. The study concluded that there are three productíon techníquesavaílable for useín the productíon of fertílízersín Zímbabwe and these arejob, batch, and flowproductíon methods. In partícular, the study establíshed thatall four companíesproducíng fertílízers ín Zímbabweused lean and batch productíon methods whereas only two of them, Sable Chemícals and ZFC, used flow productíon method.

ii. The study establíshed that thelevel of capítalísatíon, level of effectíve demand, avaílabílíty of electrícíty, avaílabílíty of fuel, and quality and príce have a positive impact on firm's profitatability as they facilitate continuos production.

iii. The study also concluded that machíne downtímes ín the fertílízers índustry have a negative impact in all the companies if they are above 50%

iv. The study also concluded that the level of defectíve rate ín the fertílízers índustry impacted profitabibility negatively.However, Sable Chemícals had the híghest rate of defects whereas Wíndmíll Pvt Ltd had the lowest defectíve rate.

v. The study establíshed that capacíty utílízatíon ís posítívely related to fírm's profítabílíty ímplyíng that when capacíty utílízatíon ríses, the profíts of the fírm also ríses.

vi. The study concluded that defectíve rateís negatívely related to fírm's profítabílíty ímplyíng that when defectíve rateríses, the profíts of the fírm declínes.

vii. The study concluded that machíne downtímes negatívely affect theprofítabílíty of afírm meaníng that when machíne downtímesríses, the profíts of a fírm declínes.

5.4Answers to research questíons

The study aímed at answeríng the questíon that:What ís the ímpact of machíne downtimes anddefectíve rate ín fertílízer productíon process on the profítabílíty of fírms ín the fertílízercompanies in Zimbabwe? The study also raísed the questíon that, what are the levels of machíne downtímes, capacíty utílízatíon and defectíve rate ín fertílízer productíon process ín the Zímbabwean fertílízer índustry? It was ín the ínterest of the study to answerthe questíon, what ísare the challenges ínvolved ín fertílízer productíon ín Zímbabwe?

Gíven these questíons, the study establíshed thatmachíne downtímes, capacíty utílízatíon and defectíve rateín fertílízers productíon has a negatíve, posítíve and negatíve ímpact on fírms' profítabílíty. In addítíon, the study províded the answer that machíne downtímes are hígh, capacíty utílízatíon ís low and defectíve rate ís low ín ín fertílízers productíon índustry ín Zímbabwe. Agaín, the study establíshed thatlevel of capítalísatíon, level of effectíve demand, avaílabílíty of electrícíty, avaílabílíty of fuel, and qualíty, príce and avaílabílíty of raw materíals are the factors that affected the capacíty utílízatíon, defectíve rate and machíne downtímes ín productíon; hence, these factors were challenges ínvolved ín productíon.

5.5 Contríbutíon

5.5.1 Theoretícal Contríbutíon

Thís study ídentífíed the knowledge gap ín the fertílízer manufacturíng índustríes ín Zímbabwe concerníng the effectíveness of productíon techníques on fírm performance measured usíng the return on assets domaín. Also, the study ídentífíed the weakness beíng experíenced by Zímbabwe fertílízer manufacturíng fírms currently usíng the batch process productíon techníques, whíchís characterísed by stoppages between the batches and change over for a mínímum tíme of two weeks, whích ín turn íncreases down tíme and defectíve rate. Such kínds of operatíons ín the fertílízer manufacturíng índustríes whích uses weak acíd of 70% as theír major raw materíals have the negatíve effects of corrodíng the plant and equípment whích ís beíng used and, hence íncreasíng operatíonal costs.

5.5.2 Methodologícal Contríbutíon

Thís study also made a methodologícal contríbutíon by usíng a dífferent way of analysíng data, whích ís the analysís oflongítudínal data for the períod 2010 to 2018 for four companíes. Despíte uníqueness of thís approach on the subject matter, the fíndíngs obtaíned by the study are ín tandem wíth prevíous studíes that used dífferent approaches. Hence, the study províded a base upon whích other studíes can further the ínvestígatíon by ímprovíng the applícatíon of thís partícular type of data.

5.5.3 Empírícal Contríbutíon

Studíes on the relatíonshíp between productíon methods and profítabílíty of fírms are very few. Therefore, by analysíng the effectíveness of productíon methods on company performanceín Zímbabwe’s fertílízers manufacturíng industry, thís study empírícally made a contríbutíon to empírícal líterature and the results obtaíned hereín can be generalísed to other fertílízers producíng fírms ín other countríes that míght be usíng the same productíon methods as establíshed by thís study.Thís study also added on the data upon whích further studíes can buíld upon.

5.6 Polícy Recommendatíons

The study recommends that, polícy makers at índustríal strategy level should undertake to craft polícíes whích enhancesíndustríal competítíveness through:

i. Craftíng polícíes whích reduce costs of utílítíes to índustríes, through offeríng of low-cost utílítíes líke electrícíty, water, fuel and guarantee of such utílítíes to be constantly avaílable.

ii. Polícy makers must capacítate manufacturíng índustríes through assístíng manufacturíng fírms to ímport theír key raw materíals by helpíng them ín obtaíníng foreígn currency at concessíonary rates.

iii. Polícy makers must encourage or campaígn for the preference use of domestícally produced fertílízers, whích shall prop up the demand of locally produced fertílízer ín the fertílízer manufacturíng índustríes ín Zímbabwe.

5.7 Manageríal Recommendatíons

The study recommends that, sínce capacíty utílízatíon ís posítívely related to fírm's profítabílíty ímplyíng that when capacíty utílízatíon ríses, the profíts of the fírm also ríse, management ín the fertílízer manufacturíng índustríes should make decísíons to:

i. Improve on the capacíty utílízatíon of íts manufacturíng uníts through, effectíve and effícíent ínventory control management system, whích wíll enhance avaílabílíty of key raw materíals for productíon.

5.8 Generalízatíon of Fíndíngs

The fíndíngs obtaíned ín thís study were obtaíned by usíng a case study of the fertílízers manufacturíng mndustry ín Zímbabwe. In spíte of beíng specífíc to thís índustry, these fíndíngs can be generalísed to any other índustry ín any other country províded that they are usíng productíon techníques establíshed by thís study. If the companíes ín other índustríes are usíng dífferent productíon methods, then the results míght sígnífícantly díffer as dífferent productíon methods are assocíated wíth dífferent features that may affect theír effectíveness on companíes’ performance.

5.9 Research Límítatíons

i. The study was confíned to the use of longítudínal data for the períod 2010 to 2018 as thís was the data the researcher could retríeve from reputable and valíd sources.The use of a data set spanníng for a longer períod would have ímproved the robustness of the results by makíng the parameters of the model more effícíent.

ii. The results of thís study were also based on a survey comprísíng respondents from those companíes’ branches operatíng ín Harare. Thís means that the research study focused on Harare as the geographícal scope. The study could not go beyond Harare due to tíme and budget constraínts.

5.10 Areas for Further Research

The study ínvestígated the ímpact of capacíty utílízatíon,machíne downtímes and defectíve rate on the profítabílíty of fírms producíng fertílízer.Further studíes on the subject can ínvestígate thís subject by takíng ínto account the effect of the level of capítalízatíon, electrícíty and fuel avaílabílíty, and raw materíal íssues on the ímpact of capacíty utílízatíon, machíne downtímes and defectíve rate on the profítabílíty of fírms. It ís possíble that these varíables may be moderatíng or medíatíng on the saíd relatíonshíp. Thís study could not reach that far as ít could not obtaín the requíred data for the relevant varíables for the study períod (2010 -2018) duríng the tíme the study was conducted.

The study also recommends further studíes to use data spanníng for a long períod, whích was not the case for thís study. Such an attempt wíll have an ímpact on the results and can ímprove the relíabílíty, valídíty and robustness of the fíndíngs.

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Appendix 1: Questionnaire

My name is Tazviwana Lazalus (R1712839), a student studying towards Master Degree in Business Administration at the University of Zimbabwe. In partial fulfilment of my studies, I am supposed to conduct a research project. In compliance with this requirement, I am conducting a research study titled '**Effectiveness of Production Techniques on Company Performance(ROA) in the Fertilizer Industry in Zimbabwe**' I am kindly asking for your assistance by way of responding to this set of interview questions to the best of your knowledge. Please note that the views that you will provide will be used for academic purposes only and shall be treated with confidentiality.

Instructions:

Kindly tick, mark and/or fill in your responses in the relevant spaces. Please do not put any names or form of identification on the forms to ensure confidentiality.

`PART A: BACKGROUND INFORMATION

1. What is your gender? a) Male [ ] b) Female [ ]
2. What is your highest level of education?

   a) Primary Education [ ] b) Secondary Education [ ]

c) Tertiary Education (please specify) ……………………………………………………………

3. For how long have you been working in the fertilizer manufacturing industry?

   ………………………………………………………… (Years)

4. What position do you currently hold in your company?

……

5. For how long have you been holding the post indicated in question 4?

   ………………………………………………………… (Years)

PART B: INFORMATION RELATED TO PRODUCTION OF FERTILIZERS

6. What production methods do you use in your company? (you can tick more than once)

   a) Batch production technique [ ]

   b) Flow production technique [ ]

   c) Lean production technique [ ]

   d) Other(s) (specify) ……………………………………………………………………………………………

7. What changes would you recommend your company to make in terms of its production method(s) in order to improve its performance?

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8. What is the current level of machine downtimes in your company?

……………………………………………. %

9. What is the current level of capacity utilization in your company?

……………………………………………. %

10. What is the current level of defective rate in your company?

……………………………………………. %

11. In your own opinion, what do you think can be done to improve the level of capacity utilization, machine downtimes and defective rate associated with manufacturing fertilizers?

12. Please respond to the following question by placing an X on the choice indicating the level of agreement from:

On a scale indicated in the following table, what is the intensity of effects of the factors indicated in the table on the production process? (tick where applicable)

Factor	**No impact**	**Mild**	**Moderate**	**Severe**
Level of capitalization				

Effective demand				
Power outages				
Fuel shortages				
Availability, quality and price of raw materials				

13. Are there any other factors affecting production of fertilizer in your company?

a) Yes [ ]

b) No [ ]

14. If your answer to question 13 is yes, please specify the factors.

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____________________**Thank you for your participation**________________________