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AN INVESTIGATION ON THE IMPACT OF SUPPLIER DEVELOPMENT ON SOYA BEAN PRODUCTION. A CASE OF GRAIN MARKETING BOARD.

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DEDICATION

This dissertation is dedicated to my mother and father for their support and unconditional love, for it is because of their love for who I am today. Many thanks to my supervisor Mr S. Bindu for his supervision throughout the whole project. I also want to express my appreciation to Mr Mupondiwa M. and Mrs Alumenda S. for their mentorship. Above all, it has been the Almighty God since day 1, and I am so grateful for His unconditional and Agape love.

ABSTRACT

The study investigates the effects of supplier development on soya bean production at Grain Marketing Board GMB. There is shortage of the crop, failing to meet the annual demand of approximately 300 000tonnes in Zimbabwe for the past decade or two. Therefore, Grain Marketing Board (GMB) is to have a great participation in developing schemes and supporting soya bean farmers, since it is the Strategic Grain Reserve for Zimbabwe. To achieve the objectives of the study, the researcher used Ordinary Least Squares (OLS) method. The dependent variable was production (of soya bean) and deliveries from farmers (one of the independent variables) was used as a measure of supplier development, and other independent variables were land, rainfall, labor, and capital investment. The study analyzed secondary data obtained from Meteorological Service Department, GMB's Soya bean company records data base. From the estimation method, results obtained showed that capital, labour, deliveries and land were significant in determining soya bean production, whereas rainfall had no significant effect in the model. The results showed that deliveries form farmers and land have a positive relationship with soya bean production, whilst capital and labour had a negative relationship with soya bean output. The study went on to suggest possible recommendations that include investing in technological advanced equipment to reduce labour intensive, offer loan facilities for farmers to purchase farm equipment, government to support with land reform schemes to provide land strictly to soya bean farmers on a large scale and GMB to improvise their supplier development policies as developing farmers was seen to have a positive relationship with soya bean output, and to promote private sector participation in mitigating the shortage of the crop in Zimbabwe.

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Table of Contents

DISSERTATION APPROVAL FORM i

RELEASE FORM ii

DEDICATION iii

ABSTRACT iv

ACKNOWLEDGEMENTS v

1.1 Introduction 1

1.2 Background of the study 1

1.3. Statement of the problem 4

1.4. Objectives of The Study 4

1.4.1. The Main Objective; 4

1.4.2. Specific objectives: 4

1.5. Research Hypothesis 5

1.6. Assumptions 5

1.7. Significance of the study 5

1.8. Delimitation 5

1.10. Definition of terms 5

1.11. Summary 6

CHAPTER II 7

LITERATURE REVIEW 7

2.1. Introduction 7

2.2. Definition 7

2.3. The Purpose of Literature Review .... **Error! Bookmark not defined.**

2.4. Theoretical Literature 7

2.4.1. Supplier development concept 7

2.4.4. Production Theory 8

2.5. Empirical Literature 9

2.5.1. Impact of supplier development on buyer's performance 10

2.5.2. Impact of supplier development on supplier's performance 11

2.5.3. Factors that affect soya bean production 12

2.6. Research gap 13

2.7. Chapter Summary 13

CHARPTER III 14

Research Methodology 14

3.1. Introduction 14
3.2. Research design 14
3.3. Theoretical Model 15
3.4. Model Specification 17
3.5. Justification of variables 19
3.6. Linear Regression model 20
3.6.1. Modification of the model 21
3.7. Diagnostic tests 22
3.7.1. Stationarity 22
3.7.2. Heteroscedasticity 22
3.7.3. Multicollinearity 22
3.7.4. Autocorrelation 23
3.8. Secondary Data 23
3.9. Ethics 23
3.10. Chapter Summary 23
CHAPTER IV 24
4.1. Introduction 24
4.2. Descriptive Statistics using EViews 10 Statistical package 24
4.3. Results of the diagnostic tests 25
4.3.1. Multicollinearity 25
4.3.2. Heteroskedasticity 25
4.3.3. Autocorrelation Test 26
4.3.4. Stationarity tests 26
4.4. Model estimation results: 27
4.4.1 Significance of the whole model 28
4.5. Interpretation of the Estimation model and discussion of results 28
4.5.1. Intercept (C) 28
4.5.2. Deliveries (Dv) 29
4.5.3. Capital investment (K (-1)) 29
4.5.4. Land (Ln) 30
4.5.5. Labour (Lb (-1)) 31
4.5.6. Rainfall (R) 32
4.6. Model conclusion 32
4.7. Summary 32

CHAPTER V 33
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 33
5.1. Introduction 33
5.2. Summary 33
5.3. Conclusions 33
5.4. Recommendations 34
5.5. Areas for further study 36
REFERENCES 37
Descriptive Statistics 40

LIST OF TABLES

Table 4.1 Descriptive Statistics..24
Table 4.2 correlation matrix..25
Table 4.3. The White Heteroskedasticity...26
Table 4.4 Augumented Dickey-Fuller (ADF) stationarity tests...26
Table 4.5 ADF 1ST Difference Unit root test results in first difference 1(1) 27
Table 4.6 Estimation Results 28

LIST OF FIGURES

Fig: 1.2.1. Soya Bean Production from 2012-2017 3

LIST OF APENDACES

Appendix 1....40
Appendix 2....40
Appendix 3....41
Appendix 4....41
Appendix 5....41
Appendix 6....42
Appendix 7....42
Appendix 8....43
Appendix 9....43
Appendix 10....44
Appendix 11....44

CHAPTER 1

1.1 Introduction

The study seeks to identify the impact of supplier development on soya bean supplied at GMB, thus the research seeks to explore the probable impacts of supplier development to the soya bean supplied at GMB. Therefore, this chapter consist of background of the study, aims of the study, statement of the problem, research objectives, research questions, and assumptions, significance of the study, delimitation, limitations, and summary.

1.2 Background of the study

Grain Marketing Board operates in the agricultural sector and is considered as the Dura reZimbabwe, meaning grain reserve for the whole nation. It came into existence since 1931, under the Maize Control Act. By then it was the sole buyer of maize from the commercial farmers around Zimbabwe and was serving only as the Strategic Grain Reserve to store, market and trade maize. Around 1951, GMB went on to diversify into all types of grains such as sorghum, millet, maize, rapoko and rice. Following this diversification of products, it is now in business of trading in cereals and oil seeds, as well as processing of products known as silo foods, that is silo salt, silo rice, silo samp, only a few to mention. GMB is a wholly state-owned company with the existing aim of ensuring national food security, www.gmbdura.co.zw.

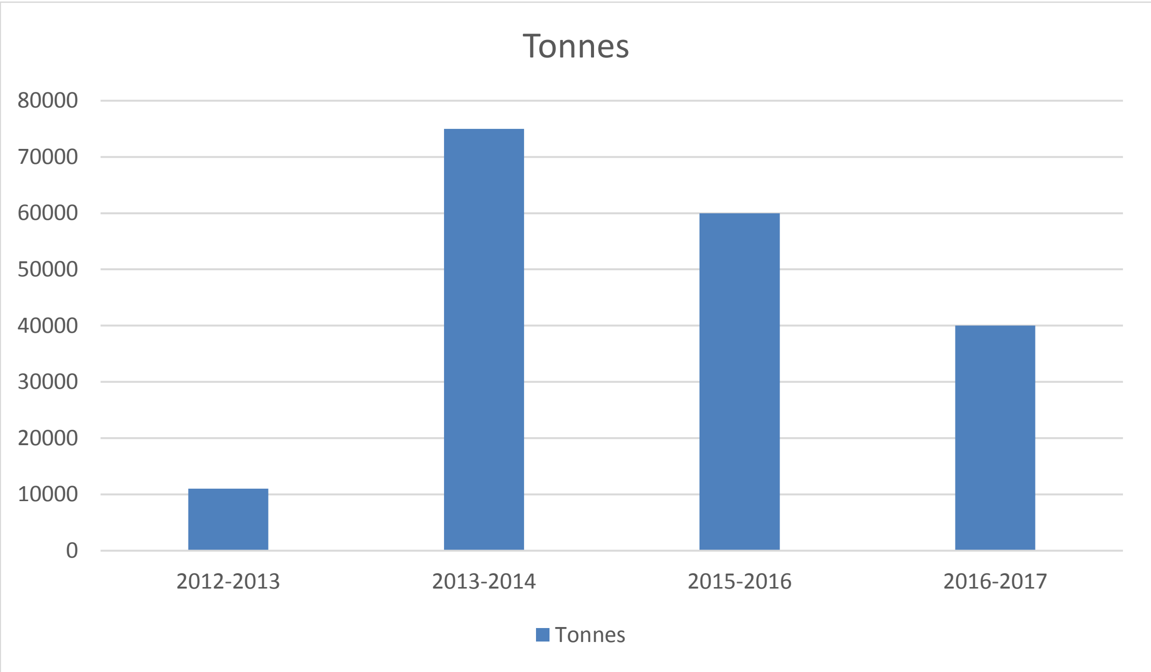
Grain Marketing Board is operating with about eight-three depots all around the country. It has managed to have at least one depot in every city, with two or more in some. As the Dura reZimbabwe, GMB holds the large reserves for grains known as silos or 'matura", of which they have a capacity of at most 5 000tonnes of grains each. The silos are divided in such most of them are meant to store maize, whereas others are for soya bean, wheat, sorghum, rapoko, and all other grains. It is not pleasing that GMB imports soya beans, of which most preferred cooking oil and stock feeds protein (47%) according to Peter Bailey et al. (2008) comes from soya beans and the nation should be self-sustaining through farming, but however it is then a challenge in Zimbabwe and the researcher is going to look at how can soya bean production be improved in Zimbabwe.

According to the Soya Bean Promotion Taskforce (2017), the nation as a whole approximately requires 300 000tons per year, thus the domestic market demand of soya beans and the country has capacity to produce 400 000tons if farmers are mobilised and adequate resources made available. The soya bean yield decreased after the land reform in 2000 to an average of 20 000tons per annum. The Zimbabwe Soya Beans Industry Trust has confirmed that the Zimbabwe national yield is 1.5tons per 1hectare, which is still far below the average yield of 2.5tons per hectare, and that of a good yield which is estimated to be 3tons per hectare. Furthermore, the Zimbabwean national yield is even 50% below soya bean high producers such as Argentina with 3.4t per hectare. Of the soya bean farmers, almost 90% of small-scale farmers uses returned seed and they do not apply the recommended agronomic practises, which then contributes to low production of soya bean having an average of 0.5t per hectare.

In around 2013, farmers where encouraged to plant soya beans as it has multiple end products such as pure cooking oil, stock feeds and other edible foods and the grain itself. Therefore, most farmers switched from cotton and maize farming to soya bean farming, and they never regretted their move because during this time the farmers experienced poor marketing seasons for other crops such as cotton. The soya bean market price offered was very high which raised from $0.35 of previous season to $1.50 per kg, thereby contributing to encourage farmers to plant soya bean and the yield increased from 11000tons of 2012-2013 season to 75 000tons in 2013-2014season. In 2016-2017 seasons the soya bean shortage looms, the yield fall to approximately 40 000tons per year in accordance with the Oil Expressers Association of Zimbabwe (2018), as the farmers dumped soya bean to maize as a result of lack of finance, which is a move which has contributed to the shortage of cooking oil and stock feeds, since soya bean cooking oil is 100% pure due to its little flavour that does not interfere with the taste of the food, as compared to that of cotton and/or sunflower, which requires triple refinery to ensure its purity. According to the Soya Bean Oil Sub-Sector Overview, (2016), the soya bean produces about 30% of cooking oil required nationally in Zimbabwe which is a significant proportion of cooking oil and thus contributing to increase in cooking oil importation from neighbouring countries such as Zambia and South Africa, www.snv.org.

The Grain Marketing Board had about 60 000tons yield of soya beans in 2015-2016 seasons, of which 40 000tons were imports, which indicated that the crop had declined from 75 000tons of 2013-214 season. Following the trends, in 2016-2017, the Grain Marketing Board had 30 000tons of soya beans from farmers, mostly from Mashonaland west, Mashonaland central and little from Manicaland provinces. Due to this downfall of soya bean yield, the country had to spend about $125 million on imports of soya bean crop in 2017, (Commercial Farmers Union of Zimbabwe, 2017). Therefore, the gap difference or variance of soya bean crop required and being yield is increasing or widening, which is not pleasing and directly harming our economy by increasing imports like of cooking oil, thereby causing unfavourable Balance of Payment (BOP). The soya bean yield can be illustrated by the graph below;

Fig: 1.2.1. Soya Bean Production from 2012-2017



Source: Secondary Data: Oil Expressers Association of Zimbabwe, (2017)

According to Van Weele, (2010), supplier development aims at improving supplier performance in a consistent way. When a supplier is unable to conform to the buying firm's expectations, the buying firm must determine the most appropriate action needed to resolve the issue, which can yield a better performance, (Benton, 2014). There are many advantages that can be obtained by both parties through supplier development as long as the buyer undertakes an activity to improve a supplier's performance, such benefits as availability of a product, improved quality product and performance and strengthening of relationships thereby increasing the firm's competency in the market.

It was first discovered by Leenders in 1966 that Supplier Development is the concept of efforts by the buyer to improve supplier's performance; many companies have adopted the concept of supplier development as it can be seen as a weapon for war, especially in this new era of a competitive market, Lysons and Farrington, 2012). Since 2013, the Grain Marketing Board has increased the buying market price of soya beans and also offers commercial training and monitoring of soya bean farming, as well as required chemicals for the plant to grow and protection from diseases.

1.3. Statement of the problem

There is shortage of soya bean supply at GMB as the required standard quantity of soya bean yield per each year is far reached. GMB reserves soya bean in huge quantities for the Oil Processors in the country and stock feeds production, of which about 300000tons per year is required for the nation. It can be seen that the nation target of 300000tons is far-reached as according to GMB Company Records Database, the production of soya bean is gradually declining almost each and every year. In 2011 GMB realised production of 115 187tons which is below half (38.4%) of the required quantity of 300 000tons. As from 2012-2015 the production of soya bean continued to decline and ranging between 70000-85000tons approximately. In the seasons of 2016 and 2017 the soya bean production continued to move down the ladder to an average of 57 850tons. This shortage of soya bean in the country is partly contributing to an increase in cooking oil and stock feed importation.

1.4. Objectives of The Study

The study sought to achieve the following objectives;

1.4.1. The Main Objective;

To determine the effect of supplier development on the soya bean production supplied at Grain Marketing Board.

1.4.2. Specific objectives:

2. To examine the effect of land on soya bean production.
3. To determine the effect of capital on soya bean production.
4. To determine the effect of labour on soya bean production.
5. To determine the effect of rainfall on soya bean production.
6. To examine whether there is a relationship between supplier development and soya bean production.

1.5. Research Hypothesis

The study sought to test the null hypothesis that land, capital, labour and rainfall has no effect on soya bean production and that there is no relationship between supplier development (measured with deliveries from farmers) and soya bean production.

1.6.Assumptions

2. The other factors that affects soya bean production that are not mentioned are held constant.

3. The data collected mirrors the real situation on the ground.

1.7. Significance of the study

This research seeks to identify the importance of supplier development in the whole supply chain of soya bean supplied at GMB. It will therefore, help in supplier development policies of GMB. In addition, the study will enlighten the researcher's research skills by linking theory and practice. The findings of this study will help to improve and maintain the supplier development schemes and how it improves the soya bean yield for the whole nation.

1.8. Delimitation

The study seeks to assess the impact of supplier development on the supply of soya bean at GMB and how GMB initiate its supportive programs to enhance the farmers' capacity. Therefore, it is restricted to the supplier development schemes at GMB in the years 2000-2017.

1.9. Limitations

The researcher is beyond the control of time factor, and some of GMB's information and financial challenges on gathering data for the research.

1.10. Definition of terms

Supplier development- refers to the process whereby a buyer provide support and works together with supplier(s) on a one-to-one basis in order to improve their capabilities and performance, for the benefit of both parties.

Soya bean production- is the process of making or growing soya bean from a given piece of land using capital and labour. Output is measured in tonnes and yearly converted into monetary value.

Balance of Payment- refers to the difference between the money that a country receives from exports and the money that it spends on imports.

ZEPARU- Zimbabwe Economic Policy Analysis and Research Unit

1.11. Summary

In this introductory chapter 1, the researcher discussed the background of the study, statement of the problem, research questions, and objectives, significance of study, limitations and delimitations of study. The chapter was meant to introduce the research topic by highlighting the problem statement, research objectives and research questions for instance. The research proceeds to the next chapter, chapter 2, which covers the literature review, which comprises of theoretical and empirical literature in relation to the research topic of investigating on the effect of supplier development on soya bean production at GMB.

CHAPTER II

LITERATURE REVIEW

2.1. Introduction

This chapter will dwell on the literature of the effect of supplier development on soya bean supplied at GMB. Other aspects looked at are purpose of literature, theoretical framework and empirical evidence.

2.2. Theoretical Literature

2.2.1. Supplier development concept

The concept of supplier development refers to any activity that a buyer undertakes to improve a supplier's performance and or capability to meet the buyer's short-term or long-term supply needs. The efforts by the buyer can be either result-oriented where a buyer assist the supplier through solving a certain problem for him, or process-oriented where the buyer assist the supplier through training facilities and educating on how to develop a certain product, (Lysons and Farrington, 2012). Therefore, when a supplier is unable to conform to the buying firm's expectations, the buyer should identify the appropriate action needed either an issue to be solved or training and monitoring required, (McGrawhill, 2010).

It is widely accepted that in order for firms to be more competitive it is high time now that they must seek, build up and maintain relationships with capable suppliers and extracts the maximum value through such relationships. Firms should be aimed at improving the suppliers' performance in their relationship with the buying organisation. The idea is that suppliers do not only determine the company's overall costs, but also its innovative capabilities and customer service. Therefore, firms should be able to identify whether current suppliers are not able to provide a demanded product, suppliers are either not performing up to expectations or requirements, is the composition and quality of a form's supplier base competitive or capable suppliers are not available in certain markets, so that they can look for suppliers to develop, (Van Weele, 2010).

Supplier development is an element or supportive of Kaizen, which is a Japanese word for continuous improvement model. Kaizen refers to an on-going effort to improve products, services or processes through incremental and breakthrough improvements. In this competitive environment, firms need to continue to “change for better” so as to survive in the market. The procurement function needs to help suppliers to continually improve as a strategic way of improving performance, (Lysons and Farrington, 2016). Kaizen is a Japanese word which refers to activities that continuously improve all functions and involve all employees from the top to the bottom-line workers. By trying to improvise processes, Kaizen tries to minimise waste and by so doing supplier development came into existence where the buyer and supplier engage in the early stages of production or identifying a need and work hand-in-hand.

Large Japanese manufacturers such as Toyota have enjoyed the fruits of supplier development in such ways as discrimination of best practices, provision of technical assistance and training through Supplier Association (SA) or Kyoryoku (a Japanese word). Supplier Association refers to a group of suppliers brought together in order to achieve strategic objectives through the development of awareness, education and programmes designed to improve performance. Therefore, Supplier Associations (SA) or Kyoryoku Kai helps to develop trust and relationship between buyer and supplier relationships. In addition, training improves the skills and the know-how of the supplier team and can then lead to zero defects principles or zero tolerance to defects, thus, high quality products can be achieved. According to Hines Kyoryoku or SA keeps suppliers and customers in touch with market developments and respects the voice of customers, (Lysons and Farrington, 2006). Furthermore, supplier development intervenes as a solution to product shortages, which is it encourages constant supply or availability of a product.

2.2.2. Production Theory

Theory of Production is a theory which greatly supports or give rise to effective supplier development. Production theory is the study of the economic process of producing outputs from the inputs, actually it has a principle which states sell ‘what you produce’. Production uses many resources to make a good or product which may be manufacturing storing and shipping, and thus it is all economic activities other than consumption. The production factors are labour, raw materials, fixed capital goods, and land, only a few to mention. In accordance with this theory, it is believed that every commercial activity other than final purchase is a form of production. Since production is a process (it happens through time and space), it requires three aspects which are quantity, form and temporal and factual distribution of the goods or services, (Mankiw, 2003).

The theory of production involves the relationship between the prices of commodities and productive factors, on the other hand, and the quantities of these commodities and productive factors that are produced or used, on the other. The productive activities are classified into short-run cost minimisation which involves decisions about methods of producing a given quantity of the output in a plant of a given size and equipment, short-run profit maximisation which refers to determining the most profitable quantities of products to produce in any given plant and long-run profit maximisation which is concerned with the determination of the most profitable size and equipment of plant.

The production theory uses the production function by Cobb Douglas, which is best used to determine the best cheapest combination of factors of production that can produce a desired output, (Mansfield, 1994). A production function is an equation that expresses the relationship between the quantities of factors employed, for example capital (K), labour (L) and the amount of product obtained (Q).

$$Q = f(K, L)$$

Assumptions

i) The firm produces one type of output with two inputs that are Labour and Capital.

ii) We assume that all units of labour and capital are homogeneous or identical.

iii) Technology is assumed to remain constant during the period of the analysis.

2.3. Empirical Literature

Empirical evidence is about the past findings that were achieved from previous studies of the different topics related to supplier development. It refers to the information that is attained by observation or experimentation, of which the data is recorded and analyzed by the analysts.

2.3.1. Impact of supplier development on buyer's performance

In Spain, a study by Hemsworth (2005), was done on the effect of supplier development on purchasing performance with different levels of implementation complexity on the firm's purchasing performance. The basic, moderate and advanced supplier development constructs were defined and the three structural models were hypothesized and tested using structural equation modelling through field research on a sample of 306 manufacturing companies. The findings were that it identified the interrelationships among the various basic, moderate and advanced supplier development practises. It was also indicated that the implementation of supplier development practises significantly contributes to the prediction of purchasing performance.

In a study in China, a researcher by the name Shuting Li, (2017) conducted a similar study on the effect of supplier development on outsourcing performance. Due to an increase in outsourcing by many firms, it has become important to for firms to depend more on their suppliers and thus have to manage and develop suppliers in order to maximise the benefits of outsourcing. In this study a structural equation modelling was used to analyse data from 213 manufacturing firms in China. The results indicated that supplier development has a strong direct positive impact on outsourcing performance, and that it also leads to enhanced outsourcing performance through reducing outsourcing opportunism risk and improving outsourcing flexibility.

Krause and Ellram in 1997 carried a study in USA in the cross-industry again and discovered that not all companies are equally successful on supplier development. However, those companies that exceeded expectations experienced superior supplier developments with regard to incoming defects and percentage of orders received completely. The results of this study can be seen as reliable as the sample used was large enough to represent the population, that is, 527 out of 1504 (size of 35%).

In order to look for success factors of supplier development, a survey by Krause and Ellram (1997), was mailed to a random sample of 1504 members and two groups were formed. The various responses from these two groups after questionnaires had been distributed to them indicated that the respondents from the buying firm (from the other group) are satisfied by their efforts on supplier development when there is likely to have a proactive attitude regarding supplier's performance, that is, put more effort and resources into their supplier development efforts, and exhibit a greater willingness to share information with their suppliers, than their counterparts who were generally dissatisfied with the firms’ supplier development results. Therefore, this survey showed that a lot of effort needs to be done by the buying firm in order for the supplier development to have positive impact to the buying firm.

2.3.2. Impact of supplier development on supplier’s performance

Watts and Hahn (1993), had to study a cross-industry in United States of America on the impact of supplier development. He discovered that overall supplier development appears to improve supplier performance but not yet to the level desired by the buyers, meaning by the time the study was done there was low or poor effort on how supplier development was done to improve supplier capabilities. The areas in which major improvements occurred as a result of supplier development are consistent with the participant’s key programme objectives, especially supplier quality improvement. However, it can be viewed that the empirical base was inappropriate, 81 out of 500, which is 16% and therefore better or good results was by no means easy to get.

In addition, in the same year of 1993 Monczka et al. obtained results that were positive on supplier development after a study, but showing there is a room for improvement. Supplier development has a positive impact on supplier’s performance in terms of quality, delivery, lead time and cost.

In efforts to find the impact of supplier development (SD) on supplier’s performance, a survey by Shing Lee was done in Hong Kong through sharing implied knowledge in mentorship under the influence of supplier’s organisational culture (OC). A questionnaire was use to collect data from 226 employees of participating suppliers after conducting a mentorship training at the supplier’s site. Its findings were that supplier development by mentorship partially intercedes the total effects of organisational culture, that is, power distance and uncertainty avoidance, on performance and that SD by mentorship is a viable strategy to enhance the performance of supply chain partners and the selection of suppliers.

In Kenya, a study to examine the effect of supplier development on performance in food manufacturing companies was conducted by a student by the name Lukhoba, (2015). The study focused on four factors which are early supplier involvement, financial support, supplier training and supplier incentives. Data collection was done and analysed and concluded that all the four factors have a positive effect on supplier performance. In addition, it recommended the use of early supplier involvement and financial support in improving the delivery performance while supplier training and supplier incentives in reducing the lead time and costs respectively in food manufacturing industries.

Supplier development can be seen with great impact to supplier's performance as concluded by a study done in Thailand. The research was done by Tungjitjarurn and Kamonchanok, (2012). to investigate the role of buyer-supplier commitment in supplier performance improvement based on two dimensions which are buyer-supplier relationships and transaction-specific investment that should exist between two parties. Data collection was done from 174 electrical products and components manufacturers in Thailand, and tested relationship by using Structural equation Modelling (SEM). The findings of this study concluded that the buyer-supplier commitment in dimensions of buyer-supplier relationship played a critical role in supplier performance improvements both directly and indirectly.

2.3.3. Factors that affect soya bean production

According to a study by the Zimbabwe Soya bean subsector (2016), the research focused on the soya bean sector dynamics from farmers to firms. A value chain analysis was used to analyse the dynamics in the soya bean oil sub-sector. Its findings were that production and productivity of soya bean is being hindered by farmer-level skills and knowledge, quality of support services such as extensions and finance, and supply of inputs. In addition, the study also concluded that less than 10% of the installed processing capacity is being used because of low productivity in soya bean, scarce or difficult access of land in communal and resettlement areas and that the land available in A2 farmers are controversial/ debatable. Basing on the results the study recommended that private sector intervention will be of importance towards meeting the national demand of soya bean in Zimbabwe.

A study in Kenya on developing the successful soya bean promotion strategies in Nigeria and Zimbabwe was conducted by Chianu, et al…, (2009). The major objective was on the crop promotion as it is critical for rural growth and market creation. The study assessed the effect of market development at household level, community level and linking farmers' groups to industrial processors on sustainable soya bean promotion in Kenya. Secondary data was used together with formal and informal interviews to stakeholders in Kenya using a three-tier approach. The findings reviewed a positive increase on the farmers' confidence to produce, process and consume more soya beans than before and trained groups developed new soya bean products for cash income, which was very profitable. In addition, the selected groups were supplying large-scale processors with soya bean grain, and substituting some imports, and the net returns have been increased from four to fourteen times for some soya bean products.

A study on effectiveness of soya bean rhizobial isolates in fixing nitrogen under Zimbabwean soils was conducted for smallholder farmers by Zengeni and Giller, (2007). The research used secondary data and was analysed using an ANOVA test. The study concluded that the number of nodules that were below average obtained were as a result of very low moisture and land with poor soil conditions. The total rainfall received during the study was far below the normal average, and could have caused water stress on the plants giving very few modules. The reason being that soya bean plants require average or above average rainfall in order to keep enough moisture.

2.4. Research gap

The researcher identified the knowledge gap that other pas researches focused on areas such as organisational performance and relationships in organisation, which focused on productivity of the whole organisation indirectly, and not on soya bean production. More so, these studies were conducted in Kenya, Thailand, United States of America, and not here in Zimbabwe for the particular crop, soya bean. In addition, the researcher focused on one type of agricultural crop in which the researcher got interested in it as this is the most vital crop for the nation as a whole, but lacking supportive measures and inputs in order to boost its production at nation level, as due to insufficient soya bean, the country’s Balance of Payment is affected negatively as a result of increase in soya bean importation.

2.5. Chapter Summary

The researcher focused on the literature review of the effect of supplier development on production. The study looked at the literature review which consisted of some theories related to the subject matter and the empirical evidence that is previous studies available related to the topic of effect of supplier development on production. Finally, the researcher managed to find a research gap, which this gap enables and gave the researcher strength to continue with or carry out the study.

CHARPTER III

Research Methodology

3.1. Introduction

This study seeks to determine the effects of supplier development on soya bean supplied at GMB. This chapter describes how the research will be conducted. It will look at the research methodology and provide the tools and techniques of how the study will be conducted and present the methods to be used in data collection. The chapter will explain the research design used, the sources of data used explained together with the theoretical model, model specifications, estimation model and justification of variables.

3.2. Research design

The researcher used the quantitative analysis through a Regression Analysis so as to determine the effect of supplier development on soya bean production. Regression Analysis, in statistical modelling is a set of statistical processes for estimating the relationships among variables. It is a dominant statistical method that allows you to scrutinize the relationship between two or more variables of interest. Regression Analysis core objective is to examine the influence of one or more independent variables on a dependent variable. Therefore, it has a greatest advantage of that it indicates the strength of effect of multiple independent variables on a dependent variable and thus the researcher seeks to achieve. However, Regression Analysis has a great disadvantage that it assumes that there is a linear relationship between dependent and independent variables, of which sometimes this is incorrect.

The researcher conducted a hypothesis test in order to test the effectiveness of land, deliveries, rainfall, capital and labour on soya bean production. A hypothesis is a claim that can turn out to be valid or invalid. According to Zikmund, (1999), a hypothesis is an assumption or guess that the researcher makes about some characteristic of the population being investigated. The null hypothesis acts as a starting point as it is the state of affairs that is accepted as true in the absence of any other information. The researcher conducted hypothesis test of which results were computed.

3.3. Theoretical Model

The researcher seeks to determine the effects of supplier development on soya bean supplied at GMB. In order to study the effectiveness and relationship between the dependent and independent variables of production and factors of production, the researcher adopted the Cobb Douglas (1928) model of production function

Q= A f (L, K) ……………………………………………. 1)

Where Q is output measured in terms of value added

L is a measure of labour input

K is a measure of capital

f is a constant return to scale function of factor inputs K and L that defines the level of output in period t, given the conditions and technology in the base period.

Therefore;

$Q=AK^{\alpha}L^{\beta}$

Where Q is the output, K is the capital, L is labour and A is total factor productivity efficiency of production. In the study Q is the total production of production.

A can be specified as;

A= f (Lb; K; Ln; Dv; R; □) …………………………………… (2)

Where

A= total production

Lb= Labour

K= Capita investment

Ln= Land in hectares

Dv= Deliveries

R= Rainfall

□= other factors that affect total factor product

Total factor productivity equals to total labour productivity and total capital productivity; however, total factor productivity is being represented by annual soya bean output. The theoretical framework can be then simplified to produce the following equation;

$TP = \square_0 + Lb^{\beta1} + K^{\beta2} + Ln^{\beta3} + Dv^{\beta4} + R^{\beta5} + e$ ………………………………. (3)

Where TP is soya bean production

Lb is labour in number of workers

K is capital investment

Ln is land planted in hectares

Dv is deliveries of output by farmers

R is average annual rainfall

Production theory has a principle which states sell what you produce, and thus this model greatly supports the supplier development concept as this all is about how to improve the production, more so, not just production but rather more into a firm producing and at the same time selling a product and, thus being a producer and a retailer simultaneously. In order to produce quality of the product and the prices of the production factors the firm's task is to produce and determine the best and cheapest combination of production factors, which can produce the desired output. This is best understood using the production function as below;

The model specification is as follows;

$P = f (L; K; m; X\square)$,

Where

P = Production

L= Labour

K= Capital investment

m = fixed variable

3.4. Model Specification

For the researcher to study the relationship between supplier development and soya bean production, a regression analysis was used to analyze and evaluate the relationship between two or more variables, with one being dependent to other independent variables. The regression analysis is useful when mathematically defining the relationship between independent variable and dependent variable. According to this regression model soya bean production is the dependent variable which is affected by labour, capital invested, land, deliveries, and rainfall. In this model some variables were left out and held as fixed, such as tractors, trucks, and combined harvesters.

P= f (Lb, K, Ln; R, Dv) ………………………………….. (4)

Where

P= production

Lb= labour (working hours)

K= capital invested

Ln= land (hectares)

R= rainfall

Dv= deliveries of the output

Modification of the model

The researcher adopted the variable inputs above because there is no production without labour and capital, for soya bean to grow it greatly depends on rain as irrigation in Zimbabwe might be a challenge due to scarce resources mostly lack of financial resources for seed and fertilizer are the immediate inputs for every farmer when it comes to large scale soya bean farming, and last but not least land remain a critical factor of production as in this context land encompasses the soil types required the soya bean production.

P is the dependent variable, and deliveries of soya bean output (Dv) by farmers to GMB shall be used to measure the supplier development. The researcher used the Cobb Douglas model because it best suits in analyzing the effectiveness of labour, capital, rainfall, deliveries from farmers and land on the production of soya bean. In this study, technology remains constant, that is dt/Da =0, taking into account that it is fixed and assuming that the use of machinery produces more output with the same inputs. For $y = \beta_0 + \beta x^{\gamma}$ $0 < \gamma < 1$, where β_0 represents the constant variables in this model such as technology, other raw materials such as soil. However, there are other factors that affect soya bean production such as technology, tractors and trucks, combined harvesters that were left out. Adjusted R^2 was used to predict the strength of the relationship between a dependent and independent variable. Of which high adjusted R^2 that is greater than 0.5 indicates that the changes in the dependent variables are highly explained by the changes in independent variables, that is, the R^2 is used together with adjusted R squared which is a better measure of goodness of fit due to its use of degrees of freedom. P value in regression that is less than the significant level 5%, $p<0.05$ indicates that the term is statistically significant, and a high p value indicates that the term is non-significant. The error term (μ) in this model will represent the other variables that affect soya bean production but not included in this model, as mentioned above.

Therefore, the final model will then be as follows;

$$P = \beta_0 + \beta_1 Lb + \beta_2 K + \beta_3 Ln + \beta_4 Dv + \beta_5 R + e$$

Where e is the error term

And β_1 ; β_2 ; β_3 ; β_4 ; β_5 ; are parameters of the variables

Where P denotes the quantity of production, and the first variable factor is labour followed by capital, land, deliveries and rainfall. The available quantity of fixed factor is land, it remains constant in the short-run, but varies in the long-run.

Therefore, the entire formula expresses the amount of output that results when specified quantities of factors of production are employed. Also, it must be noted that though the quantities of the factors determine the quantity of output, the reverse is not true, and as a general rule there will be many combinations of productive factors that could be used to produce the same output.

There is an empirical evidence on the production theory which emphasizes the usefulness of the model. A study on Credit, Money and Production was conducted by Betancourt R. and Robles B. in United States of America, (2014) in which the authors adopted the theory of production. The study was mainly to test the role of financial variables in production, and the test was based on the restricted cost function. A non-linear three stage least squares was used for analyzing the information on the financial variables. Findings of this study indicated that credit and money affect the cost of producing or manufacturing output, but however, credit and money cannot be treated as inputs.

3.5. Justification of variables

Production

Production was used as a dependent variable because it relies on factors of production and best measures the effectiveness of supplier development of soya bean. It is the total factor output. Through quantity produced of soya bean one can conclude the effectiveness of supporting farmers with inputs such as seed and fertilizer towards continuous improvement. The production can be measured by land planted, deliveries from farmers, with rainfall, labour and capital available to farmers.

Deliveries of output

Soya bean deliveries to GMB was a variable used to measure supplier development. It is assumed in this case, that the quantity of soya bean intake at GMB can explain the influence of supplier development on soya bean production. This is an independent variable which assist the success of developing suppliers or farmers on the increase of soya bean yields.

Capital investment

Capital is the capital investment injected to boost the soya bean production at GMB. According to Professor Shekhat (2014), capital can be referred to as the finance used to buy natural resources such as land, or it can be the major physical assets such as machinery (combined harvesters), inputs such as fertilizer (compound L), seed and chemicals that are used for the production of other goods, in this case, soya bean crop. In this study capital used is the total value of seed, fertilizer and chemicals. As such, finance capital is required for the soya bean production so that all required inputs can be bought, for example most fertilizer in bulk is imported. Capital is very important so that soya bean can be grown to meet the required national yield, as by so doing this will reduce the soya bean importation of the crop in Zimbabwe.

Labour

Labour can be seen as the human capital available to convert raw materials and natural resources into consumable goods. Human capital is the workforce in the economy what provides different services for the smooth flow of operations and processes in the economy. This is a factor of production which is flexible as workers can be allocated to different areas for specific tasks and works. In addition, labour is a factor which can be improvised for continuous improvement through skills training and educational workshops. Labour can be measured in working hours, salaries and wages or number of workers. Therefore, for the conversion of inputs into outputs, labour is greatly needed in farming and harvesting of the soya bean crop, (Sloman, 2006).

Land

Land is a broad factor of production, especially when it comes to agricultural produce, as it refers to all the natural resources. Land can take various forms such as from agricultural products to commercial real estate. Natural resources such as minerals (gold, oil), can be extracted for human consumption from land, also farming of crops can be achieved on land, and thus it is a broad factor, (Mankiew, 2003). In this research the researcher took land as the piece of area for cultivating or farming the soya bean crop which is rich in fertile and loom soil.

Rainfall

In the model of production modified by the researcher, rainfall has a direct effect to total output of soya bean. In Zimbabwe we have scarce resources for all the agricultural activities to implement irrigation facilities for supplement, and thus our agricultural production relies on rainfall. Rainfall is very important in the model as its absence (holding other things constant), total output is likely to be zero. Even if the farmers can supplement with irrigation schemes, the dams and rivers need to overflow with water from rainfall. Rainfall is measured annually in millimeters using the average annual rainfall. The rainfall data was obtained from Meteorological Department Services (MSD).

3.6. Linear Regression model

The Regression analysis uses the ordinary least squares (OLS) which was used to estimate the linear regression model. It is a technique used to estimate the functional relationship between two or more variables. However not all variables can be quantifiable, and thus this model exempts qualitative variables such as quality of customer services. The regression analysis aims to find a linear function which best fits the actual observations, and thus uses the least squares method which aims to find the best fit linear regression line, (Sloman, 2006). The straight line is defined as

$y = \alpha + \square x$, where α= y-intercept (independent variable), $\square$=gradient of the regression line, y= dependent variable.

It works hand in hand with correlation analysis, which is a technique used to analyze the strength of association between two sets of paired data. It measures the strength of linear association between variables x (independent) and y (dependent). The statistical measure of correlation is called a correlation coefficient. There are two measures of correlation commonly used which are Pearson's coefficient and Spearman's Rank correlation coefficient. The correlation co-efficient is a proportion that takes on values between **-1 and +1, that is, $-1 \leq r \leq +1$.**

Error term

This model of regression analysis includes the error term with a sum equal to zero as normally positives and negatives numbers have the habit of cancelling each other. The error term is important for it captures the influence of all independent or exogenous variables that are excluded in the model. The random error term μ is normally distributed.

3.6.1. Modification of the model

For the researcher to determine the relationship between supplier development and production, a linear regression analysis was used to analyze and evaluate the relationship between two or more variables that is between the dependent variable and the independent variables. The linear regression model;

$y = \alpha + \square x$ where α = y-intercept $\square$= gradient dy/dx.

Therefore, the researcher conduced a regression analysis for each independent variable with the dependent variable. In the regression model, the dependent variable is production which is affected by capital, labour, deliveries, land, seed and fertilizer.

$P = f(K; Ln; Lb; Dv; R)$

Where

P = Production

K= capital

Ln = land

Lb= labour

Dv = deliveries of output from farmers

R= rainfall

y = f (K +Ln +Lb +Dv +R)

3.7. Diagnostic tests

3.7.1. Stationarity

In mathematics and statistics, a stationary process is a stochastic process whose unconditional joint probability distribution does not change when shifted in time. The data is time series hence it may be non-stationary in levels. Non-stationary data results in standard regression techniques which produces invalid results with high R^2 which is meaningless, (Granger and Newbold, 1974). The parameters such as mean (μ) and variance (δ^2) also do not change over time, that is are constant. The researcher adopted the concept of stationarity in Regression Analysis and hypothesis test. The test is conducted between the null hypothesis which is the series are non-stationary against the alternative hypothesis that the series are stationary. The estimated t-values of δ^2 or p follows the (t) statistic and the rejection of null hypothesis when (t) statistic is significant leads to a conclusion that the series are stationary.

3.7.2. Heteroscedasticity

Under regression and analysis, using Ordinary Least Squares method, one of the assumptions is that of homoscedasticity, which refers to the assumptions of equal variance for the error term. If that assumption does not hold, we have the problem of heteroscedasticity. Heteroscedasticity is usually caused by the presence of outliers, an observation that is much different, either very small or very large. This study used the White test to dictate the presence of heteroscedasticity. The White test was chosen because it is easy to implement and the test does not rely on normality assumption.

3.7.3. Multicollinearity

Multicollinearity refers to the presence of linear relationship among the explanatory variables. When independent variables in a regression equation are correlated multicollinearity takes its presence. As a result of the stochastic nature of most regressors, correlation and interrelationships are bound to exist among them making multicollinearity inherent in most explanatory variables. The presence of multicollinearity causes small changes in the regression equation to produce great or huge changes in p-values and coefficients, (Maddala, 2001).

3.7.4. Autocorrelation

Autocorrelation arises when the error terms are correlated with one another, (Maddala, 2001). In other words, it arises when error terms are not homoscedastic. It occurs in time series studies where the errors associated with the observations in a given period are carried over the future time period. A test for autocorrelation will be carried using the Durbin-Watson statistic. According to Durban-Watson test, there is no autocorrelation among successive error terms if the computed D-W statistic lies between D upper and 4-D upper.

3.8. Secondary Data

The data used in this research is purely secondary annual data collected from the company records. The researcher used GMB Company records Database and Zimstats to obtain data. Secondary Data refers to research data that has previously been gathered and can be accessed by researchers. Secondary data is used to increase the sampling size of research studies and is also chosen for the efficiency and speed that comes with using an already existing resource. In addition, it facilitates large research projects in which many research groups working in tandem collect secondary data.

3.9. Ethics

The behavior and manner in which people cooperate is influenced by ethics. Ethics refers to the study of right from wrong in human conduct. In general ethics refers to knowing what is right and wrong. Welman et al. (2011), believe that a researcher should be concerned with ethical considerations in all research processes (i.e., when recruiting, measuring and publishing). The researcher obtained secondary data of GMB company records which this data was not shared to anyone, but only for the research purpose in order to maintain confidentiality.

3.10. Chapter Summary

The main aim of this chapter was to outline how the research was done (methodology). This chapter focused on the research design, methods and procedures collecting data, theoretical model, model specifications and its justification. Conclusively, the researcher looked at ethical considerations. The results of this research will be presented in the next chapter.

CHAPTER IV

4.1. Introduction

The previous chapter focused on research design, theoretical model specification, and justification of variables, linear regression model, diagnostics tests, secondary data and ethics. This chapter seeks to present the results obtained using the OLS Regression analysis model and diagnostic tests conducted data and analysis, and provide results. This chapter provides answer to the research questions in chapter one by making use of the steps and procedures provided for in chapter three. The results were obtained through the use of the EViews 10 Statistical Package. The results are presented as follows;

4.2. Descriptive Statistics using EViews 10 Statistical package

Descriptive statistics was carried out by the researcher in order to establish the statistical properties of the data. Descriptive statistics is a summary that quantitatively describes or summarizes features of data. Therefore, descriptive statistics enables us to present data in a meaningful way, which allows simple interpretation of the data, such interpretations of Jarque-Bera, skewness and variability. The descriptive statistics are produced under the null hypothesis that there is non-normality in the error term and hence results produced should show normality for the regressed results to be reliable.

Table 4.1 Descriptive Statistics

	P	Dv	K	Ln	Lb	R
Mean	68290.06	46699.88	1472725.	21982.24	164.8235	4395.553
Median	70256.00	35425.00	1354000.	20609.00	149.0000	4220.000
Maximum	98250.00	95385.00	2324000.	46500.00	255.0000	6525.000
Minimum	41197.00	15132.00	399880.0	10100.00	102.0000	2025.000
Std. Dev.	18219.26	24905.58	661419.0	9689.891	52.31663	1129.517
Skewness	0.043133	0.722684	-0.10362	0.929929	0.479676	0.109915
Kurtosis	1.773519	2.105315	1.658564	3.486562	1.814889	2.821760
Jarque-Bera	1.070785	2.046765	1.305030	2.617867	1.646766	0.056734
Probability	0.585439	0.359377	0.520734	0.270108	0.438944	0.972032
Sum	1160931.	793898.0	25036331	373698.0	2802.000	74724.40
Sum Sq. Dev.	5.31E+09	9.92E+09	7.00E+12	1.50E+09	43792.47	20412955

Source: EViews 10 Software Package

As shown in the table, the standard deviations are relatively equal and not deviating from the mean, indicating that there are no outliers. It can be seen that there is presence of normality since all the variables have the Jarque-Bera probability which is greater than 0.1. The coefficients of skewness were positive, that is skewed to the right for P, Dv, R, Ln and Lb, indicating that they are all positively skewed, except for K which has a negative coefficient meaning that it is negatively skewed. Variables are said to be normally distributed if the p-value is greater than the level of significance, of which in this case it is 0.05. According to the table 4.1 above, all the p-values are greater than 0.05 which means they are all normally distributed at 5% significance level.

4.3. Results of the diagnostic tests

4.3.1. Multicollinearity

Correlation matrix is used to test for the presence of multicollinearity, which refers to a situation where explanatory variables are highly correlated. The following table shows the results from correlation matrix after testing for multicollinearity between variables;

Table 4.2 correlation matrix

	Dv	K	Ln	Lb	R
Dv	1.000000	-0.203069	0.804420	0.187536	-0.471344
K	-0.203069	1.000000	-0.162363	-0.576595	0.212278
Ln	0.804420	-0.162363	1.000000	0.274090	-0.520698
Lb	0.187536	-0.576595	0.274090	1.000000	-0.102918
R	-0.471344	0.212278	-0.520698	-0.102918	1.000000

Source: EViews 10 Software Package

For multicollinearity, the presence of multicollinearity is shown when values are greater than 0.8. Multicollinearity is always present in series data and researchers are worried about its degree, and not necessarily its presence. The results presented above shows that there was no presence of multicollinearity as most of the values are less than the maximum expected of 0.8, which is the rule of thumb, except for 0.804420 which is still near or close to 0.8. Therefore, this proves that there is no presence of multicollinearity between the variables.

4.3.2. Heteroskedasticity

This is a circumstance in which the variability of a variable is unequal across the range of values of a second variable that predicts it. The evidence of rejecting the null hypothesis, that is, the significance level, can be reduced if data proceeds with heteroskedasticity. In this research, heteroskedasticity was tested using the Heteroskedasticity White test and results are presented in the table below;

Table 4.3. The White Heteroskedasticity

F-statistic	2.638869	Probability	0.0836
Observed R-squared	9.270921	Probability	0.0987

Source: EViews 10 Software Package

The probability of F static which is 0.0836 is significant as it is greater than 0.05, which shows that there is absence of heteroskedasticity. The F statistic value of 2.638869 is of significance at 5% level.

4.3.3. Autocorrelation Test

Autocorrelation is tested under the null hypothesis that there was serial autocorrelation. According to Gunderson, (2000), in the absence of autocorrelation, the DW statistic has to be around 2. Considering that the DW statistic is 2.234959 which is greater than R^2 and is around 2, this means that there is no autocorrelation in the model. Therefore, we accept the null hypothesis that there is no autocorrelation between the variables.

4.3.4. Stationarity tests

Stationarity in data refers to when time series data has statistical properties such as mean, variance, autocorrelation are all constant. In most cases time series data is not stationary and in order to avoid a problem of not being what the data is supposed to be (spurious), a Unit root test was done. The Augmented Dickey-Fuller test was used to test stationarity of all the variables and results summarised as follows;

Table 4.4 Augumented Dickey-Fuller (ADF) stationarity tests

Variables	ADF Test statistic	MacKinnon 1%	Critical 5%	Values 10%	Result
P	-3.798676	-3.920350	-3.065585	-2.67345	Stationary
Ln	-3.618274	-3.920350	-3.065585	-2.673459	Stationary
R	-3.192803	-3.920350	-3.065585	-2.673459	Stationary
Dv	-3.841007	-3.920350	-3.065585	-2.673459	Stationary
K	-0.980635	-3.920350	-3.065585	-23673459	Not stationary
Lb	-1.701623	-3.920350	-3.065585	-2.673459	Not stationary

Source: EViews 10 Software Package

Table 4.4 shows the results of stationarity for all variables at level 1(0) using the ADF unit root test. In level, production (P) is stationary at 5% and 10% level of significance since the ADF test statistic is greater than the MacKinnon critical values. Ln, R and Dv are also stationary at 5% and 10% levels of significance, and not stationary at 1% level of significance. This might be because the independent variables affect the dependent variable at different levels just as they have different units of measurements.

Since Lb and K are non-stationary using the ADF test statistic, the researcher went on to difference the variables, as a solution to non-stationarity. The following results were obtained using the ADF 1st Difference Unit root;

Table 4.5 ADF 1ST Difference Unit root test results in first difference 1(1)

Variables	ADF Test statistic	MacKimmon 1%	Critical 5%	Values 10%	Result
K (-1)	-3.313318	-3.959148	-3.081002	-2.681330	Stationary
Lb (-1)	-5.401625	3.959148	-3.081002	-2.681330	Stationary

Source: EViews 10 Software Package

Basing on the presented results in the table, K and Lb variables became stationary after testing them using ADF 1st Difference unit root. K (-1) (capital) became stationary at 5% and 10% level of significance, whilst Lb (-1) (labour) became stationary at all the levels of significance tested (1%, 5% and 10%). Now that stationarity has been achieved in all the variables, the researcher will proceed on regressing the data.

4.4. Model estimation results:

These are the results obtained after going through a regression analysis on the variables using the Ordinary Least Squares (OLS) method on the EViews 10 Software Package. The variables were tested on the null hypothesis that the variables are not significant. The results were presented as follows;

Table 4.6 Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48271.70	18619.23	2.592572	0.0250
Dv	0.313549	0.161412	1.942538	0.0781
K (-1)	-0.011605	0.004496	-2.581237	0.0255
Ln	1.063656	0.440512	2.414589	0.0343
Lb (-1)	-105.9641	57.44271	-1.844692	0.0922
R	3.765150	2.489762	1.512253	0.1587
R-squared	0.819051	Prob(F-statistic)		0.000847
Adjusted R-squared	0.736801			
F-statistic	9.958092	Durbin-Watson stat		2.234959

Source: EViews 10 Software Package

P = 48271.6989098 + 0.313548686134**Dv** - 0.0116046067212**K(-1)** + 1.0636559883**L** - 105.964117075**Lb(-1)** + 3.76514979356**R**

Where P= Production, Dv= deliveries, K= capital, L= land, labour and R= rainfall

Source: EViews 10 Software Package

4.4.1 Significance of the whole model

R^2 indicates information about goodness of fit of the model. A model is a good fit if half and more of the variations are explained in the model. From the regression results above, the model is useful and fit since it recorded a positive result of 0.819051. This means that 81.9% production variability is responsive to capital, labour, rainfall, land and output deliveries. Evidence of explanatory power of the model is indicated by adjusted R^2 of 0.736801, which is slightly lower than R^2. All other variables are significant in the model at 10% level as the probabilities are all less than 0.1 such as K (-1), Ln, Lb (-1) and Dv except for R which has a probability value greater than 0.1 indicating that the variable is not significant. The F statistic probability of **0.000847** shows that the model is correctly specified and it is significant at 1% level in explaining the variations in soya bean output. This means that we have 99% confidence that the model is correctly specified.

4.5. Interpretation of the Estimation model and discussion of results

4.5.1. Intercept (C)

The y-intercept in the regression model is denoted by C, and in the original model it the coefficient of $\square_0$. From the results above, the intercept value is **48271.70** which is positive, which means an increase in independent variable will result in an increase in the dependent variables in the estimation model. In the model the constant is statistically significant at 5% level as its p-value is less than 0.05.

4.5.2. Deliveries (Dv)

The variable is statistically significant at 10% level of significance, as the p- value of 0.0781 is less than 0.1. There is therefore 90% confidence that the variable changes result in changes in the dependent variable P (production). The coefficient of Dv 0.313549 is positive. This means that there is a positive relationship between soya bean total production and deliveries/intake at GMB from farmers. Therefore, an increase in production will lead to an increase in the deliveries at GMB.

Basing on the results of estimation, the positive result of the coefficient reflects the effectiveness and positive effect of developing suppliers. Since deliveries from farmers was used as a measure of supplier development, the results obtained shows that committing in developing farmers has a positive effect on soya bean production. Supplier development can lead to increased soya bean production as supplier's performance can be improved. These results are related to a study conducted in Thailand by Tungjitjarurn, to investigate on the role of buyer-supplier commitment in supplier's performance improvement, and the findings showed that commitment of buyer and supplier relationships played a vital role in improving directly or indirectly the supplier's performance, leading to continuous improvement in productivity.

4.5.3. Capital investment (K (-1))

The researcher is 95% confidence that K (-1) is statistically significant in the model as the p-value of 0.0255 is significant at 5% significance level. This variable has a coefficient of -0.011605 which means that there is a negative relationship between capital and soya bean production. This therefore means that a change of a change increase in capital would decrease production by 0.012%.

Basing on these results, since the research was on investigating the effects of K (capital) on soya bean production, it may be concluded that farmers may not necessarily be lacking finance or bought-in inputs such as fertilizer, seed or chemicals, but other supporting activities such as training on the soya bean crop and monitoring progress on farmers productivity may be contributing to the output downfall whilst capital is being increased, as from the findings by Shing Lee in Hong Kong on mentorship, he carried a study and discovered that mentorship is a vibrant strategy in improving the supplier's performance.

Therefore, farmers need monitoring and workshops that provides advice and training on the product, and not just the inputs.

Increase in provision of money without knowledge of the crop can lead to a decrease in the crop production, due to huge loss of input inefficiency. In another study by Lukhoba in Kenya, the researcher's study focused on the effects of early supplier involvement, financial support, supplier training and supplier incentives and found out that amongst these four he recommended that supplier training is one of the factors which helps in reducing lead time and costs, and thus can deal with the negativity relationship between capital and soya bean production. In a study by Chianu in Kenya, training farmers resulted in giving the farmers confidence to produce, process and consume more soya beans that before, and producing soya bean products for cash income, and this therefore will result in a positive relationship with capital through profitability.

4.5.4. Land (Ln)

This variable is statistically significant in the model at 5% level as its p-value of 0.0343 is less than 0.05. This means that we are 95% confidence that Ln explains variations in the dependent variable P. We therefore reject the null hypothesis and conclude that in (land) is significant in the model. The coefficient of Ln of 1.063656 is positive which means that there is a positive relationship between land and the soya bean production. An increase in land will result in a 1.063656% increase in the soya bean output.

From the results of this study, land has a positive relationship with soya bean output. This supports the theory that soya bean production requires adequate land for its farming, of which the land preferable is that with loan soil, though soya bean can adapt to many soils with the exception of clay soil in which the crop can hardly survive. This is in support with the study by Lambin and Meyfroidt, 2011), of which the conclusions emphasised that efficiency use of land can increase the soya bean output. Soya bean production to be increased, adequate land specifically for the crop farming is required, which the land preferable is that with loan soil, though soya bean can adapt to many soils with the exception of clay soil in which the crop can hardly survive. Soya bean requires well-drained soil, that is, the type of soil that is loose. In addition, proper land preparation is required to clear all unnecessary vegetation before soya bean planting. Therefore, basing on these results there is need in Zimbabwe for land reform process so as to support the soya bean farming and increase our land use efficiency.

4.5.5. Labour (Lb (-1))

Labour has a probability of 0.0922 which is statistically significant in the model at 10% level of significant. Therefore, there is 90% confidence that according to this study, Lb is significant in the model. The coefficient of Lb is -105.9641 which is a negative, meaning that Lb and soya bean production have a negative relationship. A change of a change increase in labour (number of workers) will result in a decrease in soya bean output.

Labour in this study is measured in number of workers. From the results in table 4.6 the negative coefficient implies that an increase in labour may contribute to a decrease in soya bean production, as according to the concept of marginal utility of diminishing returns, which states that extra units declines as more is consumed, that is employing few workers can produce more output than employing additional workforce for the same job, as many workers can be less productive due to sharing of available resources. In the estimation model this variable has a highest negative coefficient of 105.9641. The coefficient indicates that there is a negative relationship between labour (number of workers) and soya bean production. Though soya bean production might be labour intensive, the number of workers on a same piece of land should not be too many for no reason as this can cause workers to be idle whilst they demand their wages and salaries or commissions. Loss in unnecessary salaries and wages expenses can contribute to low level of productivity. This can be supported by the Production theory model (Cobb Douglas, 1928) which highlights that one worker can produce more output, employing two workers will produce little more output, and employing additional two workers result in the four workers producing less than what the three workers could produce, that is decreasing marginal utility. This is as a result of an increased number of workers sharing and competing on few available resources, for example A can produce 30units, A and B produce 50 units and A, B and C produce 60 units.

The agricultural sector can be lacking technological advancement. The large negative coefficient of labour can fully indicate that crop production is lacking improved technology in order to improve efficiency and effectiveness. It can be argued that labour in number of workers is tiresome as people need to rest and thus have got standard working hours, of which technology through equipment and machines can increase efficiency as they can operate 24hours, thereby improving on commercial farming of soya beans.

4.5.6. Rainfall (R)

The variable is not statistically significant in the model as the probability of 0.1587 is greater 0.05. Therefore, we fail to reject the null hypothesis that rainfall is not significant in the model.

4.6. Model conclusion

Looking at the regression results, it can be concluded that supplier development has effect on soya bean production. The results on the model shows that deliveries (Dv), land (Ln), and rainfall (R) have a positive relationship on soya bean production whereas capital (K) (-1) and labour (Lb) (-1) have a negative relationship on soya bean production, and therefore they need to be controlled for better, to avoid for worse.

4.7. Summary

This chapter looked at data presentation, analysis and interpretation. Included were the descriptive statistics, diagnostic tests and model estimation by regression analysis (OLS). The diagnostic tests included the multicollinearity, heteroskedasticity, autocorrelation, autocorrelation and stationary tests. Each variable was analysed and its coefficient was interpreted, and the results showed that deliveries, land have positive effect on soya bean production, whereas capital and labour have negative effect on soya bean production. The following chapter will focus on summary, conclusions and recommendations for further research in future.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The research seeks to investigate on the effect of supplier development on soya bean production at Grain Marketing Board. This chapter will look at the summary, conclusions and recommendations. This chapter provides the conclusions of the entire project on results from chapter four (IV) and major findings of the research. The chapter concluded by giving policy recommendations to the Grain Marketing Board that could be useful to the policy makers.

5.2. Summary

The major research objective was to investigate on the effect of supplier development on soya bean production. The research adopted the estimation model, the Ordinary Least Squares (OLS) model on land, labour, capital, seed, rainfall and fertilizer as independent variables and soya bean production as the dependent variable. The supplier development was measured using the soya bean deliveries to GMB, from farmers. The major findings indicated land, deliveries, have positive effect soya bean production, and capital and labour have negative effects on soya bean production. The study also showed that about 81.9% variations in soya bean production are explained by this model variables, and at least 18.1% of the variations are explained by other factors outside this model.

5.3. Conclusions

The main objective was to investigate on the effect of supplier development on soya bean production. The other research objectives whose findings in chapter four reviewed that:

There was a positive relationship between deliveries from farmers and soya bean production at GMB. This means that responsiveness of deliveries from farmers is very important to GMB as it shows commitment between both parties, and this was indicated by the coefficient value of 0.313549. Buyer-supplier commitment is important in supplier development as both parties' efforts and contributions are required for continuous improvement.

There was positive relationship between land and soya bean output. This means that enough land is required for improving the yield of soya bean crop. A land rich in fertile loam soil is required for improved soya bean output, though soya bean can adapt to many types of soil, with the exception of clay soil, in which it can hardly grow.

Labour has a negative effect on soya bean production, as shown by the results. In soya bean production, increasing the number of workers have a negative effect on production as workers will compete on few resources such as on the same piece of land, thus contributing to less productivity per every individual.

Capital investment had a negative relationship with soya bean production. It is of less importance to invest more on inputs only whereas there are other supportive measures lacking to the farmers such as site visits, training and monitoring farmers' progress. Therefore, due to the absence of training and monitoring, an increase in capital will contribute to a decrease in soya bean production, as capital can be increased but on the ground no action is being done by the farmers, thus no or less output is achieved. In the regression model, this variable of capital had a significant p-value of 0.0835.

The regression model is fit since it recorded R squared of 0.81905, which is above 0.5. This indicated that the variables explain the soya bean output at 81.9%. The model indicated also that the F-statistic p-value of 0.000847 shows that the model is correctly specified. The Durban-Watson statistic of 2.234959 showed that there is absence of autocorrelation in the model. There were variables capital and labour that were non-stationary when stationarity test under ADF was done at level, and where then, later stationary at 1st difference after conducting ADF 1st Difference test. It was also discovered that there was no heteroskedasticity in the model as the F static of 0.6181 is greater than 0.05.

5.4. Recommendations

According to the results of this study in chapter four, the Grain Marketing Board should improvise their supplier development schemes on soya bean production. The researcher finally recommends the Grain Marketing Board, and the government at large to engage and participate much in developing farmers in order to increase the soya bean production at a national level. The research recommends Grain Marketing Board since it is the country's Grain Strategic Reserve, to improve its supplier development policies on soya bean production, in order to continuously improve the output deliveries from farmers, which will then benefit the whole economy at large.

Private sector must participate in increasing the soya bean output. The Oil Expressers Association of Zimbabwe must contribute in strategic decision making with their industrial knowledge, supportive measures such as ensuring equipment is in place for farmers so that their processes can be 100% utilised due to increased soya bean output. Private sector intervention might be of help, since the players are more on profit maximisation, and therefore their experience and knowledge can be shared on increasing soya bean productivity.

It is of importance to note that an increase in number of workers does not guarantee increased productivity, as concluded by the study. Unnecessary increments in employing workers for the same piece of work or land can affect the soya bean crop in a negative way. The farmers should have a basis of employing workers for job which is standard, so that they can reduce idleness of workers in fields. This can be as a result of other works or processes being done mechanically, for example using combined harvesters when harvesting, using cultivators when cultivating the land or using tractors to dig/farm the land. These activities only require few people operating the machines and equipment. Therefore, Grain Marketing Board can increase awarding farmers with or providing loan schemes for acquiring such equipment as tractors and combined harvesters so that the farmers can reduce the number of workers on a piece of land. This can be the reason why the crop yield is falling, that in agricultural sector there is lack of use of technological advanced equipment in order to improve efficiency and effectiveness in the soya bean production.

Capital in this case is the value of seed, fertilizer and chemicals, is important in the soya bean production as concluded by the regression model which showed that it is significant in the model. However, caution should be taken when investing in the soya bean crop as according to the study, the relationship with soya bean production was negative. GMB should ensure proper management of funds in investing on the soya bean production, such as auditing the supplier development practises and funds, so that the negative relationship can be mitigated. Cases of fraud may be contributing to this negative relationship, that is, capital investments maybe increased but mismanagement of the funds or inputs might be taking place. Therefore, proper auditing and monitoring the supplier development schemes should be done so that increasing capital investment will yield a positive relationship to the soya bean production. In addition, GMB should also capitalise in farm equipment and offer affordable loan facilities to farmers for acquiring equipment, so as to support and contiuously improve on the soya bean production at commercial scale.

It might be of importance that the government should assist and support the increase in soya bean crop through land reform process, with the objective of provision of land strictly to the soya bean farmers on a large-scale commercial ground, as this can increase the crop's yield at nation level. This can be supported by the results of the estimation model that indicated that land has a positive relationship with the soya bean production. Therefore, many farm owners should be concerned on soya bean crop production at commercial level in order to work on meeting the nation's annual demand of soya bean crop which is approximately 300000tonnes, and thus can be achieved through support from the government. Therefore, effective policy measures should be put in place towards boosting the economy through reduction in soya bean imports.

5.5. Areas for further study

This study recommends that further researches to be conducted at provincial level in order to find the effects of supplier development on soya bean production in the particular provinces. The production or farming of soya bean can be affected by different factors and variables per each province in Zimbabwe, and this is of importance to research on.

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Appendix 1

Descriptive Statistics

Dependent Variable: P
Method: Least Squares
Date: 04/12/19 Time: 16:18
Sample: 2001 2017
Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48271.70	18619.23	2.592572	0.0250
DV	0.313549	0.161412	1.942538	0.0781
K	-0.011605	0.004496	-2.581237	0.0255
L	1.063656	0.440512	2.414589	0.0343
LB	-105.9641	57.44271	-1.844692	0.0922
R	3.765150	2.489762	1.512253	0.1587

R-squared	0.819051	Mean dependent var	68290.06
Adjusted R-squared	0.736801	S.D. dependent var	18219.26
S.E. of regression	9347.016	Akaike info criterion	21.39407
Sum squared resid	9.61E+08	Schwarz criterion	21.68814
Log likelihood	-175.8496	Hannan-Quinn criter.	21.42330
F-statistic	9.958092	Durbin-Watson stat	2.234959
Prob(F-statistic)	0.000847		

Appendix 2

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.173963	Prob. F(2,9)	0.3523
Obs*R-squared	3.517361	Prob. Chi-Square(2)	0.1723

Test Equation:
Dependent Variable: RESID
Method: Least Squares

Date: 04/12/19 Time: 16:03
Sample: 2001 2017
Included observations: 17
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-20352.67	22734.86	-0.895218	0.3940
DV	-0.026213	0.170541	-0.153707	0.8812
K	0.004356	0.005298	0.822170	0.4322
L	-0.121572	0.454465	-0.267505	0.7951
LB	68.85543	72.82941	0.945434	0.3691
R	1.663951	2.688906	0.618821	0.5514
RESID(-1)	-0.784271	0.517641	-1.515086	0.1641
RESID(-2)	-0.438999	0.426165	-1.030115	0.3298

R-squared	0.206904	Mean dependent var	1.82E-12
Adjusted R-squared	-0.409949	S.D. dependent var	7750.136

S.E. of regression	9202.611	Akaike info criterion	21.39755
Sum squared resid	7.62E+08	Schwarz criterion	21.78965
Log likelihood	-173.8792	Hannan-Quinn criter.	21.43653
F-statistic	0.335418	Durbin-Watson stat	1.398089
Prob(F-statistic)	0.918092		

Appendix 3

Correlation Matrix

	P	Dv	K	L	Lb	R
P	1.000000	0.802146	-0.375179	0.773952	0.150047	-0.321278
Dv	0.802146	1.000000	-0.203069	0.804420	0.187536	-0.471344
K	-0.375179	-0.203069	1.000000	-0.162363	-0.576595	0.212278
L	0.773952	0.804420	-0.162363	1.000000	0.274090	-0.520698
Lb	0.150047	0.187536	-0.576595	0.274090	1.000000	-0.102918
R	-0.321278	-0.471344	0.212278	-0.520698	-0.102918	1.000000

Appendix 4

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.173963	Prob. F(2,9)	0.3523
Obs*R-squared	3.517361	Prob. Chi-Square(2)	0.1723

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 04/12/19 Time: 16:03
Sample: 2001 2017
Included observations: 17
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-20352.67	22734.86	-0.895218	0.3940
DV	-0.026213	0.170541	-0.153707	0.8812
K	0.004356	0.005298	0.822170	0.4322
L	-0.121572	0.454465	-0.267505	0.7951
LB	68.85543	72.82941	0.945434	0.3691
R	1.663951	2.688906	0.618821	0.5514

Appendix 5

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.638869	Prob. F(5,11)	0.0836
Obs*R-squared	9.270921	Prob. Chi-Square(5)	0.0987
Scaled explained SS	2.902725	Prob. Chi-Square(5)	0.7150

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/12/19 Time: 15:53
Sample: 2001 2017
Included observations: 17
White-Hinkley (HC1) heteroskedasticity consistent standard errors and Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.45E+08	1.13E+08	-1.291918	0.2229
DV	-185.1108	722.3786	-0.256252	0.8025
K	-46.97304	28.14590	-1.668913	0.1233
L	2745.079	2186.929	1.255221	0.2354
LB	57456.34	288556.3	0.199117	0.8458
R	47783.82	18193.76	2.626384	0.0236

R-squared	0.545348	Mean dependent var	56531400
Adjusted R-squared	0.338688	S.D. dependent var	71263464
S.E. of regression	57952207	Akaike info criterion	38.85870
Sum squared resid	3.69E+16	Schwarz criterion	39.15278
Log likelihood	-324.2989	Hannan-Quinn criter.	38.88793
F-statistic	2.638869	Durbin-Watson stat	2.109566
Prob(F-statistic)	0.083550		

Appendix 6
Unit root tests

Null Hypothesis: P has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.798676	0.0126
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

Appendix 7

ADFtest at level

Null Hypothesis: Ln has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.618274	0.0178
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

Variable	Coefficient	Std. Error	t-Statistic	Prob.

Ln(-1)	-0.709075	0.195971	-3.618274	0.0028
C	13865.93	4795.893	2.891208	0.0118

R-squared	0.483241	Mean dependent var	-2181.250
Adjusted R-squared	0.446329	S.D. dependent var	9811.261
S.E. of regression	7300.467	Akaike info criterion	20.74573
Sum squared resid	7.46E+08	Schwarz criterion	20.84231
Log likelihood	-163.9659	Hannan-Quinn criter.	20.75068
F-statistic	13.09191	Durbin-Watson stat	2.487299
Prob(F-statistic)	0.002795		

Appendix 8

ADF test at level

Null Hypothesis: R has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.192803	0.0396
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

Appendix 9

ADF test at level

Null Hypothesis: Dv has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.841007	0.0116
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Dv(-1)	-0.973883	0.253549	-3.841007	0.0018
C	43367.80	13589.53	3.191265	0.0065

R-squared	0.513100	Mean dependent var	-2995.000
Adjusted R-squared	0.478321	S.D. dependent var	34575.89
S.E. of regression	24973.24	Akaike info criterion	23.20547
Sum squared resid	8.73E+09	Schwarz criterion	23.30204
Log likelihood	-183.6437	Hannan-Quinn criter.	23.21041
F-statistic	14.75334	Durbin-Watson stat	2.115861
Prob(F-statistic)	0.001799		

Appendix 10

ADF test at 1st Difference

Null Hypothesis: D(Lb) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.401625	0.0007
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Lb(-1))	-1.223435	0.226494	-5.401625	0.0001
C	-7.256326	7.959144	-0.911697	0.3785

R-squared	0.691779	Mean dependent var	4.733333
Adjusted R-squared	0.668070	S.D. dependent var	51.38158
S.E. of regression	29.60266	Akaike info criterion	9.737171
Sum squared resid	11392.13	Schwarz criterion	9.831578
Log likelihood	-71.02879	Hannan-Quinn criter.	9.736166
F-statistic	29.17756	Durbin-Watson stat	2.111566
Prob(F-statistic)	0.000121		

Appendix 11

ADF test at 1st Difference

Null Hypothesis: D(K) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.313318	0.0329
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(K(-1))	-0.893404	0.269640	-3.313318	0.0056
C	77273.56	107202.9	0.720816	0.4838

R-squared	0.457838	Mean dependent var	9443.200
Adjusted R-squared	0.416133	S.D. dependent var	533369.8
S.E. of regression	407554.1	Akaike info criterion	28.79730
Sum squared resid	2.16E+12	Schwarz criterion	28.89171
Log likelihood	-213.9798	Hannan-Quinn criter.	28.79630

F-statistic	10.97808	Durbin-Watson stat	1.702148
Prob(F-statistic)	0.005602		