

Exploring the potential influence of inventory forecasting on profitability

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ABSTRACT

The level of inventory can play a pivotal role in profitability (Simeon & John, 2018). Therefore, is the model used to do inventory forecasting with crucial in any business that carries inventory? Numerous forecasting models exist, but all are not appropriate to use in just any situation (Heizer *et al.*, 2016). This study investigated the ideal forecasting model to be used in the poultry industry, and more specifically, in a poultry abattoir in a rural area of the eastern Free State of South Africa.

The study investigated the different forecasting models to establish which of the models will best suit a rural poultry abattoir. The different forecasting models were compared to each other, and the different pros and cons were measured up against each other. Given the unique traits of a poultry abattoir and the specific demographic location of the company used during this study, and after a thorough literature study, the PROBABILISTIC MODEL was identified as the most applicable model to be used.

This identified model considers the uncertain and rather unpredictable variance in demand planning as well as the often-changing lead times. Although this model does have a disadvantage of being difficult to use, computer programs can and will make it a viable and feasible option.

The concepts of profitability and forecasting were also investigated and discussed during the literature study to create the necessary reference and understanding of the topic at hand.

To understand the variables that influence each other in terms of forecasting, inventory and profitability, it is crucial to understand the influence each has on the other (O'Neill & Sanni, 2018). To ensure that this study was more than just a theoretical exercise, interviews and discussions regarding this topic were done with some key decision-makers in the company as well as an industry expert. In total, the interviewees have more than 112 years of hands-on experience in the poultry industry. Some insightful inputs were gathered in this process.

The data from the interviews were analysed in Atlas.ti to establish which factors influence which. Network maps were drawn up to make this visual. Out of this analysis, it became clear that some factors do influence each other. The financial statements and figures were also analysed. Correlations and regressions were drawn from the data obtained. Causal relationships were established, and statistical significance determined.

Data from the interviews indicated that there are other factors than inventory levels that had an even bigger influence on profitability. This was confirmed by the financial statements and figures analysed. In the poultry industry, the influences of feed prices, chic prices and maize prices are so big that the influence of inventory levels is almost not a factor. In conclusion, it is recommended that this study be done on a company that has fewer other influences on profitability to truly establish the impact of inventory levels on a company.

KEYWORDS

Abattoir, Analysis, Availability, Correlation, Data, Factors, Feed, Forecasting, Interview, Inventory, Lead times, Maize, Manufacturing, Material, Out-of-stocks, Order, Overstock, Population, Poultry, Price, Procurement, Production, Profit, Profitability, Regression, Relationship, Reports, Sales, Stores and Volume

ABBREVIATIONS AND ACRONYMS

ARIMA	Autoregressive Integrated Moving Average
BDLM	Bayesian Dynamic Linear Model
EOQ	Economic Order Quantity
EPQ	Economic Production Quantity model
ES	Exponential Smoothing
FIFO	First In First Out
FMCG	Fast Moving Consumer Goods
GFC	Grain Field Chickens
CoGS	Cost of Goods Sold
JELS	Joint Economic Lot Sizing
JIT	Just-in-time
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percentage Error
NAV	Navision computer program
NSV	Net Sales Value
NWU	North-West University
PBIT	Profit Before Income Tax
ROP	Reorder Point
ROT	Reordering Tool
VKB	Vrystaat Koöperasie Beperk
WIP	Work in Progress

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CHAPTER 1: NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

Availability of raw material is imperative in any manufacturing environment (Kourentzes *et al.*, 2019). Purchasing of too much raw materials will take up unnecessary storage space and will cost money in the sense that capital is locked up and cannot be utilised in the day-to-day running of the business; while purchasing too little raw materials will cause out-of-stock situations and consequently force the manufacturing unit to bring production to a standstill (Yan *et al.*, 2019). Without production, no product to be sold will be produced and in the long run, the business will be closed (Arcelus *et al.*, 2018).

Therefore, there is a crucial balance between profitability and having just enough raw materials in storage, neither too much to have too much capital locked up, nor too little to run out of stock (Kho & Jeong, 2019). This study investigated the balance that is needed with regard to the optimal raw material to be in stock, and therefore the optimal influence that it will have on profitability.

Background on the facility studied: Grain Field Chickens (GFC) is a poultry abattoir, slaughtering broilers (chickens). GFC is part of the VKB (Vrystaat Koöperasie Beperk) group of companies and situated in the eastern Free State of South Africa. GFC is slaughtering, processing, cooling, packing, storing and distributing products to the national market. GFC is packing numerous poultry products: from fresh products in trays, to frozen products in bags to very specific quick service restaurants products. All these products use different packaging material with different specifications.

1.2 PROBLEM STATEMENT

The problem that this study addresses is that of bad/inaccurate inventory forecasting, resulting in a negative impact on profitability (Zaitseva *et al.*, 2018):

- *Out-of-stock* situations, leading to missed sales opportunities, inefficiencies on the production floor due to stop-start operations, and frustration/conflict between different departments in the workplace.
- *Overstock* situations, which lead to unneeded inventory that needs to be financed, controlled, and stored, and that needs to be accounted for. This can lead to losses in the sense of write-offs when an item is expired or no longer needed/used.

The core research question was (Arcelus *et al.*, 2018): How can raw material inventory forecasting be done consistently and effectively/accurately in a fast-moving consumer goods business, to maximise profitability?

1.3 OBJECTIVES OF THE STUDY

The objective of this research was to investigate and identify different ways in which raw material inventory forecasting could have been done and what impact each had on profitability (Oberoi, 2017).

Different raw material forecasting models (Kourentzes *et al.*, 2019) and techniques were used, and different models were weighed up against each other to determine their practicality in a fast-moving consumer goods (FMCG) industry, to determine which of them would have the highest impact on profitability.

Research questions that are answered in this study:

- What are the general raw material inventory forecasting tools currently in use in the selected company?
- Which raw material inventory forecasting tool best suits the fast-moving consumer goods industry, and more specifically, a poultry abattoir?
- Why does the identified raw material inventory forecasting tool work best in the poultry abattoir industry and more specifically, Grain Field Chickens?
- What are the pros and cons of each raw material inventory forecasting tool that was identified/discussed in this study?
- What is the potential influence that different inventory forecasting models can have on profitability?
- Is Grain Field Chickens utilising inventory forecasting effectively to maximise profitability?

1.4 SCOPE OF THE STUDY

The scope of this study was raw material forecasting in the FMCG industry. To be more specific, the study was done using a poultry abattoir that is manufacturing frozen and fresh poultry products.

What was included in this study?

- Packaging material used in the frozen product range
- Packaging material used in the fresh product range
- Engineering/maintenance stores
- Ingredients used in the manufacturing process (brine powder for frozen products)
- The financial impact that the different forecasting models had on this abattoir
- Other factors in the poultry industry that influence profitability

What were excluded from this study?

- Live broilers (chickens) that were planned for slaughtering
- Any other part or raw material not mentioned above as part of this study
- Financial analysis of the business in totality

1.5 RESEARCH METHODOLOGY

1.5.1 INTRODUCTION

This study was done on the grounds of technical analysis of the relationship between different forecasting models and profitability in a poultry abattoir in a rather rural area of South Africa. Validity was addressed by making use of interviews with key role players in the organisation, and comparing that with the results obtained from the study.

The researcher used a variety of academic records and literature in fields where similarities could have been established. This study mainly used a quantitative research approach as the emphasis was on the collection and analysis of data, and the natural sciences were used as well as a positivist approach (Bryman, 2014). Numerical and statistical data were collected from the chosen business within the fast-moving consumer goods industry to identify opportunities for improvement. Inventory levels were measured as well as stock days kept. Furthermore, quantitative research was conclusive, and this was used to quantify the problems and opportunities; this produced comparisons of different forecasting options.

Individual discussions with key role players and decision-makers also took place for recommendation and conclusion purposes. These interviews were the qualitative part of this study.

The following methods were used to conduct statistical analyses, to name but a few (Barrow *et al.*, 2018):

- Median
- Mean
- Standard deviation
- Correlations
- Linear regression
- Chi square
- Cramer's V

The mean is a simple measure to describe the norm stock and growth rates of the business. Furthermore, standard deviations give scientific information in variations from the norm. Numerous statistical formulas were used in the data analysis.

1.5.2 OVERALL RESEARCH DESIGN

The research starts with a literature review, followed by interviews with the relevant personnel. During this interview, lists with predetermined questions were asked and participants were elicited on the relationship between the variables being researched, and this was used for qualitative data analysis. Furthermore, during these interviews, relevant data were obtained.

This data included, among others:

- Financial reports and figures
- Inventory stock counts/levels
- General information regarding inventory order cycles and methods in use

The different forecasting models were applied to the quantitative data collected. The data collected were then analysed. During this process, the best-suited method for this type of industry was identified. The quantitative and qualitative data were integrated to establish support for each other.

1.5.3 STUDY POPULATION

The study population (unit of analysis/sampling) consisted of the following:

- Individuals
 - Managing director: He was relevant to the study as he gave approval for the study and confirmed the accuracy of the findings of the research.
 - Financial manager: He was relevant to the study as his inputs on the financial importance and the effect that the forecasting models had on the profitability were important/substantial.
 - Procurement manager: He was relevant to the study as he adjusted his forecasting models as needed/requested to gather the relevant outcomes of the different forecasting models on profitability.
- Organisation
 - The organisation used in the study is Grain Field Chickens (GFC). GFC is a poultry abattoir, situated in Reitz in the eastern Free State of South Africa. GFC is part of the VKB Group. GFC slaughters $\pm 180,000$ broilers per day over a five-day week. GFC is in a rural area, making just-in-time (JIT) deliveries difficult to achieve as it is not on a major route or near any big distribution depots. The result is the necessity of carrying enough inventory to cover extended lead times, minimum batch runs required by suppliers and deliveries that are unpredictable/unreliable with regard to on-time delivery. GFC employs $\pm 1\,700$ personnel, mostly from the direct community. 90% of the workforce is female. Literacy in the rural area is a challenge and most of the people working with the inventory do not have tertiary qualifications. Most of the people on site also have very limited skills regarding computer systems. The personnel working directly with the inventory forecasting have computer skills that range from skilled to limited, and the result is that difficult statistical methods will not be able to be utilised effectively and to its full potential.
- Systems and programs
 - The system that GFC is using for ordering stock is called Navision (NAV). This is an accounting system that is used to do all ordering, stock holding, invoicing etc. NAV does not have the functionality to do proper stock control and inventory management. With regard to inventory, NAV is merely a system that shows the quantity of stock with rand values.
 - Forecasting programs that are used at the moment are restricted to Microsoft Excel. A spreadsheet was developed to manage the re-ordering quantities – called the “re-ordering tool” (ROT). The outcome of this ROT is solely reliant on the inputs

that are given to it. If the wrong data are put into it, then wrong re-order quantities will be predicted. Some work has been done on this ROT in the past, but further fine-tuning still needs to happen as some out-of-stock situations still occur from time to time.

- Financial reports
 - The finance department sends out financial reports on a monthly basis. These include income statements, balance sheet statements etc. Expense management is a continuous focus point as GFC is in a low margin/high volume industry. Official physical stock counts are done twice a year, but for ordering purposes, some line items are counted at least weekly.

1.5.4 DATA COLLECTION

As per the literature (Calkins, 2015), data are seen as facts or figures, be it in the form of numeric or non-numeric, which a person can use to reach a conclusion. The nature of this can be or quantitative or qualitative. Quantitative data represent counts in discrete or continuous form. Discrete data are seen as data that are numeric with a finite number of possible values. The level of measurements or analysis that were done were seen as direct interval measurements. *The nature of the data that were collected for this study was the following:*

- Interviews: An unstructured interview style was used and the questioning style was informal (Bryman, 2014), and different questions were asked for different individuals, depending on what is relevant for that specific person. Furthermore, a general interview guide was used, allowing the interviewee the freedom to answer questions as they think, but these questions were strictly relevant to the subject and reflected the researcher's concerns.
- Financial reports: Financial reports and data were studied to establish the impact of
 - out-of-stock situations on profitability
 - overstock situations on profitability
 - the lowest level of inventory (without going out-of-stock) on profitability
 - the raw material inventory level over time
 - factors that influenced the raw material inventory level over time
 - the cost of capital expenditure to automate the raw material forecasting and handling system on profitability – the payback period

The data collected were analysed and conclusions were drawn.

1.5.5 DATA ANALYSIS

Bryman (2014) makes it clear that certain pitfalls are worth avoiding. The statistical analysing techniques were kept in mind from early on to gather the correct kinds of data, and to use the correct sample size.

Given the accessibility of the study units, the reports that were analysed, the questions that were asked in the interviews and types of calculations that were done, missing data were not an issue.

The data analysis technique that was used in this study is that of contingency tables. The contingency tables are very flexible and were able to effectively analyse the relationship between variables. Percentages could have been included and used effectively (Bryman, 2014). Furthermore, the Cramer's V and chi-square tests were used to establish how strong the relationship or association between variables were.

The relationships that were used in different combinations were:

- Profitability vs store R-value
- Profitability vs out-of-stocks
- Store R-value vs out-of-stocks
- Margin lost vs quantity of items out-of-stock
- Turnover lost vs quantity of items out-of-stock

Different raw material forecasting models were tested, and the results were analysed and tested. Calculations were made using the different forecasting models to predict different outcomes and the impact it had on profitability. This technique was combined with multivariate analysis technique to establish whether there was a mutual relationship between three or more variables, as Bryman (2014) put it. *Statistical terms that were used during the data analysis:*

- Mode: Defined as the data element that occurs the most recurrently in the data.
- Midrange: This is the arrhythmic mean of the lowest and the highest measurements.
- Arrhythmic mean: This is the average.
- Median: This is the middle element when data are set in order of scale ascending or descending.
- Standard deviation: This refers to the standard distance that each element in the set of data is from the mean.
- Measures of dispersion: This refers to the data's variability.

The interviews that were done, helped to draw conclusions and recommendations.

Software programs that were used in this study were:

- Microsoft Excel
- Navision Data capturing system
- Atlas.ti

1.6 LAYOUT OF THE STUDY

Chapter 1: Nature and scope

This chapter describes the nature and the scope of the study that was done and why this topic was chosen. A brief introduction was given, and the problem statement was made. This was followed by the objectives of the study and a discussion of what the scope covers. The research methodology was then discussed in some detail.

Chapter 2: Literature review

This chapter aims to evaluate relevant and related concepts to forecasting models and the impact it has on profitability. Different forecasting models are discussed in some detail as well as how they influence profitability. Current forecasting methods in use were also discussed.

Chapter 3: Data gathering and analysis

This chapter focuses on the gathering of all the data, using the interview questionnaires and gathering all the financial reports and data needed for the study.

Chapter 4: Empirical research

This chapter focuses on the results that were obtained by this study via the interviews and analysing the financial reports and figures. These are analysed and interpreted in this chapter. In this chapter, the questionnaire questions are also discussed.

Chapter 5: Research findings and recommendations

This chapter focuses on the results of the analysis of all the data and these are discussed and deliberated on. Recommendations and conclusions are made regarding the impact of the different forecasting models on profitability as well as other factors that came to light. Future research suggestions that can be done in this research field are also made.

1.7 SUMMARY OF CHAPTER 1

Raw materials are needed for manufacturing. The levels of raw material kept in inventory have a direct effect on profitability, and furthermore, it can also result in an over- or understocked situation if not managed correctly and efficiently. There is a fine balance between having just enough raw material to the point of not running out-of-stock and on the other hand, having too much raw material that results in unnecessary storage and capital expenditure.

Clear objectives were set to establish the impact of different forecasting models on profitability, as different scenarios should yield different results. Research questions to be answered by this study were set, and the ultimate question to be answered is: "What impact does an effective raw material forecasting model have on profitability?".

The scope and methodology of the research are discussed in some detail and the layout of the study is also provided.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The objective of this literature review is to investigate the different types of inventory forecasting models that can be used in the fast-moving consumer goods (FMCG) manufacturing environment and the impact of those models on a company's profitability.

Relevant terms are defined in order to create a mutual understanding of words and terms. These included words and concepts such as forecasting, inventory, profitability, profit and forecasting model. This is followed by a detailed analysis and discussion of the applicable/chosen forecasting models and how they work. The advantages and disadvantages of this specific environment are discussed and analysed. The way in which profitability is measured is discussed, as well as the impact of the application of these models on profitability.

Academic literature from well-established and trusted scientific sources is used to ensure the information given in the literature review is correct and relevant.

2.2 DEFINING FORECASTING

Forecasting can be defined as the science that enables you to predict future events and outcomes (Heizer *et al.*, 2016). Forecasting can be found and applied in different forms (Heizer *et al.*, 2016):

- *Mathematical models* that use past events or results and then project it into expected future outcomes – these are also called quantitative forecasts and are based on historical data.
- *Intuitive predictions*, which are greatly subjective, where an individual with certain experience will make predictive statements, for example where a sales manager predicts that the sales of a certain product will increase with 10 to 15% for a specific period, given certain market conditions or some privileged information regarding customer plans. This form of forecasting depends greatly on assumptions, emotions, intuitions and personal experience – these are also called qualitative forecasts.
- Sometimes, *forecasts* can be a combination of the above-mentioned forms. Experience and knowledge as well as assumptions in a specific environment in which a person

operates do play a crucial part in this and a combination of these two methods normally yields the best results.

One forecasting technique is not superior to another (Heizer *et al.*, 2016), but circumstances of situations and/or operations do differ. Therefore, one forecasting technique will not necessarily fit all situations as there are numerous factors that influence forecasts (Alencar *et al.*, 2017). Some products are complementary to the sale of other products, which can be used in making forecasts (Rohde & Seal, 2018). The position of a product in the product lifecycle can be kept in mind when making a forecast (Estep, 2016).

In the end, a forecast is exactly just that, a forecast. It will often not be 100% accurate, in fact, more often than not, it will not be 100% accurate, but the more accurate it becomes, the better planning can be done for future actions (Prak & Teunter, 2019).

2.3 DEFINING INVENTORY

Inventory can be defined as a complete list of goods, and can include items such as property, contents of a building or goods in stock (Dictionary, 2018). For the purpose of this study, inventory was the line of goods of stock, and more specifically, finished goods, ready to be sold to a customer; work in progress, such as products that are not yet ready to be sold (WIP: work in progress); dry/raw material, used in the process; and maintenance spare parts, items used to fix breakdowns and/or to service equipment (via scheduled or preventative maintenance plan). More focus was on the dry/raw materials such as packaging material (all different types from primary packaging, secondary packaging and tertiary packaging materials), dry ingredients (such as brine powder) and wooden pallets.

Maximising a company's profit is the main goal of any corporate business. Many aspects influence the margin of profit and one of the things that can influence this profit margin the most is the level of inventory kept (Sritharan, 2019). There are different inventory valuation methods in use, which will influence the profitability figures (Simeon & John, 2018). Inventory management has a significant impact on the profitability measures of gross profit margins (Sritharan, 2019). Inventory management is a fine balance between inventory investment and customer service (Heizer *et al.*, 2016).

The trade-off between the level of inventory kept and customer service is well known (Syntetos *et al.*, 2015). A well-designed inventory control and forecasting system is critical to the success of a business (O'Neill & Sanni, 2018), especially in the FMCG industry.

The complexity of the supply chain needs to be kept in mind when choosing a forecasting system, as a more complex supply chain will require a more advanced method to schedule inventories (Valencia-Cárdenas *et al.*, 2016), especially when it is used to forecast a multitude of raw materials, sourced from a variety of suppliers through multiple channels, used in different products with ever-changing customer demands.

2.4 DEFINING PROFITABILITY AND PROFIT

Profitability is defined as “The degree to which a business or activity, yields profit or financial gain” (Dictionary, 2018). Further to this, profit can be defined as the excess of income over cost and expenses, where income is the value of sales of goods or services produced by the business, and expenses are the costs involved. Examples of these costs are purchasing of raw materials, as well as manufacturing or providing those goods or services. Expenses will also include marketing and selling, production, distribution and storage, human resources, IT, financing, administration and management costs involved in operating the business (Janse van Rensburg *et al.*, 2015). The cost associated with inventory management is really part of cost (cost of sales), although some of these costs appear on the income statement as expenses. Purchasing too much raw materials will take up a great deal of storage space and will cost money in the sense of capital that is locked up and cannot be utilised in the day-to-day running of the business. Purchasing too little raw material is likely to result in out-of-stock situations and consequently force production to a standstill. Without production, no product will be manufactured and there will be no final product available to be sold (O'Neill & Sanni, 2018).

There is therefore a crucial balance between profitability and having just enough raw materials in storage, not too much to have a great deal of capital locked up; not too little to run out-of-stock (Cárdenas *et al.*, 2015). This study investigates the balance between the optimal raw material level in stock, by testing different forecasting models, and the influence that it has on profitability.

In terms of this study, profit was looked at to be maximised by (Alfares, 2015):

- Lowering inventory levels, resulting in:
 - less capital needed to keep stocks and goods
 - less interest payable on loans – financing cost reduction
 - less storage space needed to keep the inventory stored
 - less inventory losses (write-offs) due to lower levels of stock
 - easier to control, enabling an effective FIFO (first-in-first-out) system, resulting in fewer losses in terms of expired stock (where applicable)
- Maximising sales (and more specific profit margins) by
 - inventory availability – enabling the sales team to capitalise on sales opportunities when presented with one
 - enabling the sales team to maximise on profit margin because of product availability on very short notice
 - The main goal is to maximise the profit by lowering/minimising the inventory and maximising sales (profit margin). The larger the profit the bigger the indication that the business is becoming efficient and profitable (Guarino, 2018). It is also a good idea to analyse the inventory turnover in terms of (or compared to) the profit made (Hazriyanto *et al.*, 2015).

2.5 DEFINING A FORECASTING MODEL

A forecasting model in terms of inventory is a program or system or way in which a prediction for the future use/need for raw material can be made (Kourentzes *et al.*, 2019). Inventory forecasting models, to a great degree, rely on future demand or usage that is known and/or relatively accurate, which is often not the case (Kourentzes *et al.*, 2019). Good forecasts will ensure an efficient manufacturing operation (Heizer *et al.*, 2016). Numerous inventory forecasting models exist (Valencia-Cárdenas *et al.*, 2016) (Zaitseva, 2017) (Heizer *et al.*, 2016) (Alevizakou & Pantazis, 2017) (Cárdenas *et al.*, 2015) (Boluki *et al.*, 2017) (Khalilpourazari & Pasandideh, 2018) (Naniek *et al.*, 2017) (Duari & Chakrabarti, 2017) (Wijaya, 2017) (Gharaei *et al.*, 2019) (Glock, 2012) (Buergin *et al.*, 2018) (García *et al.*, 2017):

Not all these models are discussed and analysed or used in this study, as all models are not necessarily applicable in the environment where this study was conducted.

- Autoregressive integrated moving average (ARIMA)
 - Description:
 - This model makes predictions based on historical data
 - Advantage:
 - This model can be fitted to almost any time series, if enough elements are averaged and regressed.
 - Disadvantage:
 - This model is computationally expensive, and it is difficult to understand.
 - This model is 'backward looking'
 - Used or excluded in this study, and why?
 - Excluded, due to the difficulty level of this model with relation to the level of the GFC personnel that need to work with it.

- Exponential smoothing (ES)
 - Description:
 - This model calculates forecasts with importance weights exponentially decreasing the further into the past the observation moves
 - Advantage:
 - Suited well for one-step-ahead forecasting
 - This model is simple to understand
 - Disadvantage:
 - This model ignores complex relationships in data
 - Only suitable if there is no seasonality in the dataset
 - More suitable for no-trend series
 - Dependent on a single parameter and is only appropriate for stationary series.
 - Used or excluded in this study, and why?
 - Excluded, as the data used by GFC have more than one parameter.

- Bayesian dynamic linear model (BDLM)
 - Description:
 - This method is used for time series data analysis and short-term forecasting.
 - Advantage:
 - This model can predict values and inventory cost at the same time
 - Disadvantage:

- This model is computationally expensive, and it is difficult to understand.
 - This model requires advanced algorithms to be developed.
- Used or excluded in this study, and why?
 - Excluded, due to the difficulty level of this model with relation to the level of the GFC personnel that need to work with it.
- Economic order quantity (EOQ)
 - Description:
 - This model calculates the number of units the system should add to the inventory with each order processed
 - Advantage:
 - This model can practically be used for backordering
 - This model can handle different operational constraints
 - Disadvantage:
 - This model does make use of complex nonlinear calculations, which may be difficult to understand and apply by the user.
 - Used or excluded in this study, and why?
 - This model was used in this study, as this is a typical model used to forecast and order raw material within the manufacturing environment.
- Economic production quantity model (EPQ)
 - Description:
 - This model determines the quantity needed to be ordered to minimise the total inventory cost by balancing the inventory storage cost and the average fixed ordering cost.
 - Advantage:
 - This model is relatively simple to understand
 - This model makes use of relatively fewer and simple calculations
 - Disadvantage:
 - This model does not take into account reworking of products that might be defective and do not conform to standards
 - Used or excluded in this study, and why?
 - This model is often used in the manufacturing environment to minimise inventory and to determine optimal lot size.
 - This model was used in this study.

- Joint economic lot sizing (JELS)
 - Description:
 - This model is based on a jointly coordinated buyer-seller inventory strategy that is more beneficial to the organisation as it ensures cost minimisation.
 - Advantage:
 - This model considers raw material replenishment and is a multi-product.
 - This model takes into consideration real-world issues such as economic lot-size limitations, ordering, space limitations and procurement costs.
 - Disadvantage:
 - This model seeks the ultimate order quantity between the customer and the supplier. If the demand and supply are not equal, which most of the times they are not, one of the two parties will have a disadvantage and the other will minimise its total relevant costs.
 - Used or excluded in this study, and why?
 - This model was excluded from this study as establishing a working relation with current suppliers in this regard fell outside of the timeframe for this study.

- Just-in-time (JIT)
 - Description:
 - This system orders inventory in such a way that it arrives at the processing plant just in time for usage. This system minimises storage cost as almost no inventory is kept.
 - Advantage:
 - No storage is needed for inventory items, as it will be used as it is delivered.
 - The firm will make more money in the long term if it can get this to work correctly.
 - Disadvantage:
 - If the ordered inventory is not delivered just when needed, the total manufacturing unit comes to a standstill because of the lack of raw material.
 - Big losses may result if the total manufacturing line comes to a standstill.
 - Reliable transport, distribution and deliveries are of the utmost importance, which is a general problem in South Africa.
 - Used or excluded in this study, and why?
 - This model was used in this study as this is an ideal system to maximise profit, although in South Africa, with the conditions of the roads and reliability of transport, it might not be viable.

- Production order quantity model
 - Description:
 - This model orders just enough inventory to complete a set order.
 - Advantage:
 - This model is good to use where and when there is a constant movement in inventory.
 - This model is also good to use when raw materials are received while finished products are been sold.
 - Disadvantage:
 - This model does not consider reworking of products that might be defective and do not conform to standards
 - Used or excluded in this study, and why?
 - This model was used in this study as this model is especially suitable to be used in a manufacturing environment.

- Quantity discount model
 - Description:
 - With this model, the basis is that inventory will be purchased at a lower price as and when more is purchased – lowering unit costs.
 - Advantage:
 - This model works on the basis that the more you purchase, the more you save, in the sense that the unit price becomes lower the more units you purchase.
 - Disadvantage:
 - Although many suppliers will give discount on price when larger quantities are purchased, not all suppliers do.
 - Used or excluded in this study, and why?
 - This model is excluded from this study, as price negotiations do not form part of this study.

- Probabilistic model
 - Description:
 - This model is based on the probability assumption that a certain item might be needed and then forecasted accordingly.
 - Advantage:
 - This model is used where the demand for a product is not known.
 - This model is ideal to use when lead times are not always constant.

- Disadvantage:
 - This model is based on calculations of probability distribution, which may be difficult for some people to do
- Used or excluded in this study, and why?
 - This model was used in this study as this is a great model to use in the real world of manufacturing, where factors change continuously.
- Single-period model
 - Description:
 - This model is forecasting inventory for a single period of use only.
 - Advantage:
 - This model is used when a specific manufacturing run needs to be done in a very specific period.
 - Disadvantage:
 - After the production run and/or after the sales period is over, the raw material has very little if any value
 - Used or excluded in this study, and why?
 - This model was not used in this study, as the study was done in a manufacturing environment where sales and manufacturing continue for a long time without the period being over.
- Fixed-period model
 - Description:
 - This model is only used at the end of a specific period and also then to just top up inventory to a predetermined level
 - Advantage:
 - Continuous inventory monitoring is not needed when this model is used as an order is only placed at the end of a specific, predetermined fixed period.
 - Disadvantage:
 - The order quantity is not always the same and out-of-stock situations might occur as stock is only counted after a fixed period.
 - Used or excluded in this study, and why?
 - This model was used in this study, as some items in the organisation are ordered based on this model.

2.6 DETAILED DISCUSSION OF FORECASTING

Great emphasis can be placed on choosing the correct forecasting model in the quest to achieve a reliable forecast (Alencar *et al.*, 2017).

Ultimately, an inventory forecasting model needs to answer two questions (Heizer *et al.*, 2016):

- When to order
- How much to order

According to Alencar *et al.* (2017), there are four main factors to consider when choosing a forecasting model:

- The data availability
 - When an order needs to be made and a forecasting model is used, the data need to be available to be able to do the needed calculations.
- The characteristics of the data that are available
 - Data normally are of numeric nature, such as stock counts, in terms of figures. If the stock count only indicates “too little” or “too much”, nobody will know how much to order of the item.
- The types of data that are available
 - The types of data refer to how the data were compiled. Was it a physical count or maybe a mathematical calculation or even just a guess?
- The frequency of forecasts that are required for a specific project.
 - The frequency will determine how often a forecast needs to be done, depending on the lead time, the movement rate of the inventory, storage space and shelf life of the item.

2.6.1 Forecasting factors

Forecasting can be classified in terms of future time horizons. In general, these time horizons can be in three categories (Heizer *et al.*, 2016; Reindl *et al.*, 2017):

- Short-range forecast: This type of forecast is suitable for forecasts that go up to one year, but normally it is used for periods of less than three months. It is suitable and used for planning production levels, job assignments, job scheduling, workforce levels and purchasing planning.

- Medium-range forecast: Also called intermediate forecast, has a general time span from three months to as much as three years. This is suitable and used for production planning and budgeting, analysis of various operating plans, cash budgeting and sales planning.
- Long-range forecast: This type of forecast is normally used for periods of more than three years. This is suitable and used for capital expenditure, new products, facility location or expansion planning as well as in research and development.

Features and characteristics that differ regarding medium- and long-range forecasts versus short-range forecasts, are as follows (Saurabh, 2018):

- *Long-range and intermediate* forecasts are more used for forecasts that have to do with comprehensive issues that will support management decisions with regard to aspects such as planning and developing new products, processes and plant layouts or even new facilities.
- *Short-range forecasts* use different methodologies. Mathematical techniques such as exponential smoothing, moving averages and trend extrapolation are commonly used in this type of forecast.
- Lastly, *short-range forecasts* are likely to be more accurate. The forecasting accuracy does deteriorate over time as the factors that influence demand change over time. Forecasts, therefore, need to be updated regularly to maintain an accurate reflection of what happens.

Seven general steps are normally found in a forecasting systems (Yang & Zhang, 2019). These seven steps give a systematic way to initiate, design and implement a forecasting model and system:

- Determining the use. This will define what the forecast will be used for.
- Selection of the items that need to be forecasted.
- Selection of the time horizon, as discussed above.
- Determining which forecasting model to be used.
- Gathering all the data that will be used in the forecasting model
- Making the forecast using the forecasting model
- Validating and implementing the results/outcomes of the forecasting model.

Further to the above, more factors also need to be considered in a continuous manufacturing environment, such as (Estep, 2016):

- Lead time

- Forecast error distribution
- Product cost
- Replenishment frequencies
- Service targets
- Supplier lead time variability
- Minimum order quantities

Most forecasting tools only consider about half of these. The fewer factors considered, the more inaccurate the forecast will be. Further to this, one should also keep in mind the optimisation of raw material inventory in order to prevent environmental pollution, as more and more pressure comes from that arena in the modern era (Khatua & Maity, 2016). When doing the calculations in forecasts, the ideal will be to make it as automatic/electronic as possible to limit human intervention and effort (Alencar *et al.*, 2017). Based on these factors, numerous forecasting models were excluded from discussion and analysis for this study.

2.6.2 Forecasting models

Only the selected forecasting models were used in this study for the following reasons: Grain Field Chickens is a poultry abattoir in a rural area. Most workers are from the local community and do not have tertiary qualifications. Although most do have a matric certificate, mathematical skills are very low.

As most of the forecasting models are mainly based on statistical methods and some even quite difficult to understand statistics, the below mentioned models were used as these are the ones that the people in employment of GFC will be able to apply in their work environment.

2.6.2.1 FORECASTING ERROR

Before the forecasting models themselves are discussed, the principle of forecasting error first needs to be established. The importance for a company to determine the forecasting error is to enable the decision-makers in the company to adopt a culture of accuracy. The forecasting error shows how accurately a forecast was. This is done by using different statistical methods, such as: mean absolute deviation (MAD), mean absolute percentage error (MAPE), mean squared error (Jochemsen-van der Leeuw *et al.*, 2015), root mean squared error (RMSE) and mean squared error (Jochemsen-van der Leeuw *et al.*, 2015; Khair *et al.*, 2017) (Saurabh, 2018) (Sen & Chaudhuri, 2017). There is no single best accuracy measure (Chen *et al.*, 2017), and some of the above-mentioned were used in this study to determine the accuracy of the model applied.

2.6.2.2 ECONOMIC ORDER QUANTITY (EOQ) MODEL

The EOQ model is commonly used and is based on the following assumptions (Heizer *et al.*, 2016):

- The demand is known, constant and it is independent of other items' demands
- The lead time on orders is known and constant
- Inventory deliveries/orders arrive in full (no backorders) and at one time.
- No quantity discounts are applicable
- Out-of-stock situations (or stock-outs) are 100% avoidable if the stock is ordered at the correct time

Because the demand is constant, the level of the inventory will uniformly deteriorate until such time that the item needs to be ordered again (Valencia-Cárdenas *et al.*, 2016). Ultimately, an inventory model should minimise the total cost. The main cost contributors in terms of inventory are the setup cost, the holding costs and the cost of the inventory itself. If any of these three costs can be minimised, the total cost will be lowered. The optimal order size can be utilised to minimise total cost. The total number of orders placed will decrease as the order size increases, which might lead to a cost-saving in terms of 'order placing costs', but it can also lead to an additional cost in the sense of additional storage cost and capital cost.

To reach the optimal order size, one should determine the quantity that will minimise the total cost – this will be at the point where the total holding cost is equal the total setup cost (Mishra & Shaikh, 2017).

The quantity to be ordered is the other major consideration (Shenoy & Zhao, 2019). Simple inventory forecasting models assume that stock is immediately available when the order was placed; most of the time, this is not the case (Bottani *et al.*, 2017). Most of the time, there is a lead time involved. The lead time is the time between the moment the order was placed and the time the stock is delivered. Lead times can vary vastly, as some can be as short as a few hours, while others will be weeks or even months. This needs to be taken into consideration when determining how much of an item needs to be ordered. The inventory level where an order should be placed is called the reorder point (DiPietro *et al.*).

The ROP considers the demand or usage of the item as well as the lead time. When demand and lead times are not constant, it will be necessary to keep some safety stock (this is extra stock that is kept as a back-up in case the demand fluctuates or in case the lead time changes due to postponed deliveries). The ROP is normally used in conjunction with a fixed-quantity system. In practice, this will result in the same order quantity for an item every time it is

ordered. In this system, it is of utmost importance that inventory levels are constantly monitored, to determine whether the ROP has been reached yet. This is done using a perpetual inventory system. A perpetual inventory system is normally electronic and it continually keeps track of each transaction/change in the inventory level – records are therefore always current (Zaitseva, 2017).

2.6.2.3 PRODUCTION ORDER QUANTITY MODEL

This model is utilised when an order is not delivered all at once but over a period. This type of model is used when (Vaz & Mansori, 2017):

- inventory continuously builds up over time, or
- production is running, and sales are made at the same time.

Daily production rate and inventory demand rates are then considered. This model is ideal for production environments and therefore the name PRODUCTION ORDER QUANTITY MODEL. In this model, most of the traditional assumptions of an EOQ model are still valid and used, as discussed above, in the previous section – therefore it will not be repeated here.

2.6.2.4 PROBABILISTIC MODEL

This model is utilised when the demand for an item is not constant or certain, but it can be determined by the probability distribution. The ultimate goal of inventory management is to ensure adequate service levels under uncertain demand and supply circumstances. The more demand and supply become uncertain (fluctuating), the greater the possibility of an out-of-stock situation – keeping additional stock reduces the risk (safety stock). The level of safety stock to be kept will greatly depend on the cost of an out-of-stock situation versus the cost of holding the additional inventory (Mitra, 2017). In this model, most of the traditional assumptions of an EOQ model are still valid and used, as discussed above, in the previous section – therefore it will not be repeated here.

2.6.2.5 FIXED-PERIOD SYSTEM

In a fixed-period system, the principle of ROP is not used. In this system, the level of inventory is only checked (counted) at the end of a specific period and then normally ordered up to a predetermined quantity/level, taking lead times and safety stock levels into account. Fixed-period systems utilised several of the assumptions as in the EOQ model, for example:

- Relevant costs are only holding- and ordering costs.
- Lead times are known and constant.
- Items are not dependent on each other.

In general, orders are placed in predetermined frequencies and times. This may save delivery costs, as a load may be utilised to the full. The disadvantage of this type of system is that inventory levels are not reviewed during the period and if a sudden demand depletes the inventory, it will lead to out-of-stock situations, until the time of the next order. To counter this, high levels of safety stock need to be kept, which will come at a cost (Singhvi *et al.*, 2017).

2.6.2.6 JUST-IN-TIME INVENTORY SYSTEM

The just-in-time (JIT) inventory system works on the principle that the inventory is delivered just before it is needed in the manufacturing process. The biggest advantage is that very little to no inventory has to be carried as stock and there will consequently be very little to no storage or holding cost involved (Zaitseva, 2017). Proper purchasing agreements with suppliers must be set up to ensure frequent and small deliveries are done, reducing response time from suppliers to a minimum. In principle, the reduction in total inventory cost will be achieved when using a JIT system (O'Neill & Sanni, 2018).

In this study, only mathematical calculations will be done as the practical implementation thereof is not possible for the following reasons:

- Reitz, where this study was conducted, is situated in the rural area of the eastern Free State of South Africa.
- No supplier is close by to do small and quick deliveries.
- The local/provincial roads are not in good condition, often resulting in vehicle damage and breakdowns of delivery vehicles.
- The local distribution network of trucks is not trustworthy and more often than not, do not keep to delivery slot times.
- Bringing production to a standstill, because of raw material out-of-stock situation, has an enormous financial implication.
- Unreliability of suppliers, not delivering orders in full as ordered.

The ultimate goal of a JIT system is to be able to cause no delays (out-of-stock situations) while meeting the customers' demands on short notice. This process also achieves improved product quality, reduced waste and improved production efficiency. Reducing costs as no warehousing of raw material inventory is needed will also be a positive spinoff. Less money is

spent on purchasing raw material, as just enough is purchased for each production run (Zaitseva, 2017).

2.7 MEASURING PROFITABILITY AND PROFIT

Inventory holding costs consist of several components, such as storage costs, insurance, spoilage/expiring stock, opportunity losses (which are hard to calculate accurately) and it also can influence taxes to be paid. Further to this, the capital stuck in the inventory could have been used to generate other income and profits (Alfares, 2015). To calculate profit, one needs to consider turnover and expenses in different formats (Charan Sahoo *et al.*, 2016).

For the purpose of this study, profit was measured and analysed using the following formulas (Rohde & Seal, 2018):

- Gross profit = net sales – cost of goods sold (CoGS)
- CoGS = beginning inventory + purchased inventory during period – ending inventory
- Operating profit = gross profit – operating costs
- Operating cost = operating expenses + CoGS

Theoretical comparisons were done using these formulas against the different forecasting modules.

2.8 SUMMARY OF CHAPTER 2

A thorough literature review was done on forecasting error, the different forecasting models and these models' impact on a company's profitability. Definitions and terms were briefly discussed to ensure a mutual understanding. A distinctive trade-off exists where the level of inventory kept and the level of customer service has a direct link. Keeping more inventory ensures a high level of customer service as the demand can always be fulfilled, but this comes at a price as the inventory that is kept in stock is not stored free of charge. The way in which profitability will be measured in the study was discussed. It is clear that different models, depending on the application and use, influence profitability to a lesser and greater extent. It can be said that one forecasting model is not superior to others, but the circumstances and application of the model on a specific situation are crucial, as not all models fit all situations.

CHAPTER 3: DATA GATHERING AND INTERVIEWS

3.1 INTRODUCTION

To understand the variables that influence each other in terms of forecasting, inventory and profitability, it is crucial to understand the influence each has on the other (O'Neill & Sanni, 2018). From the title, it is clear – the key variables will influence each other. Inputs, opinions and data were gathered by having numerous interviews with key role players in GFC as well as some expert opinions from a person in the poultry industry, all who have vast experience in the poultry industry. Further to this, other data were gathered that were used for the technical analysis.

Forecast-driven models used in the poultry industry are greatly dependent on the projected demand inputs and that will then, in turn, determine the type and quantity of inventory that needs to be kept (Estep, 2016). Customer satisfaction can only be guaranteed if a company can deliver what the customer expected. In order to achieve this, a company cannot run out of inventory of any kind (Wijaya, 2017). Factors such as safety stock, lead times, minimum order quantities, storage space, to name but a few, all have an influence in order to achieve the highest level of satisfaction (Saurabh, 2018).

3.2 FINANCIAL DATA

The gathering of data was done to be used in the technical analysis. The primary focus was data that relate to inventory, forecasting and profitability, as this was the focus of this study. However, after the interviews, it became apparent that there were numerous other factors that had an even bigger influence on profitability, especially in a poultry abattoir. Those data were also gathered and analysed to establish the correlation between the factors that were raised in the interviews.

Data that were gathered consist of:

- Various financial reports and figures
- Inventory reports, specifically store value
- Stock availability of the items in the stores
- Forecasting models and/or programs in use at GFC

Numerous calculations were done with this data gathered. Some before the interviews and some after the interviews – after some additional insight was obtained.

3.3 INTERVIEWEES

The interviews were held with the following people:

- *Theo van Strijp*, managing director of GFC, who has 26 years' experience in the poultry industry. Theo worked for numerous poultry plants from an entry-level worker to his current position in top management. Theo is also well educated and did his BCom as well as an MBA.
- *Rob Fairly*, sales and marketing director of VKB Agri Processors, who has 26 years' experience in the poultry industry and worked for numerous poultry entities.
- *Corne Vermaak*, financial manager of GFC, who has 10 years' experience. Corne worked for agricultural companies before and has five years' experience in the poultry industry. Corne has sound financial knowledge and background and has a BCom degree.
- *Wessel Smal*, procurement manager of GFC, who has 20 years' experience in the poultry industry and worked his way up from a driver, store man and purchasing clerk, up to his current position. Wessel has first-hand experience in handling inventory at store level.
- *Izaak Breitenbach*, general manager of the Broiler Organisation South African Poultry Association, who has more than 30 years' experience in the poultry industry and worked for numerous agricultural companies. Izaak has an MBA.

It is clear that the interviewees have the necessary experience and knowledge to provide good insight into the world of inventory control, forecasting and items that drive profitability, with more than 112 years of experience between them.

3.4 INTERVIEW QUESTIONS

The purpose of the interview questions was to establish whether there is any link between forecasting, inventory and profitability from the viewpoint of the interviewees. If a link could be established, the aim was then to determine the strength of the causal relationship between the different factors.

Open-ended questions were asked in order to give the interviewees the freedom to share any knowledge and experience regarding the topic at hand.

The following open-ended questions were asked:

- What is your experience in the poultry industry?

This question was asked to establish whether the interviewee has the expected and applicable knowledge regarding the topic at hand, in this environment and industry. Any demographic information that the interviewee wanted to share, would be elicited under this question.

- What are the key drivers of profitability in the poultry industry and more specifically for GFC?

This question was asked to establish what the different interviewees experienced to be profitability drivers. Further to this, also to confirm whether the world of business corresponds with the literature review that was done.

- What can the poultry industry and more specifically GFC do to increase profitability?

This question was asked to establish what can be done to increase profitability in this specific industry as per the different interviewees, given their knowledge and experience. Further to this, also to confirm whether the world of business corresponds with the literature review that was done.

- What do you think is the link between forecasting, inventory and profitability?

This question was asked to test the perception that there is a link between the three factors. Each factor, according to literature, does influence each other, but in practice and in the real business world, the researcher tried to confirm whether this is the case.

- Explain the current forecasting model/program currently used in GFC and/or in general in the poultry industry.

This question was asked to establish which model, if any, was in use at GFC, but also in general in the poultry industry. The researcher tried to establish whether there is a relation between different companies and/or whether GFC is so much different from the rest of the companies in the industry.

- How do you experience the current forecasting model being used in terms of effectiveness and/or problems?

This question was asked to establish whether the current forecasting model in use is actually effective and well used – yielding the desired results.

- How do you measure the accuracy of your forecasting?

This question was asked to establish whether the interviewee understands how forecasting works and what is important when looking at indicators for effective forecasting.

- What are the biggest causes of forecasting errors?

This question was also asked to establish whether the interviewee understands how forecasting works and what is important when looking at indicators for effective forecasting.

- Given your experience, do other similar businesses achieve better results? If so, what do they do differently?

This question was asked to establish how good or bad GFC does compared to other poultry companies in the industry and then also to establish whether other companies are doing something vastly differently than GFC, which might have a big impact.

- Is there anything else you would like to share with me that might be relevant regarding this topic?

This question was asked to give the interviewee an open floor to discuss any relevant information that might be applicable.

All interview responses were transferred into written text. The interview data were transcribed into Atlas.ti for analysis. Firstly, codes were established. A total 821 codes were identified. Secondly, the codes were combined where possible and applicable. The result was a new code count of 551. From the combined codes, code groups were established. A total of nine code groups were formed. From the code groups, networks were established. Focus was placed on three key themes, in line with the title of this study as well as with what was found in the interviews. The three themes that were focused on, were inventory, procurement and profitability. Detailed network maps were established from these networks that were focused on.

Based on the outcome of the interviews, further correlations and analyses were done. To establish statistical significance and relevance and to establish causal relationships, the chi-square and Cramer's V were also calculated. Because almost all the factors were evaluated against the PBIT, these calculations came out skewed, because the PBIT figures were in the millions and vary between positive and negative as well as the other factors' figures were quite small, only in the tens or maybe thousands. This caused the chi-square and Cramer's V to be skewed.

Chi-square is a test that measures how expectations compare to actual observed data, while the Cramer's V is a measure of association between two variables (Stephanie, 2020).

3.5 SUMMARY OF CHAPTER 3

Data were gathered in the forms of reports and figures from financial reports. The data gathered were well structured and could be used for meaningful analysis. Interviews were conducted with key role players and decision-makers in GFC, all who have experience and knowledge, but also influence on decisions made in the company. Between the interviewees are more than 110 years of experience, numerous tertiary qualifications, and practical hands-on knowledge – these form a solid platform for well-educated and experienced inputs. During the interviews, it became apparent that there are numerous additional factors that also influence profitability. Those data were also gathered to be analysed.

The close relation between forecasting, inventory and profitability was linked with each other. The numerous interviews highlighted the importance of accurate and efficient forecasting of inventory levels as well as the influence of inventory levels on profitability. It was seen that optimum inventory levels are sure to improve customer satisfaction and customer experience. With stock on hand at all times, due to sufficient inventory levels, proper market penetration can be achieved (Sritharan, 2019).

CHAPTER 4: EMPIRICAL STUDY

4.1 INTRODUCTION

The study seeks to answer the problem statement, based on the information available, obtained by the interviews and the analysis thereof, and the technical analysis done on the different financial reports and figures, as well as the literature review. A reliable statistical outcome was established by a reliable sample set – the fact that all those people who are knowledgeable about inventory management in the organisation were included – and the fact that this type of analysis is relevant to this type of topic.

In Chapter 2, the relationships between the different factors, namely forecasting, inventory and profitability were discussed in detail, as part of the literature review. During the interviews, it came to light that in the poultry industry specifically, there are also numerous other factors that are influencing profitability, even more than inaccurate raw material inventory forecasting.

Types of variables and factors, as well as the links established by using Atlas.ti, could be significant to identify relationships between the identified factors. The links between these factors, recorded in the interviews, are discussed in some detail in this chapter. Analysis of the influence of the different factors towards each other was done by means of the software of Atlas.ti as well as correlation and regression analysis done with Microsoft Excel®.

Due to a partly quantitative approach followed, the data obtained from the financial reports and figures were all historical. The financial reports and figures are in actual use by the business analysed and are therefore validated figures. The raw data obtained from the business will not be displayed or shown in the appendix, as some of the information might be of a confidential and sensitive nature and permission to publish this data was not granted by the company.

Studying inventory forecasting and its factors influencing it was relevant to understand how each factor can influence profitability. Without a profit, there is no business (O'Neill & Sanni, 2018). One of the main drivers of this, which plays a critical role in the process, is the people (employees). Employees are running the systems, doing the stock counts, and making the final decisions, even if a forecasting program maybe suggests otherwise (Heizer *et al.*, 2016).

4.2 PRIMARY FINANCIAL STATEMENTS AND -FIGURES ANALYSIS

Numerous financial statements and figures were gathered. The study was done in a company that is relatively young (established in June 2012) and only a limited quantity of reliable data were available. Only data from April 2016 to June 2020 were used in this study. This gives a sample set of 51 consecutive months. No random sampling was needed, and this sample set gave accurate and reliable answers. The data before the date of April 2016 are not reliable, or there were no data to be found for that period in certain fields.

Given the sensitivity of some of the information, figures will not be plotted on the graphs and only the correlation factors were given. Correlation between the basic factors as per the title was calculated, based on the outcome of the literature study. The term *dry stores* refers to the store where all the dry goods are stored, which will include, but is not limited to all packaging material, bags, boxed, polystyrene trays, labels, brine powder, shrink wrapping, stretch wrapping and the like. The term *engineering stores* refers to the store where all the machine spares are kept, which will include motors, gearboxes, blades, knives and all kinds of poultry equipment spare parts used for maintenance. The following items were graphed on a scatter graph and discussed further:

- Dry stores value & PBIT
- Engineering stores value & PBIT
- Total stores value & PBIT
- % stock availability & PBIT
- % stock availability & turnover

4.2.1.1 DRY STORES VALUE & PBIT

Although the correlation between the dry stores value and the PBIT was found not to be as high, it was still seen as important to discuss as this is what this study was all about from the start. Dry stores value and PBIT had a positive correlation with a correlation coefficient factor of only 0.54. This positive correlation was not expected by the researcher. It was found that the higher the dry stores inventory level, the higher the profits were. According to literature, this should be a negative correlation as the higher the value of inventory, the lower profitability should be, as it adds costs (Chen *et al.*, 2017). The R^2 for these two factors was 0.2876. The higher the R^2 value, the higher the predictability of one factor towards the other. The positive correlation can be seen on the graph, and the predictability is also rather high. See the graph of these two factors below.

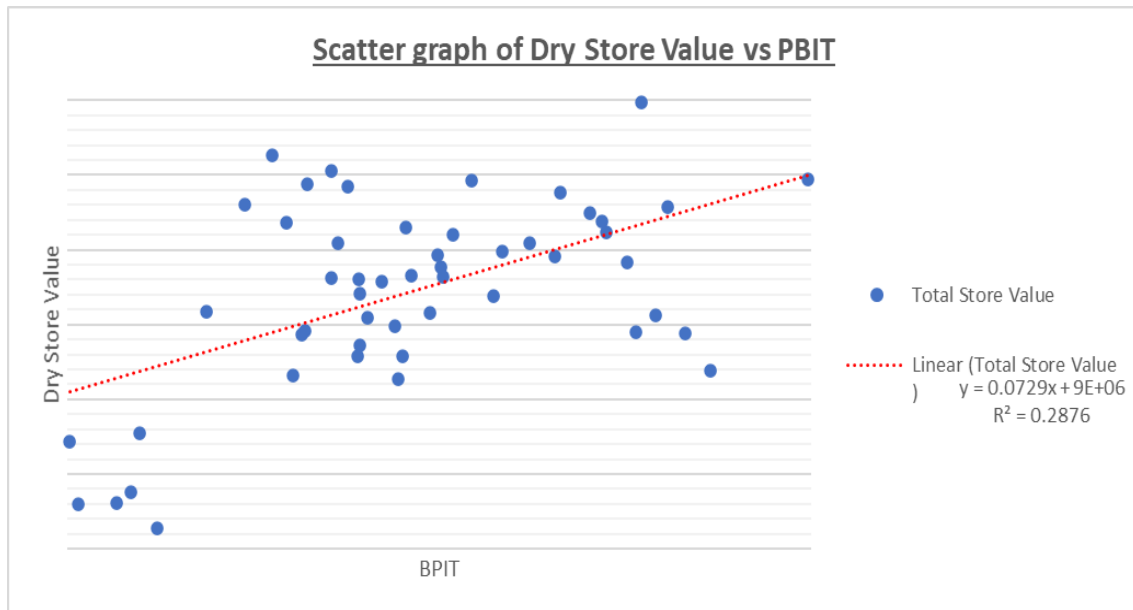


Figure 1: Scatter graph of dry store value vs PBIT

The slope of the linear line has a rather steep incline, indicating a positive correlation.

The correlation indicates that the higher the value of the dry goods store for the month, the higher the PBIT. This goes against literature and understanding as explained above. A possible reason for this can be that in a period of good sales, more product is needed to be sold and the more product to be sold leads to more raw material needed to be able to manufacture this product. Although this might be a possibility, this is rather unlikely, as process volumes are rather stable form month to month, although the sales quantities might differ. Therefore, in months where fewer sales were made than products processed, the company will build stock in the warehouse and in months where more product is sold than what was processed, the stock in the warehouse will decline.

To analyse this unexpected result, two linear regressions were carried out on the data: Firstly, dry store value (DSV) was used as the independent variable and PBIT as the dependent variable to determine whether DSV has a significant influence on PBIT. The regression output is given in the table below.

Table 1: Regression results: DSV (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.505227105				
R Square	0.255254427				
Adjusted R Square	0.239738895				
Standard Error	8039077.36				
Observations	50				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.06321E+15	1.06321E+15	16.45154125	0.000182496
Residual	48	3.10208E+15	6.46268E+13		
Total	49	4.16529E+15			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	-31172900.79	9185188.95	-3.393822485	0.00139023	
6282821	3.890151034	0.959098402	4.056049957	0.000182496	

The beta-coefficient of 3.89 is indicative that dry store value indeed has a causal influence on PBIT. The low p-value of less than 0.05 indicates that the result is statistically significant.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and DSV as the dependent variable, to determine whether there is a causal influence of PBIT on DSV. The output is given in the table below.

Table 2: Regression results: PBIT (independent) vs DSV (dependent)

<i>Regression Statistics</i>					
Multiple R	0.505227105				
R Square	0.255254427				
Adjusted R Square	0.239738895				
Standard Error	1044062.234				
Observations	50				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.79333E+13	1.79333E+13	16.45154125	0.000182496
Residual	48	5.23232E+13	1.09007E+12		
Total	49	7.02564E+13			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	9122935.069	174909.8146	52.15793688	6.29231E-44	
-8184221.78	0.065615557	0.016177206	4.056049957	0.000182496	

The beta-coefficient of 0.065 is indicative that PBIT does not have a causal influence on DSV. The low p-value of less than 0.05 indicates that the result is statistically significant.

It can, therefore, be summarised that, in agreement with the results described by Chen *et al.* (2017), that the DSV does influence PBIT.

4.2.1.2 ENGINEERING STORES VALUE & PBIT

Although the correlation between the engineering stores value and the PBIT was found to be very low, it was still seen as important to discuss as this is what this study was all about from the start. Engineering stores value and PBIT had a positive correlation, with a correlation coefficient factor of only 0.10

This positive correlation was unexpected by the researcher. It was found that the higher the engineering stores value is, the higher the profits were. According to literature, this should be a negative correlation as the higher the value of inventory, the lower profitability should be, as it adds costs. The R^2 for these two factors was only 0.0091. The higher the R^2 value is, the higher the predictability of one factor towards the other. The positive correlation can be seen on the graph below, and the predictability is low. *See the graph of these two factors below:*

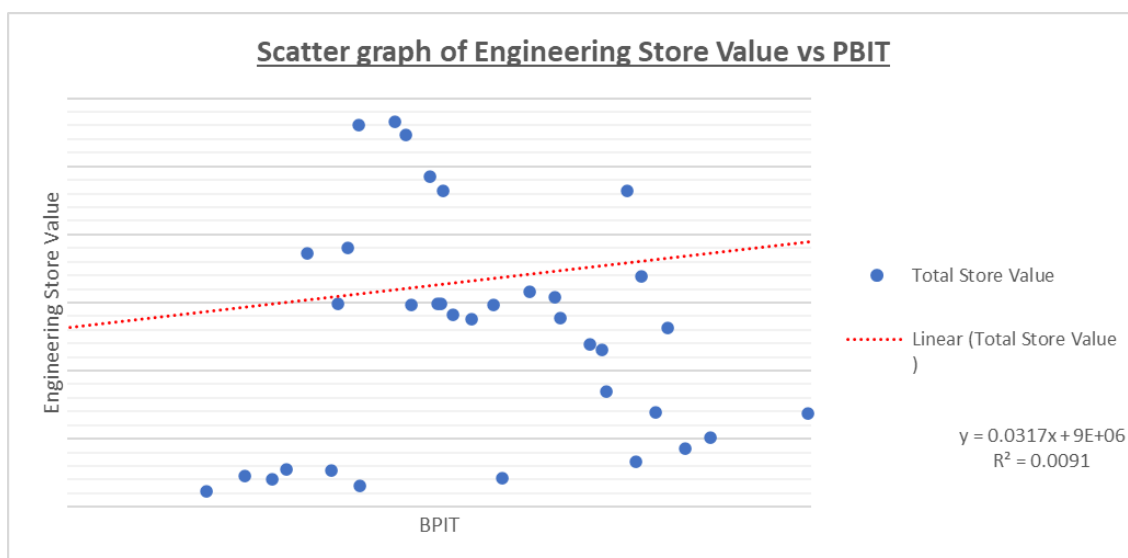


Figure 2: Scatter graph of engineering store value vs PBIT

The slope of the linear line has a slight incline, indicating a positive correlation.

The correlation indicates that the higher the value of the engineering store for the month, the higher the PBIT will be. This goes against literature and understanding as explained above.

A possible reason for this can be that in a period of good sales, more product is needed to be sold and the more product to be sold leads to higher production and with higher production volumes, more machine maintenance will be needed. Although this might be a possibility, this is rather unlikely, as process volumes are rather stable from month to month, although the sales quantities might differ. Therefore, in months where fewer sales were made than product processed, the company will build stock in the warehouse, and in months where more product is sold than what was processed, the stock in the warehouse will decline.

To analyse this unexpected result, two linear regressions were carried out on the data: Firstly, engineering store value (ESV) was used as the independent variable and PBIT as the dependent variable to determine whether ESV has a significant influence on PBIT. The regression output is given in the table below:

Table 3: Regression results: ESV (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.0496964				
R Square	0.002469732				
Adjusted R Square	-0.018312148				
Standard Error	9303905.357				
Observations	50				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.02872E+13	1.02872E+13	0.11884065	0.731801273
Residual	48	4.15501E+15	8.65627E+13		
Total	49	4.16529E+15			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	4393518.149	4276351.31	1.027398787	0.309382418	
	4231342	0.150454021	0.436436727	0.344732722	0.731801273

The small beta-coefficient of 0.15 indicates a small positive causal influence of ESV on PBIT, which is to be expected. The p-value of more than 0.05 indicates that the result is not statistically significant. No conclusion can be drawn about the causal relationship between ESV and PBIT.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and ESV as the dependent variable, to determine whether there is a causal influence of PBIT on ESV. *The output is given in the table below:*

Table 4: Regression results: PBIT (independent) vs ESV (dependent)

Regression Statistics					
Multiple R	0.0496964				
R Square	0.002469732				
Adjusted R Square	-0.018312148				
Standard Error	3073168.808				
Observations	50				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1.12237E+12	1.12237E+12	0.11884065	0.731801273
Residual	48	4.5333E+14	9.44437E+12		
Total	49	4.54452E+14			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	9227849.578	514842.2851	17.9236435	6.63601E-23	
	-8184221.78	0.016415196	0.047617167	0.344732722	
				0.731801273	

The very small beta-coefficient value of 0.016 indicates a negligible causal influence of PBIT on ESV, which is to be expected. The result is not statistically significant at a level of significance of 0.05, as indicated by the p-value of 0.73.

No conclusion can be drawn about the causal relationship between PBIT and ESV.

4.2.1.3 TOTAL STORES VALUE & PBIT

Given the positive correlation between the dry store value and the minimal positive correlation between die engineering store with the PBIT, the researcher finds it fit to analyse the correlation between the total stores value and the PBIT – as this was core to the study objectives. The total stores value includes the value for all the stores and therefore includes all raw material inventory. The total stores value and PBIT had a positive correlation with a correlation coefficient factor of 0.28

This positive correlation was unexpected by the researcher. It was found that the higher the total stores inventory level is, the higher the profits were. According to literature, this should be a negative correlation as the higher the value of inventory is, the lower profitability should be, as it adds costs. The R^2 for these two factors was only 0.0789. The higher the R^2 value, the higher the predictability of one factor towards the other. The positive correlation can be seen, and the predictability is very low. See the graph of these two factors below:

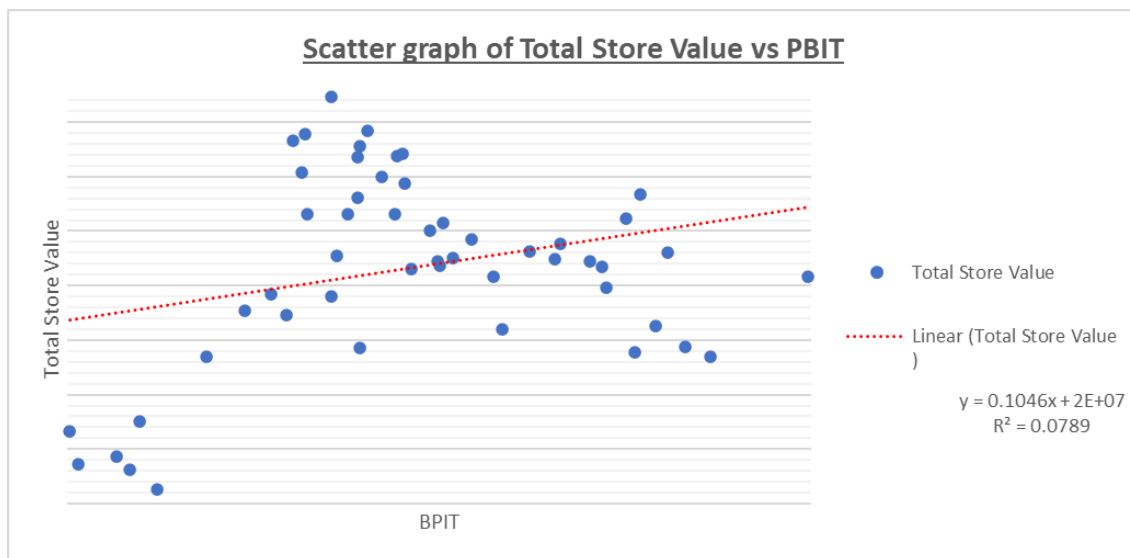


Figure 3: Scatter graph of total store value vs PBIT

The slope of the linear line has an incline, indicating a positive correlation.

The correlation indicates that the higher the total value of the stores for the month, the higher the PBIT. This goes against literature and understanding as explained above.

A possible reason for this can be that in a period of good sales, more product is needed to be sold and the more product to be sold leads to higher production and with higher production volumes, more machine maintenance will be needed, increasing the ESV, as well as more raw materials will be needed, increasing the DSV. Although this might be a possibility, this is rather unlikely, as process volumes are rather stable from month to month, although the sales quantities might differ. Therefore, in months where fewer sales were made than product processed, the company will build stock in the warehouse and in months where more product is sold than what was processed, the stock in the warehouse will decline.

To analyse this unexpected result, two linear regressions were carried out on the data: Firstly, total store value (TSV) was used as the independent variable and PBIT as the dependent variable to determine whether TSV has a significant influence on PBIT. The regression output is given in the table below:

Table 5: *Regression results: TSV (independent) vs PBIT (dependent)*

Regression Statistics					
Multiple R	0.228586568				
R Square	0.052251819				
Adjusted R Square	0.032507065				
Standard Error	9068776.997				
Observations	50				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	2.17644E+14	2.17644E+14	2.646364672	0.110334946
Residual	48	3.94765E+15	8.22427E+13		
Total	49	4.16529E+15			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	-6195715.436	7482368.05	-0.828042058	0.411744909	
10514163	0.636978415	0.391561398	1.626765094	0.110334946	

The small beta-coefficient of 0.63 indicates a small positive causal influence of TSV on PBIT, which is to be expected. The p-value of more than 0.05 indicates that the result is not statistically significant. No conclusion can be drawn about the causal relationship between TSV and PBIT.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and TSV as the dependent variable, to determine whether there is a causal influence of PBIT on TSV. The output is given in the table below.

Table 6: Regression results: PBIT (independent) vs TSV (dependent)

Regression Statistics					
Multiple R	0.228586568				
R Square	0.052251819				
Adjusted R Square	0.032507065				
Standard Error	3254428.341				
Observations	50				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	2.80285E+13	2.80285E+13	2.646364672	0.110334946
Residual	48	5.08383E+14	1.05913E+13		
Total	49	5.36411E+14			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	18350784.65	545208.3594	33.65829656	4.83665E-35	
	-8184221.78	0.082030753	0.05042569	1.626765094	0.110334946

The very small beta-coefficient value of 0.082 indicates a negligible causal influence of PBIT on TSV, which is to be expected. The result is not statistically significant at a level of significance of 0.05, as indicated by the p-value of 0.11

No conclusion can be drawn about the causal relationship between PBIT and ESV.

4.2.1.4 % STOCK AVAILABILITY & PBIT

The % stock availability is an indication of the degree of out-of-stock situations experienced monthly. When there are numerous out-of-stock situations, the % stock availability will be low. When there was not one out-of-stock situation in a month, the % stock availability will be 100% for that month. The % stock availability and PBIT had a negative correlation with a correlation coefficient factor of -0.44

This negative correlation was unexpected, as with a high level of raw material inventory on hand, in theory, all orders will be made, thereby achieving a higher profit. The R^2 for these two factors was 0.1946. The higher the R^2 value is, the higher the predictability of one factor towards the other will be. The negative correlation can be seen, and the predictability is not as low as expected. *See the graph of these two factors below:*

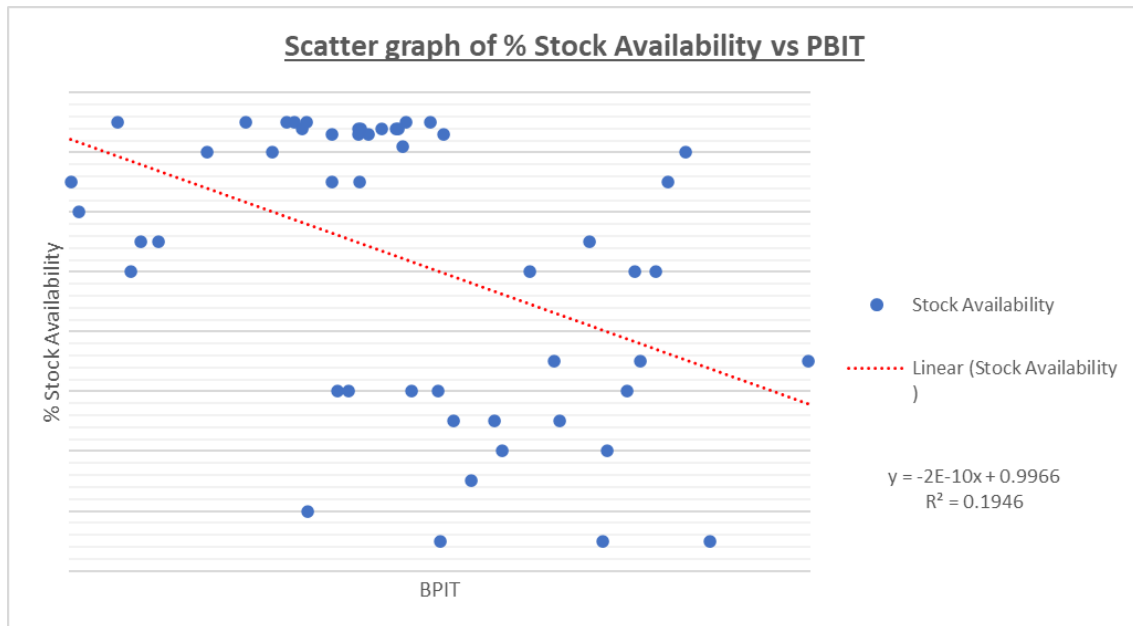


Figure 4: Scatter graph of % stock availability vs PBIT

The slope of the linear line has a rather steep decline, indicating a negative correlation.

The correlation indicates that the higher the % of stock availability for the month is, the lower the PBIT will be. This goes against literature and understanding as explained above.

A possible reason for this can be that in a period of poor sales, less raw material was used, as less product was needed to be made. Although this might be a possibility, this is rather unlikely, as process volumes are rather stable from month to month, although the sales quantities might differ. Therefore, in months where fewer sales were made than product processed, the company will build stock in the warehouse, and in months where more product is sold than what was processed, the stock in the warehouse will decline.

To analyse this unexpected result, two linear regressions were carried out on the data: Firstly, stock availability (SA) was used as the independent variable and PBIT as the dependent variable to determine whether DSV has a significant influence on PBIT. *The regression output is given in the table below:*

Table 7: Regression results: SA (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.446946449				
R Square	0.199761129				
Adjusted R Square	0.183089486				
Standard Error	8333204.975				
Observations	50				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	8.32064E+14	8.32064E+14	11.98209	0.001138369
Residual	48	3.33323E+15	6.94423E+13		
Total	49	4.16529E+15			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	867495108.2	248939676.3	3.484760329	0.001062394	
	0.996 -865743662.4	250105379.1	-3.461515564	0.001138369	

The beta-coefficient is indicative that the SA has a causal influence on PBIT. The low p-value of less than 0.05 indicates that the result is statistically significant.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and SA as the dependent variable, to determine whether there is a causal influence of PBIT on SA. *The output is given in the table below:*

Table 8: Regression results: PBIT (independent) vs SA (dependent)

<i>Regression Statistics</i>					
Multiple R	0.446946449				
R Square	0.199761129				
Adjusted R Square	0.183089486				
Standard Error	0.004302078				
Observations	50				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.000221763	0.000221763	11.98209	0.001138369
Residual	48	0.000888378	1.85079E-05		
Total	49	0.001110141			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	0.996665411	0.000720719	1382.87638	4.477E-112	
	-8184221.78 -2.30739E-10	6.66585E-11	-3.461515564	0.001138369	

The beta-coefficient value indicates that there is a causal influence of PBIT on SA, which is to be expected. The result is statistically significant at a level of significance of 0.05, as indicated by the p-value of 0.001

4.2.1.5 % STOCK AVAILABILITY & TURNOVER

The % stock availability is an indication of the degree of out-of-stock situations experienced monthly. When there are numerous out-of-stock situations, the % stock availability will be low. When there was not one out-of-stock situation in a month, the % stock availability will be 100% for that month. Given the unexpected outcome of the correlation between % stock availability and PBIT, the researcher found it fit to analyse the correlation between % stock availability and turnover. The % stock availability and turnover had a slight positive correlation with a correlation coefficient factor of only 0.09

This positive correlation was expected, although a higher/stronger correlation was expected, as explained above. The R^2 for these two factors was 0.0085. The higher the R^2 value is, the higher the predictability of one factor towards the other will be. A slight positive correlation can be seen, and the predictability is very low. See the graph of these two factors below:

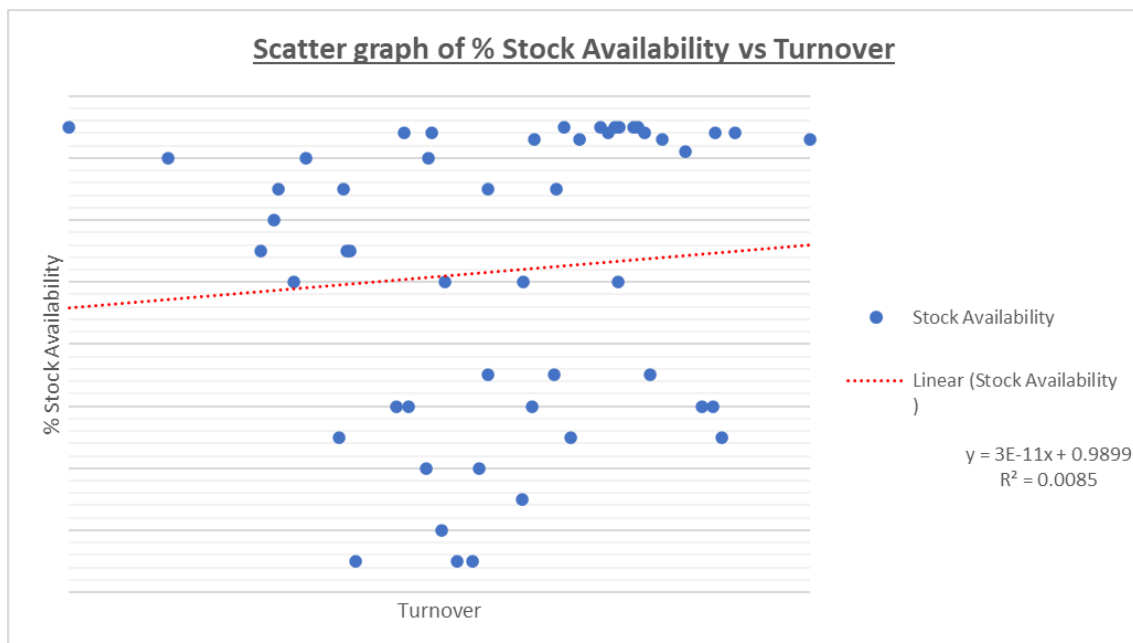


Figure 5: Scatter graph of % stock availability vs turnover

The slope of the linear line has a slight incline, indicating a weak positive correlation.

The correlation indicates that the higher the % of stock availability for the month, the higher the turnover will be, which is expected.

To analyse this expected result, two linear regressions were carried out on the data: Firstly, dry store availability (SA) was used as the independent variable and turnover (TO) as the dependent variable to determine whether SA has a significant influence on TO. *The regression output is given in the table below:*

Table 9: Regression results: SA (independent) vs TO (dependent)

Regression Statistics					
Multiple R	0.095645425				
R Square	0.009148047				
Adjusted R Square	-0.011494702				
Standard Error	16196520.19				
Observations	50				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1.16253E+14	1.16253E+14	0.443160318	0.50878763
Residual	48	1.25917E+16	2.62327E+14		
Total	49	1.2708E+16			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	-120261143.5	483842231.9	-0.248554458	0.804765831	
	0.996	323603431	486107906.3	0.665702876	0.50878763

The large beta-coefficient is indicative that SA indeed has a causal influence on TO. The larger than 0.05 p-value indicates that the result is not statistically significant.

Following this, a linear regression analysis was carried out on the same dataset with TO set as the independent variable and SA as the dependent variable, to determine whether there is a causal influence of TO on SA. *The output is given in the table below:*

Table 10: Regression results: TO (independent) vs SA (dependent)

<i>Regression Statistics</i>					
Multiple R	0.092089527				
R Square	0.008480481				
Adjusted R Square	-0.011754611				
Standard Error	16181663.99				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.09739E+14	1.09739E+14	0.419097719	0.520409212
Residual	49	1.28305E+16	2.61846E+14		
Total	50	1.29402E+16			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	-111350929.8	483308361.4	-0.230393138	0.818745492	
X Variable 1	314344027.6	485565212.4	0.647377571	0.520409212	

The large beta-coefficient is indicative that TO indeed has a causal influence on SA. The larger than 0.05 p-value indicates that the result is not statistically significant.

4.2.1.6 CONCLUSION ON PRIMARY FINANCIAL ANALYSIS

The following correlations were done:

- Dry stores value & PBIT
- Engineering stores value & PBIT
- Total stores value & PBIT
- % stock availability & PBIT
- % stock availability & turnover

The results of these correlations were unexpected. Of the five correlations, only one result was as expected, based on the literature study. The one that came out as expected was the correlation between % stock availability & turnover. The rest of the four correlations were all opposite of that expected from literature. This raised questions and concerns of why this was found. To confirm the statistical significance of these regressions, the beta-coefficient and the p-values were determined for different factors against each other. *The following findings were made:*

- The dry store value has a causal influence on PBIT, and it is statistically significant.
- The PBIT does not have a causal influence on dry store value and it is statistically significant.
- The engineering store value has a causal influence on PBIT, although small, but it is not statistically significant.
- The PBIT does not have a mentionable causal influence on engineering store value and is not statistically significant.
- The total store value has a small causal influence on PBIT, and it is not statistically significant.
- The PBIT does not have a mentionable causal influence on total store value and it is not statistically significant
- The % stock availability has a causal influence on PBIT, and it is statistically significant.
- The PBIT has a causal influence on the % stock availability, and it is statistically significant.
- The % stock availability has a causal influence on turnover, but it is not statistically significant.
- Turnover has a causal influence on % stock availability, but it is not statistically significant.

It became apparent that more financial reports and -figures must be analysed to understand this phenomenon. The interviews were conducted to try and solve this unexpected outcome.

4.3 FINDINGS FROM QUALITATIVE RESEARCH

Following the financial analysis where the relationships between the various inventory metrics and financial results were investigated, interviews were conducted with those people in the organisation who had insight into the way inventory is managed in the company, as described in *paragraph 1.5.3*. The first topic that was discussed is what the issues surrounding the management of inventory in the organisation are. The interviews were transcribed and coded, and analysis of the codes, using Atlas.ti software, yielded some interesting links.

4.3.1 INVENTORY

The first network map that was drawn, was that of inventory. As interviewee 1 put it, there is no formal inventory forecasting model in use. Interviewee 2 stressed that when a clear forecast

is received, it is possible to responsibly lower inventory levels, which will lead to less capital tied up and lower cost associated with storage and insurance, which will benefit profitability. The impact of forecasting as an element of budgeting is underestimated and not used to the fullest potential. There are numerous factors that influence inventory, which are also related to other items as can be seen in the figure below:

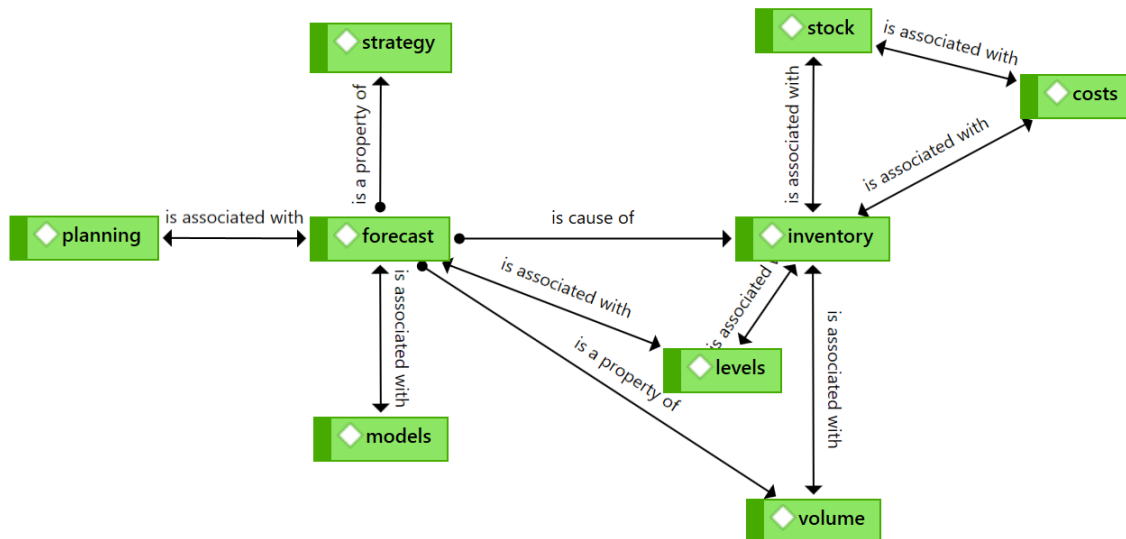


Figure 6: Network map for inventory

The overall insight that this network yields is the massive impact that forecasting has on inventory levels, and through this impact, also on inventory costs. The specific relationships that emerged from this are the following:

- Planning is associated with forecasting and will thus influence it.
- The forecasting model used is a property and is in line with the company strategy.
- The associated forecasting model used will influence the forecasting actions and outcomes.
- Forecasting is a property of volume and will therefore influence it.
- Forecasting is associated with levels of stock and will therefore influence it.
- Forecasting is a direct cause of inventory.
- Levels of stock are associated with inventory as to a large degree it is the same thing.
- Volume (in the poultry industry anyway) is associated with inventory as to a large degree it is the same thing.
- Inventory is associated with stock, as to a large degree it is the same thing.
- Both stock and inventory are associated with cost as it has a direct influence on it.

Overall, it can be said and concluded that the planning and forecasting process and model will directly influence the inventory level and consequently the cost of the company. This confirms what was found in the literature review.

4.3.2 PROCUREMENT

The second network map that was drawn was that of the procurement function. As interviewee 1 put it, there should be a plan of what to procure for the month based on the forecasted production volume. Interviewee 3 was adamant that there is a link between forecasting models and inventory levels. *There are numerous factors that influence the procurement function, which are also related to other items as can be seen in the figure below:*

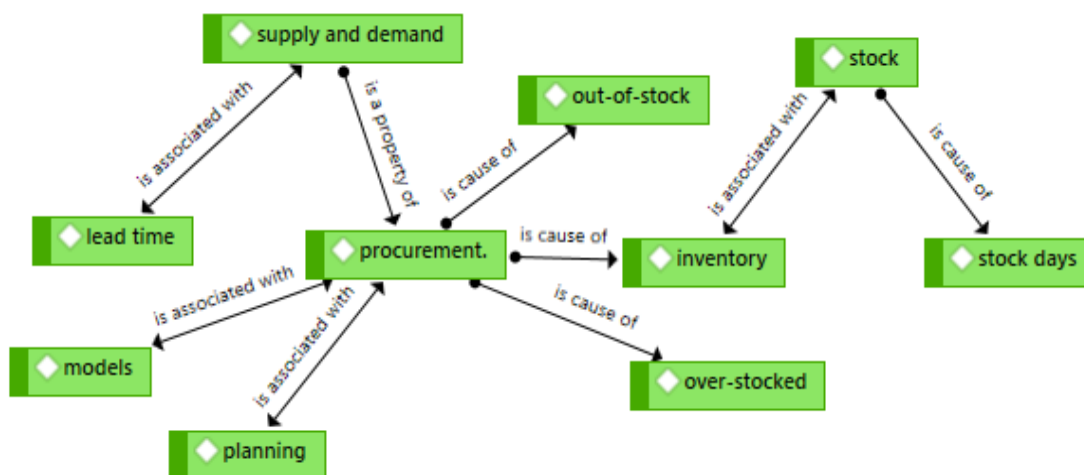


Figure 7: Network map for procurement

The overall insight from this diagram is that the procurement function has a critically important effect on inventory in the organisation. Specific relationships from the diagram are:

- Lead time is associated with the supply & demand function and will therefore influence it.
- Planning is associated with the procurement function and will therefore influence it.
- The model used to do the forecasting with is associated with the procurement function and will therefore influence it.
- The procurement function will directly cause over-stocked and out-of-stock situations.
- The procurement function will also directly be a cause of inventory levels.
- The inventory levels are associated with stock levels as they are the same thing to a large degree (in the poultry industry anyway).

- The stock on hand will result directly in stock days on hand as it is a direct calculation of average usage.

Overall, it can be said and concluded that the forecasting model used will directly influence the quantity of stock on hand.

4.3.3 PROFITABILITY

The third and last network map that was drawn was that of profitability. From the primary financial analysis, it became apparent that the profitability of this specific business used in this study is much more complex than originally assumed. This was also emphasised by the interviewees, as interviewee 3 put it, there are numerous factors that will influence profitability in a poultry abattoir – such as operational costs, sales volumes, sales pricing, inventory levels, but also other costs such as the feed costs, which are mainly driven by the maize price. There are numerous factors that influence the profitability, which are also related to other items as can be seen in the figure below:

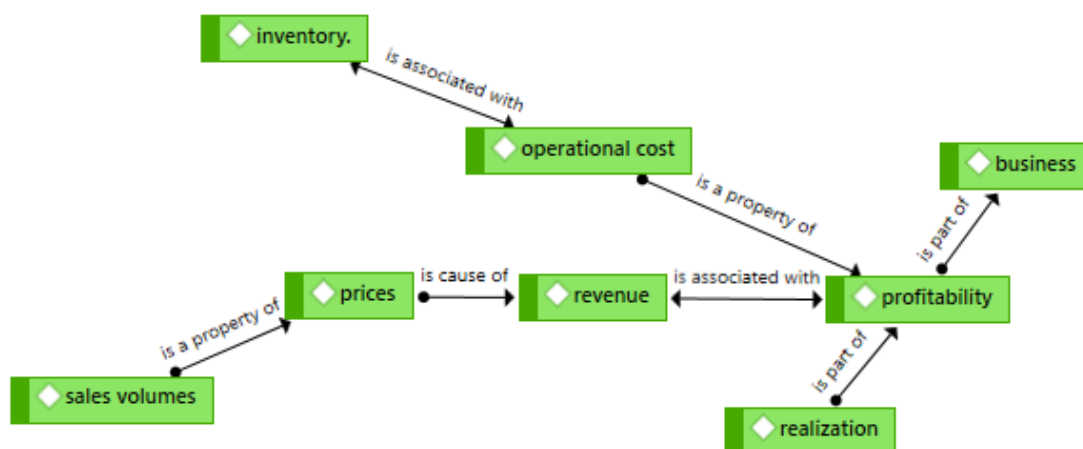


Figure 8: Network map for profitability

The overall insight that this network yields is the massive impact that inventory, sales volumes and operational cost have on profitability, and through this impact, also on the business. *The specific relationships that emerged from this are the following:*

- Inventory (stock level) is associated with operational cost, which is a property of profitability and has a negative or contradicting effect on profitability, although the finding after the primary financial analysis suggests otherwise.
- Sales volume is a property of prices as it is directly influenced by it.

- The prices will cause the level of revenue of the business, depending on the volume of sales.
- The revenue is associated with profitability and will have a direct influence on it.
- The realisation is part of profitability, as this is the level of profit made on each unit sold and will therefore directly influence the profitability.
- The profitability is part of the business, as without a profit, there will be no business.

Overall, it can be concluded that the inventory will directly influence the profitability, in theory, together with factors such as the sales volumes and the realisation of the sales. It was also established that numerous other factors will also influence profitability. The impact of those factors needs to be analysed.

4.3.4 CONCLUSION ON INTERVIEW NETWORK MAPS

The interviews mostly echoed the relationships that were found in the literature study, that procurement influences inventory and that inventory, along with sales volumes and other costs, influences profitability. In conclusion, with reference to the interview network maps above, it can be said that the forecasting model directly influences the inventory level of the company and that the inventory level directly influence the profitability of the business in totality, in theory at least. From the interviews it also emerged that profitability is also influenced by other factors and not only by inventory levels, although the inventory levels should have a direct effect on the profitability as was indicated by the literature review. Further analysis on more financial factors that might influence profitability needs to be done.

4.4 SECONDARY FINANCIAL STATEMENTS AND -FIGURES

Additional financial statements and figures were gathered. Once again, only data from April 2016 to June 2020 were used in this additional analysis to ensure that conclusions derived from this analysis are based on the same information as those derived from the original analysis. The data before the date of April 2016 are not reliable, or there were no data to be found for that period in certain fields.

Given the sensitivity of some of the information, figures will again not be plotted on the graphs and only the correlation factors are given. Correlations between additional factors that were suggested during the interviews, are calculated. All the correlations between all the fields,

including the primary and secondary analysis, were calculated (see Table 1). *The following items were additionally graphed on a scatter graph and discussed further to try and establish why the unexpected results were obtained during the primary financial analysis:*

- NSV & PBIT (net sales value & profit before income tax)
- Chick price & PBIT
- Feed price & PBIT
- Feed price & maize price
- Feed price & soybean price
- Maize price & PBIT

Chick price, feed price and the price of specific feed ingredients – such as soy and maize – seem to have the biggest effect on profitability and therefore are analysed in this secondary financial analysis. The degree of influence had to be established in order to explain the unexpected results and correlations obtained in the primary financial analysis.

4.4.1 CORRELATIONS ON ACTUALS

Below is a table of the correlations calculated on the all the actual figures that were obtained after each month ended. These include primary and secondary financial analysis factors.

Table 11: Correlation matrix

Correlation Coefficient Matix	PBIT	NSV	Turnover	Chick Price	Feed Price	Maize Price	Soybean Price	Quantity of Personnel	Dry Stores Value	Engineering Stores Value	Total Stores Value	Stock Availability
PBIT	1.00	0.69	0.30	-0.79	-0.71	-0.76	-0.66	0.34	0.54	0.10	0.28	-0.44
NSV	0.69	1.00	0.56	-0.42	-0.36	-0.44	-0.62	0.62	0.57	0.63	0.77	-0.06
Turnover	0.30	0.56	1.00	-0.19	-0.24	-0.25	-0.31	0.50	0.14	0.58	0.57	0.09
Chick Price	-0.79	-0.42	-0.19	1.00	0.94	0.95	0.38	-0.39	-0.36	-0.05	-0.18	0.60
Feed Price	-0.71	-0.36	-0.24	0.94	1.00	0.94	0.71	-0.41	-0.19	-0.09	-0.15	0.58
Maize Price	-0.76	-0.44	-0.25	0.95	0.94	1.00	0.33	-0.40	-0.29	-0.13	-0.23	0.58
Soybean Price	-0.66	-0.62	-0.31	0.38	0.71	0.33	1.00	-0.35	-0.55	-0.12	-0.30	0.12
Quantity of Personnel	0.34	0.62	0.50	-0.39	-0.41	-0.40	-0.35	1.00	0.29	0.68	0.71	0.11
Dry Stores Value	0.54	0.57	0.14	-0.36	-0.19	-0.29	-0.55	0.29	1.00	0.11	0.46	-0.34
Engineering Stores Value	0.10	0.63	0.58	-0.05	-0.09	-0.13	-0.12	0.68	0.11	1.00	0.93	0.30
Total Stores Value	0.28	0.77	0.57	-0.18	-0.15	-0.23	-0.30	0.71	0.46	0.93	1.00	0.14
Stock Availability	-0.44	-0.06	0.09	0.60	0.58	0.58	0.12	0.11	-0.34	0.30	0.14	1.00

Given the nature of this study, special attention was given to items that can and will influence profitability (expressed as PBIT in the table).

The items marked in green had high correlations and/or were found necessary to be discussed given the nature of the study. Although some other values are also high, they follow the same trend as some of the others and are therefore not discussed separately. Furthermore, as seen in Table 11, the relationships between NSC and the different feed ingredient prices are not discussed, since the effect of the different specific feed ingredient prices on PBIT would be through the effect of the feed price on cost, and not on product price, as indicated in the NSV figures.

4.4.1.1 NSV & PBIT

NSV and PBIT had a positive correlation with a correlation coefficient factor of 0.69.

This positive correlation was expected as the higher the selling price, normally, the better/higher the profit – depending on the cost structure. The selling price is to a large degree dependent on market conditions, especially for poultry products. The company does have some degree of control over the prices and as costs are increasing, so the price can be adjusted to compensate. The R^2 for these two factors was 0.2869. The higher the R^2 value, the higher the predictability of one factor towards the other.

Therefore, although there is a high correlation, the predictability is lower than expected by the researcher. See the graph of these two factors below:

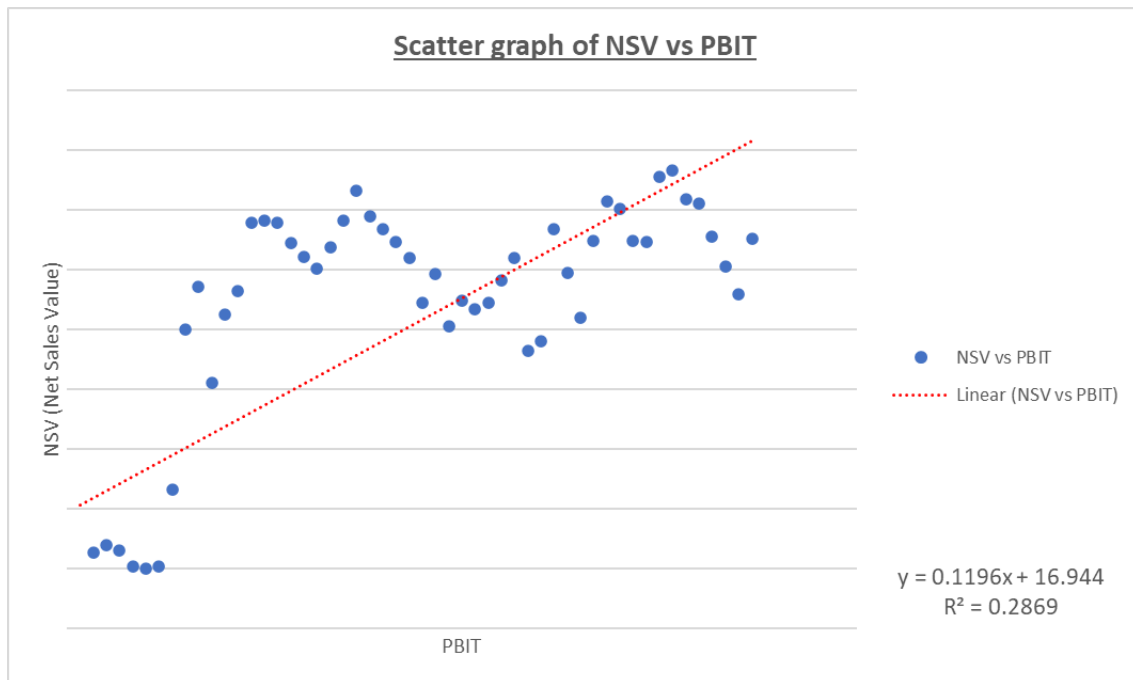


Figure 9: Scatter graph of NSV vs PBIT

The slope of the linear line is quite steep in a positive direction.

The correlation indicates that the lower the net sales value that was obtained for the month, the lower the profit before income tax was. This was expected, as the higher the prices obtained out of the market, given stable or lower costs, the profit will be higher. To analyse this expected result, two linear regressions were carried out on the data: Firstly, NSV was used as the independent variable and PBIT as the dependent variable to determine whether NSV has a significant influence on PBIT. The regression output is given in the table below.

Table 12: Regression results: NSV (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.691844039				
R Square	0.478648174				
Adjusted R Square	0.468008341				
Standard Error	1.349958552				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	81.98274524	81.98274524	44.98643597	1.88574E-08
Residual	49	89.29701654	1.822388093		
Total	50	171.2797618			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	19.74959258	0.220199194	89.68966781	5.20838E-56	
X Variable 1	1.37174E-07	2.04518E-08	6.707192853	1.88574E-08	

The large beta-coefficient value is indicative that NSV indeed has a causal influence on PBIT. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and NSV as the dependent variable, to determine whether there is a causal influence of PBIT on NSV. *The output is given in the table below.*

Table 13: Regression results: PBIT (independent) vs NSV (dependent)

<i>Regression Statistics</i>					
Multiple R	0.691844039				
R Square	0.478648174				
Adjusted R Square	0.468008341				
Standard Error	6808585.934				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.08543E+15	2.08543E+15	44.98643597	1.88574E-08
Residual	49	2.27149E+15	4.63568E+13		
Total	50	4.35691E+15			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	-66034322.47	10711120.77	-6.165024545	1.30242E-07	
X Variable 1	3489351.272	520240.1882	6.707192853	1.88574E-08	

The large beta-coefficient value is indicative that PBIT does have a causal influence on NSV. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Although not statistically significant, it can be said that NSV and PBIT do have a causal influence on each other.

4.4.1.2 CHICK PRICE & PBIT

Chick price and BPIT had a negative correlation with a correlation coefficient factor of -0.79

This negative correlation was expected as a high purchasing price of chicks will increase input costs and will therefore lower profits. The R^2 for these two factors was 0.0379. The higher the R^2 value, the higher the predictability of one factor towards the other. *Therefore, although there is a high negative correlation, the predictability is lower than expected by the researcher. See the graph of these two factors below.*

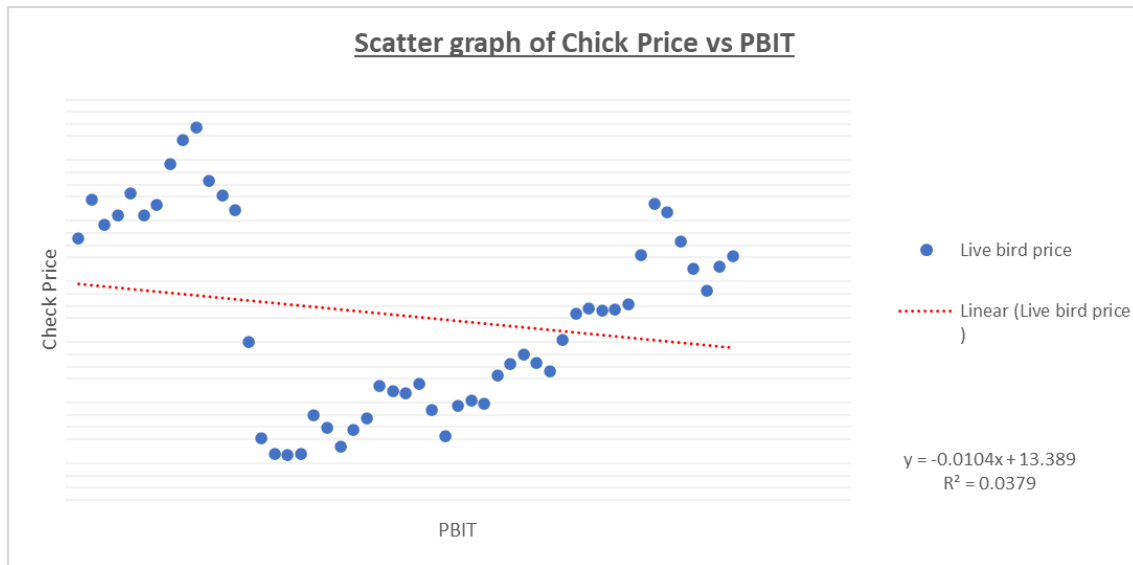


Figure 10: Scatter graph of chick price vs PBIT

The slope of the linear line is declining, indicating a negative correlation.

The correlation indicates that the higher the chick prices for the month, the lower the profit before income tax. Please note that these chick prices indicate the prices that were paid for chickens to be slaughtered, seen here as raw material to the slaughtering process. This was expected, as the higher the chick price, or input costs are, the lower the profit will be. To analyse this expected result, two linear regressions were carried out on the data: Firstly, chick price was used as the independent variable and PBIT as the dependent variable to determine whether chick price has a significant influence on PBIT. *The regression output is given in the table below.*

Table 14: Regression results: Chick price (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.786268051				
R Square	0.618217449				
Adjusted R Square	0.610425968				
Standard Error	0.497384322				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	19.62932866	19.62932866	79.34531028	8.09907E-12
Residual	49	12.12216703	0.247391164		
Total	50	31.75149569			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	13.4888532	0.081131103	166.25995	4.23995E-69	
X Variable 1	-6.71217E-08	7.53534E-09	-8.907598457	8.09907E-12	

The large beta-coefficient value is indicative that chick price indeed has a causal influence on PBIT. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and chick price as the dependent variable, to determine whether there is a causal influence of PBIT on chick price. *The output is given in the table below:*

Table 15: Regression results: PBIT (independent) vs chick price (dependent)

<i>Regression Statistics</i>					
Multiple R	0.786268051				
R Square	0.618217449				
Adjusted R Square	0.610425968				
Standard Error	5826389.466				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.69352E+15	2.69352E+15	79.34531028	8.09907E-12
Residual	49	1.66339E+15	3.39468E+13		
Total	50	4.35691E+15			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	126345838.6	13588637.39	9.29790346	2.13092E-12	
X Variable 1	-9210390.614	1033992.569	-8.907598457	8.09907E-12	

The large beta-coefficient value is indicative that PBIT does have a causal influence on chick price. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Although not statistically significant, it can be said that chick price and PBIT do have a causal influence on each other.

4.4.1.3 FEED PRICE & PBIT

Feed prices and BPIT had a negative correlation with a correlation coefficient factor of -0.71

This negative correlation was expected as a high feed cost will increase input costs, and this will lower profits. The R^2 for these two factors was 0.5031. The higher the R^2 value, the higher the predictability of one factor towards the other. Therefore, there is a high negative correlation and the predictability is also high. This factor will greatly influence profitability of the business. *See the graph of these two factors below:*

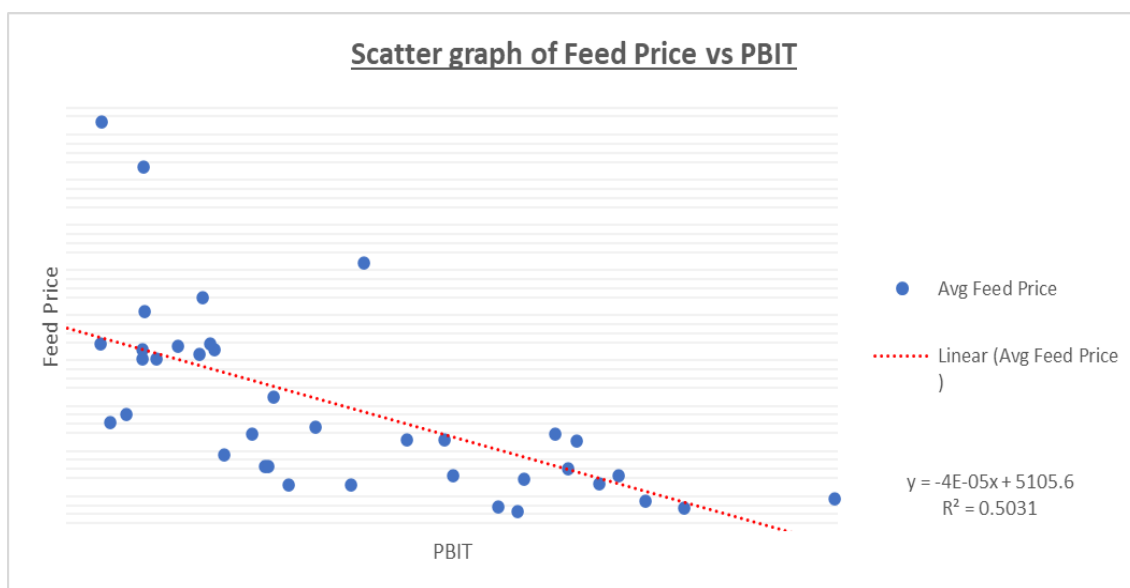


Figure 11: Scatter graph of feed prices vs PBIT

The slope of the linear line is quite steep declining, indicating a strong negative correlation.

The correlation indicates that the higher the feed prices for the month, the lower the profit before income tax. This factor was mentioned by all the interviewees as the single most important factor that influences profitability in the poultry industry.

This negative correlation was expected, as the higher the feed price, or input costs are, the lower the profit will be. To analyse this expected result, two linear regressions were carried out on the data: Firstly, feed price was used as the independent variable and PBIT as the dependent variable to determine whether feed price has a significant influence on PBIT. *The regression output is given in the table below:*

Table 16: Regression results: Feed price (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.709319736				
R Square	0.503134488				
Adjusted R Square	0.492994376				
Standard Error	334.4723719				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	5550879.693	5550879.693	49.61823538	5.67002E-09
Residual	49	5481716.609	111871.7675		
Total	50	11032596.3			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	5105.602205	54.55763561	93.58180845	6.57425E-57	
X Variable 1	-3.56937E-05	5.06723E-06	-7.04402125	5.67002E-09	

The large beta-coefficient value is indicative that chick price indeed has a causal influence on PBIT. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and feed price as the dependent variable, to determine whether there is a causal influence of PBIT on feed price. *The output is given in the table below:*

Table 17: Regression results: PBIT (independent) vs feed price (dependent)

<i>Regression Statistics</i>					
Multiple R	0.209344489				
R Square	0.043825115				
Adjusted R Square	0.024311342				
Standard Error	954523.1027				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.04623E+12	2.04623E+12	2.245855522	0.140388112
Residual	49	4.46446E+13	9.11114E+11		
Total	50	4.66908E+13			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	4263834.278	1416893.714	3.009283078	0.004128395	
X Variable 1	430.6639187	287.3740713	1.49861787	0.140388112	

The large beta-coefficient value is indicative that PBIT does have a causal influence on feed price. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Although not statistically significant, it can be said that feed price and PBIT do have a causal influence on each other.

4.4.1.4 FEED PRICE & MAIZE PRICE

With the strong correlation between the feed price and the PBIT, further investigation was done to establish the items that make up the feed price. It was found that feed mainly consists of maize and soybean. Therefore, the correlations between these were also analysed. Feed prices and maize price had a very strong positive correlation with a correlation coefficient factor of 0.94

This positive correlation was expected as the higher the maize price, the higher the feed price will be. Maize form the bulk/majority ingredient of the feed in totality. The R^2 for these two factors was very high with a value of 0.8843. The higher the R^2 value, the higher the predictability of one factor towards the other. Therefore, with this strong positive correlation, and the high predictability, these factors will have a very high influence on profitability in general. *See the graph of these two factors below:*

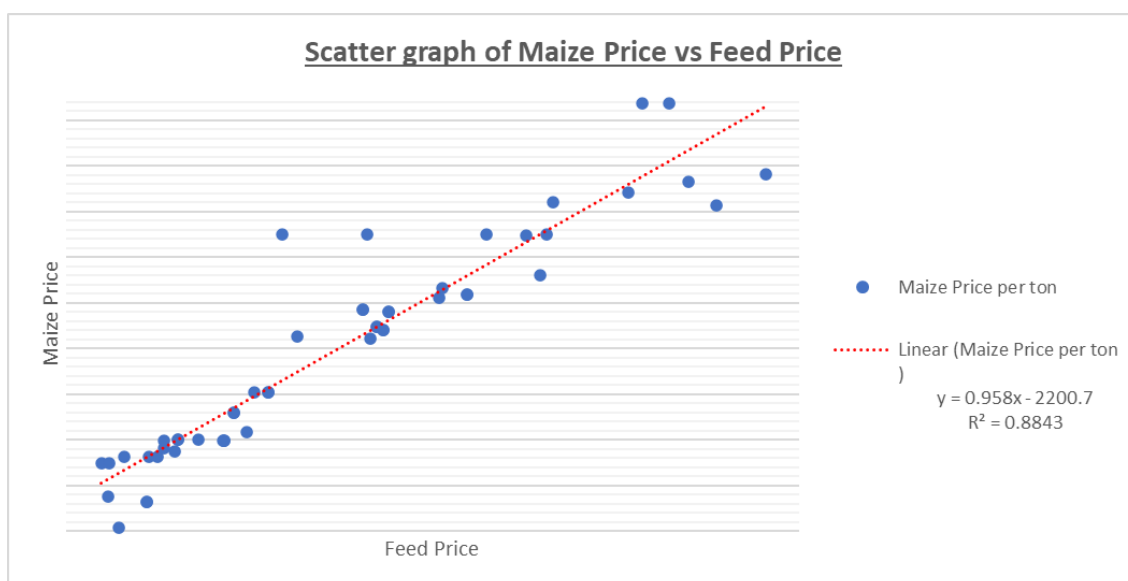


Figure 12: Scatter graph of maize price vs feed price

The slope of the linear line is steeply inclining, indicating a very strong positive correlation.

The correlation indicates that the higher the maize prices for the month, the higher the feed price will be. This correlation was expected, as the higher the maize price is, the higher the feed price will be. To analyse this expected result, two linear regressions were carried out on the data: Firstly, maize price was used as the independent variable and feed price as the dependent variable to determine whether maize price has a significant influence on feed price. The regression output is given in the table below.

Table 18: Regression results: Maize price (independent) vs feed price (dependent)

Regression Statistics					
Multiple R	0.940376457				
R Square	0.88430788				
Adjusted R Square	0.881946817				
Standard Error	164.4167932				
Observations	51				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	10124839.42	10124839.42	374.5379223	1.35257E-24
Residual	49	1324611.212	27032.88188		
Total	50	11449450.63			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	-2200.681511	244.0602224	-9.016961016	5.56241E-12	
X Variable 1	0.957977278	0.049500241	19.35298226	1.35257E-24	

The small beta-coefficient value of 0.95 indicates a small positive causal influence of maize price on feed price. The high p-value of more than 0.05 indicates that the result is not statistically significant.

Following this, a linear regression analysis was carried out on the same dataset with feed price set as the independent variable and maize price as the dependent variable, to determine whether there is a causal influence of feed price on maize price. *The output is given in the table below:*

Table 19: Regression results: Feed Price (independent) vs Maize Price (dependent)

Regression Statistics					
Multiple R	0.940376457				
R Square	0.88430788				
Adjusted R Square	0.881946817				
Standard Error	161.3959798				
Observations	51				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	9756211.851	9756211.851	374.5379223	1.35257E-24
Residual	49	1276384.452	26048.66228		
Total	50	11032596.3			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	2599.321588	121.4403919	21.40409419	1.62202E-26	
X Variable 1	0.923099013	0.047698024	19.35298226	1.35257E-24	

The small beta-coefficient value of 0.92 indicates a small positive causal influence of feed price on maize price. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Although not statistically significant, it can be said that feed price and maize price do have a causal influence on each other.

4.4.1.5 FEED PRICE & SOYBEAN PRICE

The other main ingredient of the feed is soybean. Therefore, the correlations between soybean and feed prices were also analysed. Feed prices and soybean price had a positive correlation with a correlation coefficient factor of 0.71

This positive correlation was expected as the higher the soybean price, the higher the feed price will be. Soybean is the other bulk/majority ingredient of the feed, although less than maize. The R^2 for these two factors was 0.0625. The higher the R^2 value, the higher the predictability of one factor towards the other. Therefore, although there is a strong positive correlation, the predictability is lower than expected by the researcher. See the graph of these two factors below:

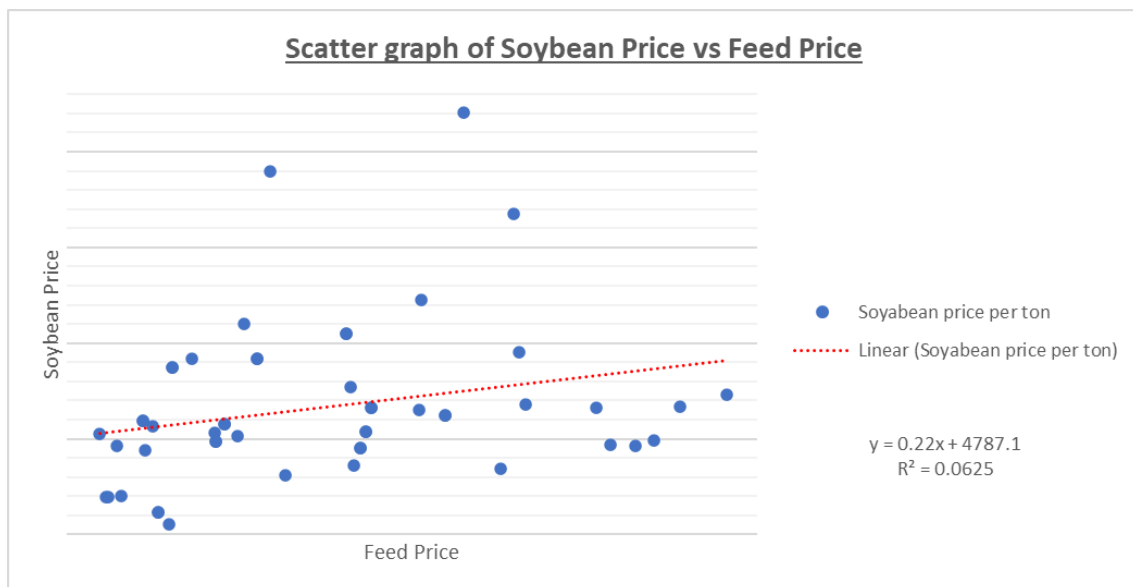


Figure 13: Scatter graph of Soybean Price vs Feed Price

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The slope of the linear line is inclining, indicating a positive correlation.

The correlation indicates that the higher the soybean prices for the month, the higher the feed price will be. This correlation was expected, as the higher the soy price is, the higher the feed price will be. To analyse this expected result, two linear regressions were carried out on the data: Firstly, soy price was used as the independent variable and feed price as the dependent variable to determine whether soy price has a significant influence on feed price. The regression output is given in the table below.

Table 20: Regression results: Soy price (independent) vs feed price (dependent)

<i>Regression Statistics</i>					
Multiple R	0.250096761				
R Square	0.06254839				
Adjusted R Square	0.043416724				
Standard Error	404.0537093				
Observations	51				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	533754.5021	533754.5021	3.269364594	0.076724227
Residual	49	7999710.6	163259.4		
Total	50	8533465.102			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	4787.059837	599.7771654	7.981397279	2.03985E-10	
X Variable 1	0.219954024	0.121646673	1.808138433	0.076724227	

The small beta-coefficient value of 0.22 indicates a small positive causal influence of soy price on feed price. The p-value of just more than 0.05 indicates that the result is not statistically significant.

Following this, a linear regression analysis was carried out on the same dataset with feed price set as the independent variable and soy price as the dependent variable, to determine whether there is a causal influence of feed price on soy price. *The output is given in the table below:*

Table 21: Regression results: Feed price (independent) vs soy price (dependent)

<i>Regression Statistics</i>					
Multiple R	0.250096761				
R Square	0.06254839				
Adjusted R Square	0.043416724				
Standard Error	459.4256656				
Observations	51				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	690071.1347	690071.1347	3.269364594	0.076724227
Residual	49	10342525.17	211071.9422		
Total	50	11032596.3			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	3240.182711	924.9107201	3.503238356	0.00099166	
X Variable 1	0.284370291	0.157272411	1.808138433	0.076724227	

The small beta-coefficient value of 0.28 indicates a very small positive causal influence of feed price on soy price. The p-value of just more than 0.05 indicates that the result is not statistically significant though.

Although not statistically significant, it can be said that feed price and soy price do have a very small causal influence on each other.

4.4.1.6 MAIZE PRICE & PBIT

With the strong correlation between the feed price and the PBIT as well as the strong correlation between the maize price and the feed price, further investigation was done to establish the level of correlation between the maize price and PBIT. Maize prices and PBIT had a negative correlation with a high negative correlation coefficient factor of -0.76

This strong negative correlation was expected as the higher the maize price, the higher the feed price and therefore the lower the profit, as costs will increase. The R^2 for these two factors was 0.5831. The higher the R^2 value, the higher the predictability of one factor towards the other. Therefore, there is a strong negative correlation, and the predictability is also high, indicating that the maize price will have a strong influence on the business. *See the graph of these two factors below:*

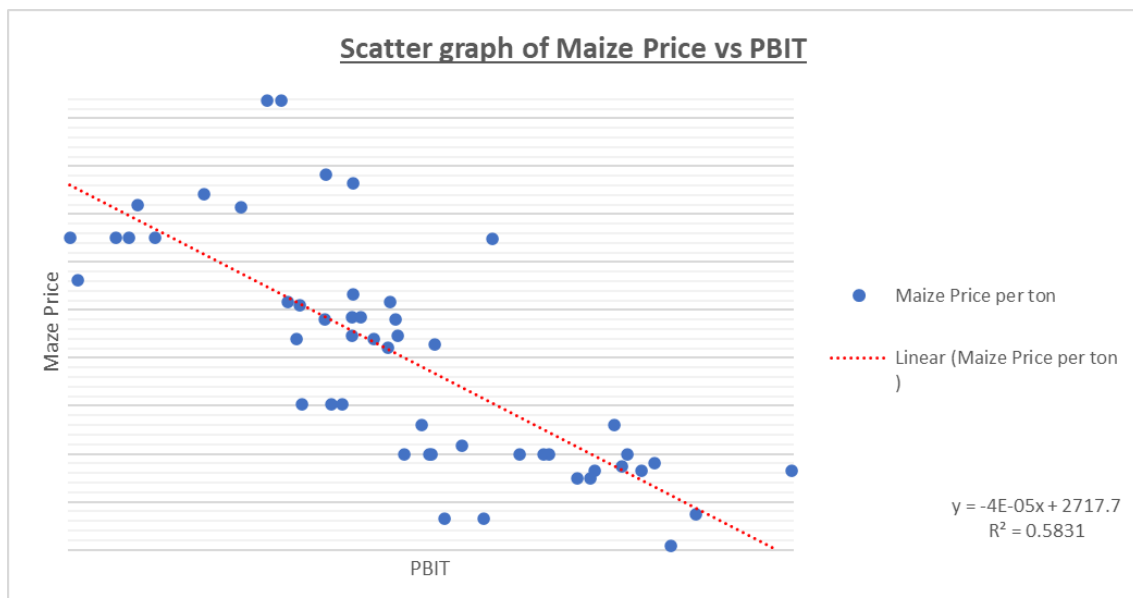


Figure 14: Scatter graph of Maize price vs PBIT

The slope of the linear line has a strong decline, indicating a strong negative correlation.

The correlation indicates that the higher the maize prices for the month, the lower the PBIT will be. This factor was mentioned by all the interviewees as the biggest influence on profitability in the poultry industry. This negative correlation was expected, as the higher the maize price, or input costs are, the lower the profit will be. To analyse this expected result, two linear regressions were carried out on the data: Firstly, maize price was used as the independent variable and PBIT as the dependent variable to determine whether maize price has a significant influence on PBIT. *The regression output is given in the table below:*

Table 22: Regression results: Maize Price (independent) vs PBIT (dependent)

<i>Regression Statistics</i>					
Multiple R	0.763630655				
R Square	0.583131777				
Adjusted R Square	0.574624263				
Standard Error	312.099936				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	6676538.494	6676538.494	68.54314034	7.17493E-11
Residual	49	4772912.134	97406.37007		
Total	50	11449450.63			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	2717.715532	50.90834406	53.38448111	4.39806E-45	
X Variable 1	-3.91459E-05	4.72829E-06	-8.279078472	7.17493E-11	

The large beta-coefficient value is indicative that maize price indeed has a causal influence on PBIT. The high p-value of more than 0.05 indicates that the result is not statistically significant though.

Following this, a linear regression analysis was carried out on the same dataset with PBIT set as the independent variable and maize price as the dependent variable, to determine whether there is a causal influence of PBIT on maize price. *The output is given in the table below:*

Table 23: Regression results: PBIT (independent) vs maize price (dependent)

<i>Regression Statistics</i>					
Multiple R	0.289384232				
R Square	0.083743234				
Adjusted R Square	0.065044116				
Standard Error	1226320.913				
Observations	51				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	6.73499E+12	6.73499E+12	4.478459108	0.039428995
Residual	49	7.36893E+13	1.50386E+12		
Total	50	8.04243E+13			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	11358713.26	922729.8758	12.30990083	1.31513E-16	
X Variable 1	-766.9660089	362.4197115	-2.116237016	0.039428995	

The large beta-coefficient value is indicative that PBIT does have a causal influence on maize price. The high p-value of less than 0.05 indicates that the result is statistically significant.

4.4.2 CONCLUSION ON SECONDARY FINANCIAL ANALYSIS

The following additional correlations were done:

- NSV & PBIT (net sales value & profit before income tax)
- Chick price & PBIT
- Feed price & PBIT
- Feed price & maize price
- Feed price & soybean price
- Maize price & PBIT

The results of these additional correlations were expected. The researcher was surprised by the strong correlations that exist between some of these factors and the correlation that some factors have on the profitability of the business. To confirm the statistical significance of these regressions, the beta-coefficient and the p-values were determined for different factors against each other.

The following findings were made:

- The net sales value has a causal influence on PBIT, although it is not statistically significant.
- The PBIT has a causal influence on net sales value, although it is not statistically significant.
- The chick price has a causal influence on PBIT, although it is not statistically significant.
- The PBIT has a causal influence on chick price, although it is not statistically significant.
- The feed price has a causal influence on PBIT, although it is not statistically significant.
- The PBIT has a causal influence on feed price, although it is not statistically significant.
- The maize price has a causal influence on feed price, although it is not statistically significant.
- The feed price has a causal influence on maize price, although it is not statistically significant.
- The soy price has a causal influence on feed price, although it is not statistically significant.
- The feed price has a causal influence on soy price, although it is not statistically significant.
- The maize price has a causal influence on PBIT, although it is not statistically significant.
- The PBIT has a causal influence on maize price, and it was found statistically significant.

The conclusion can be made that the factors in the secondary financial analysis have such a strong correlation and high predictability – although most were found to be not statistically significant, and specifically the feed price on profitability, that the unexpected results found during the primary financial analysis are explained by the secondary financial analysis.

It is now clear that there are factors that have a larger influence on profitability than inventory and forecasting, specifically for this poultry abattoir. Based on the findings of the secondary financial analysis, the researcher found it necessary to investigate the correlation between the actual financial figures and the budgeted financial figures.

4.5 CORRELATIONS BETWEEN ACTUALS vs BUDGETS

During the analysis of the data and figures as well as the analysis of the correlations between the different items evaluated, it became apparent that some financial figures, such as PBIT,

sometimes had negative values. Further to that, the formulas used to calculate the chi-values were directly influenced by these negative values.

Furthermore, problems were experienced where the PBIT values were correlated to, for instance, the NSV. The PBIT values were typically in the millions and the NSVs were typically quite low – between R15.00 and R23.00 per kilogram of product.

The way the expected values are calculated, as per literature, to obtain the chi-value, sometimes led to a negative NSV value, like when the PBIT was negative, which is not practical or applicable. Therefore, it was decided to calculate the correlation between the budget figures and the actual figures – specifically for financial results that cannot be a negative value, such as NSV or Feed prices.

4.5.1 PBIT: EXPECTED vs BUDGET vs ACTUAL

Below are graphs to display and compare the PBIT in terms of the calculated expected-, budget- and actual figures, obtained from the data gathered.

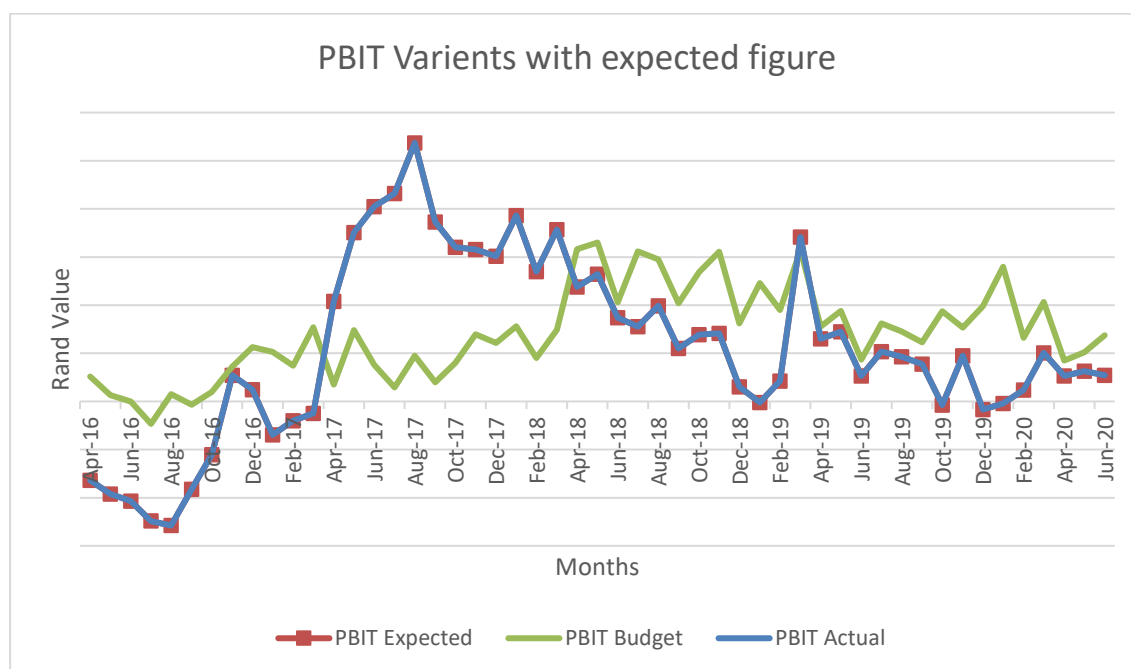


Figure 15: PBIT Variants with expected figure

Because the PBIT figure is so large, the calculated expected figures and the actual figures are directly on top of each other on the graph. Please note the orange markers on the graph underneath the blue line.

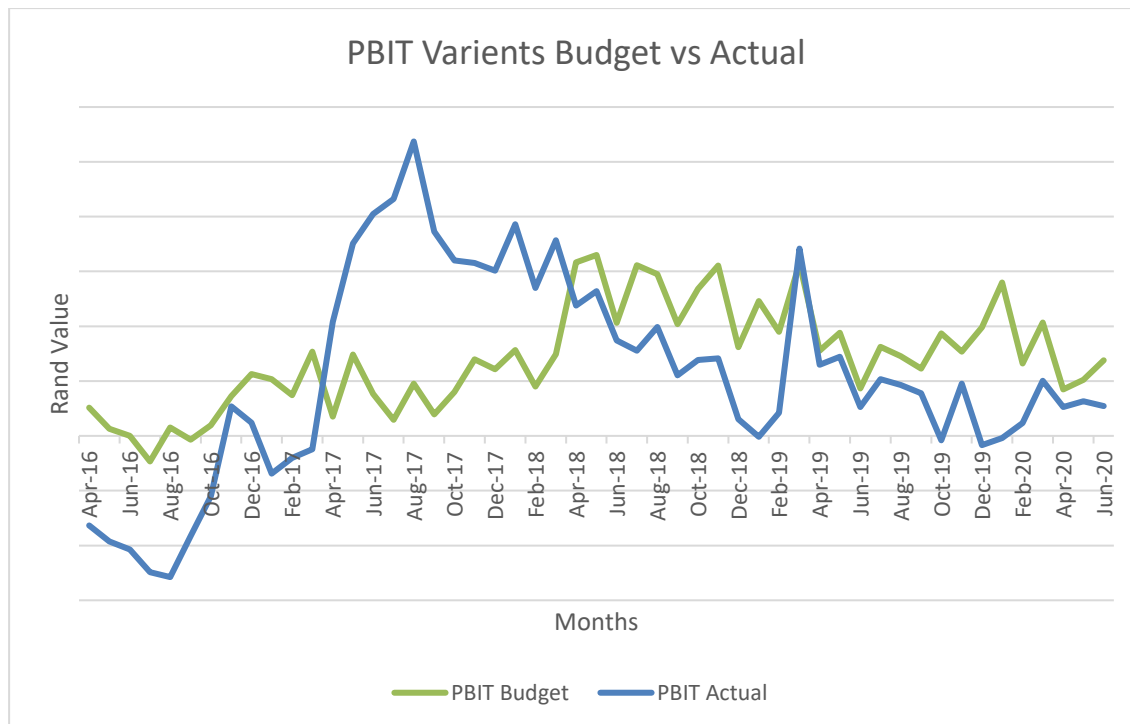


Figure 16: PBIT variants budget vs actual

In this graph, the PBIT calculated expected values are excluded. Only the actual and budgeted PBIT values are graphed. From the graph, it is clear that the budget and the actuals are at times quite far apart. The accuracy of the budgeting process is therefore questionable. The correlation between the budgeted PBIT and the actual PBIT was found relatively low at a correlation coefficient of only 0.312. The correlation between the actual PBIT and the calculated expected PBIT was found to be almost perfectly correlated with a correlation coefficient of almost a perfect 1.00. The way the expected value is calculated, based on literature, causes the PBIT, because the figure is so big, to be almost 1.00.

4.5.2 NSV: EXPECTED vs BUDGET vs ACTUAL

Below are graphs to display and compare the NSV in terms of the calculated expected-, budget- and actual figures, obtained from the data gathered.

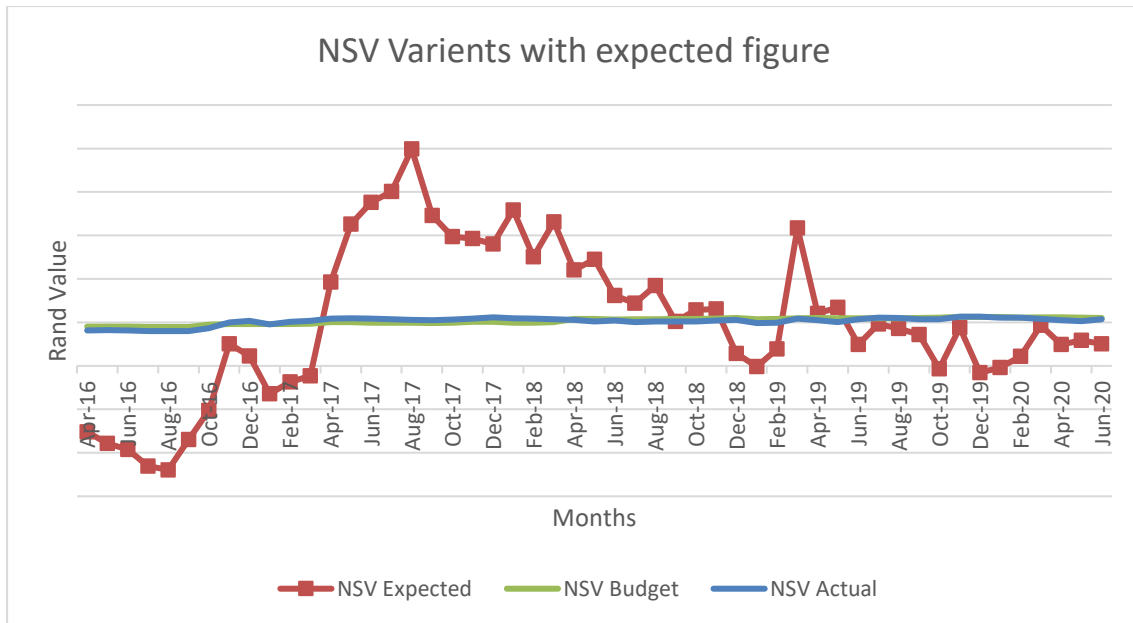


Figure 17: NSV variants with expected figure

Because the expected NSV is calculated making use of the PBIT figure, the calculated NSV figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT. Note how close the NSV budget line is to that of the NSV actual line on this graph.

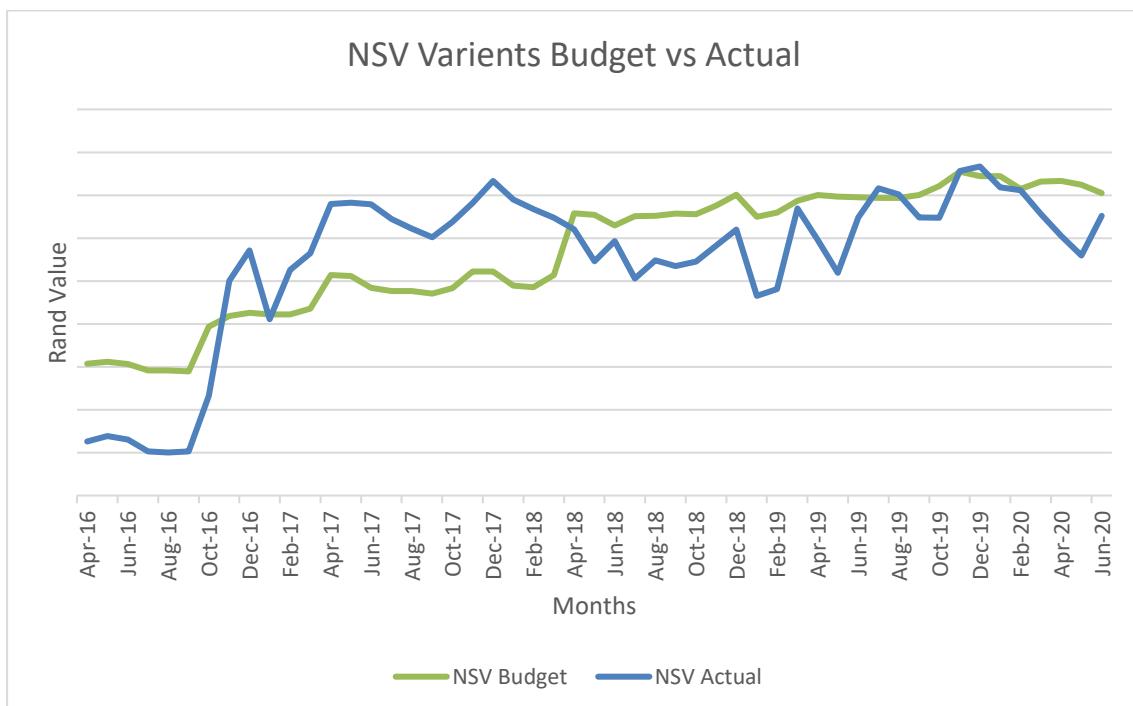


Figure 18: NSV variants budget vs actual

In this graph, the NSV calculated expected values are excluded. Only the actual and budgeted NSV values are graphed. From the graph, it is clear that the budget and the actuals are mostly quite close to each other. The budgeting process of the NSV seems to be in order. The correlation between the budgeted NSV and the actual NSV was found to be significant with a correlation coefficient of 0.705. The correlation between the actual NSV and the calculated expected NSV was found to be 0.692

4.5.3 CHICK PRICES: EXPECTED vs BUDGET vs ACTUAL

Below are graphs to display and compare the chick prices in terms of the calculated expected, budget- and actual figures, obtained from the data gathered.

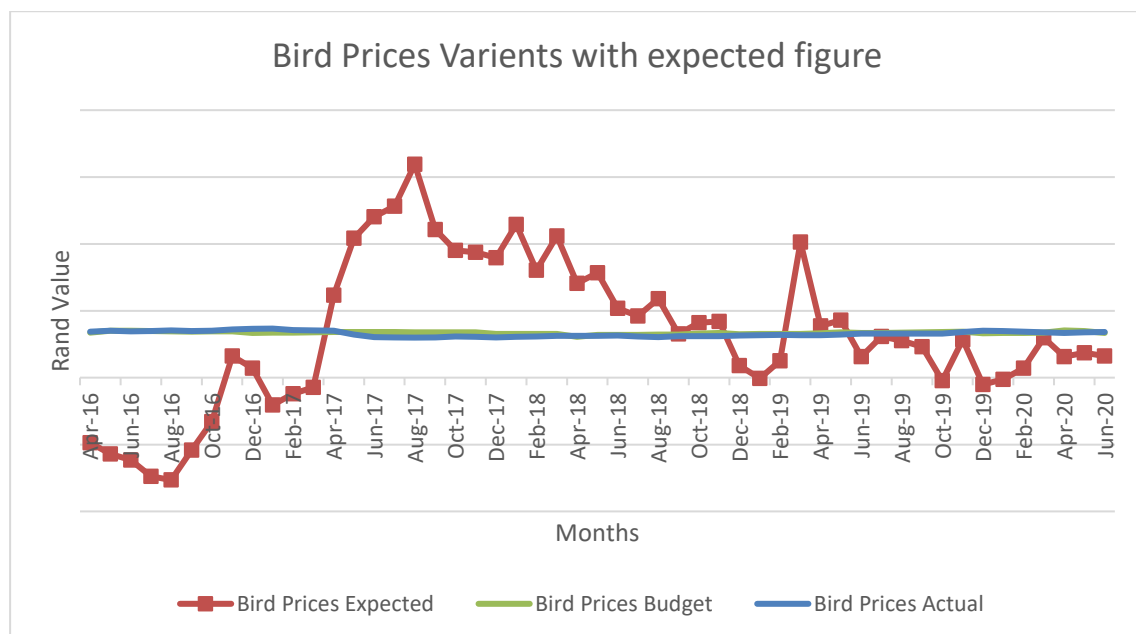


Figure 19: Bird prices variants with expected figure

Because the expected bird price is calculated making use of the PBIT figure, the calculated bird prices figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT. Note how close the bird price budget line is to that of the NSV actual line on this graph.

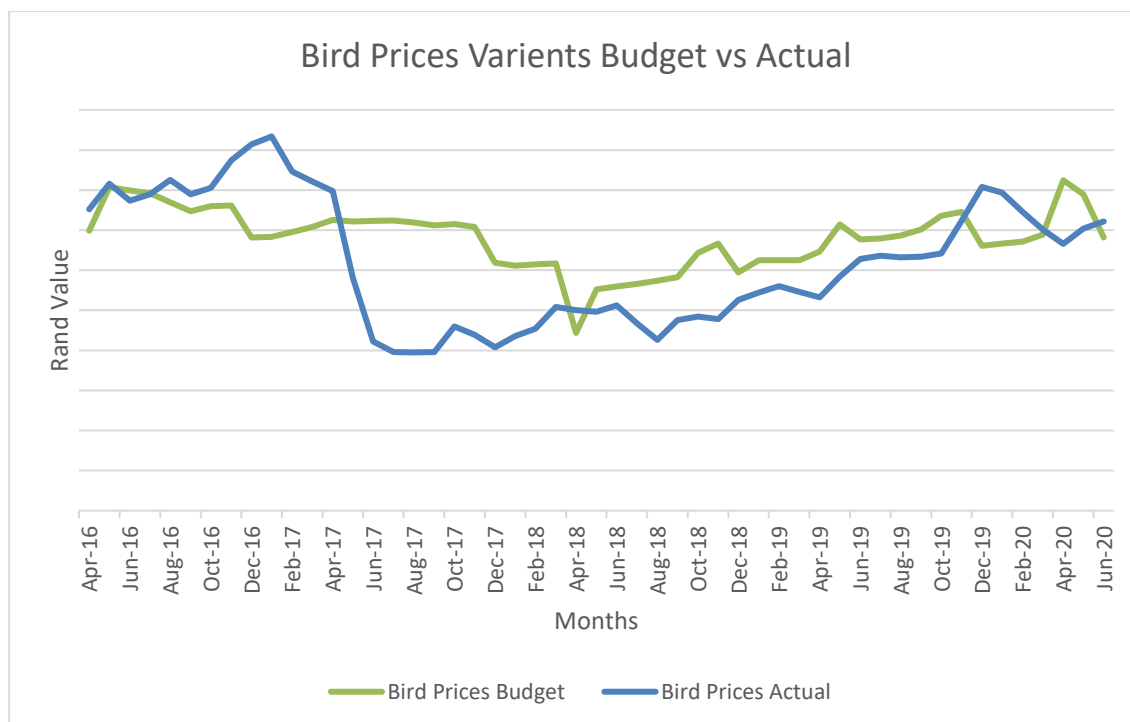


Figure 20: Bird prices variants budget vs actual

In this graph, the bird price calculated expected values are excluded. Only the actual and budgeted bird price values are graphed. From the graph, it is clear that the budget and the actuals are mostly quite close to each other. The budgeting process of the bird prices seems to be in order. The correlation between the budgeted bird prices and the actual bird prices was found to be significant with a correlation coefficient of 0.504. The correlation between the actual bird prices and the calculated expected bird prices was found to be -0.786. This negative correlation was caused by the negative PBIT figures used in the calculations.

4.5.4 FEED PRICES: EXPECTED vs BUDGET vs ACTUAL

Because the expected feed prices are calculated making use of the PBIT figure, the calculated feed prices figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT. Note how close the feed prices budget line is to that of the feed prices actual line on this graph.

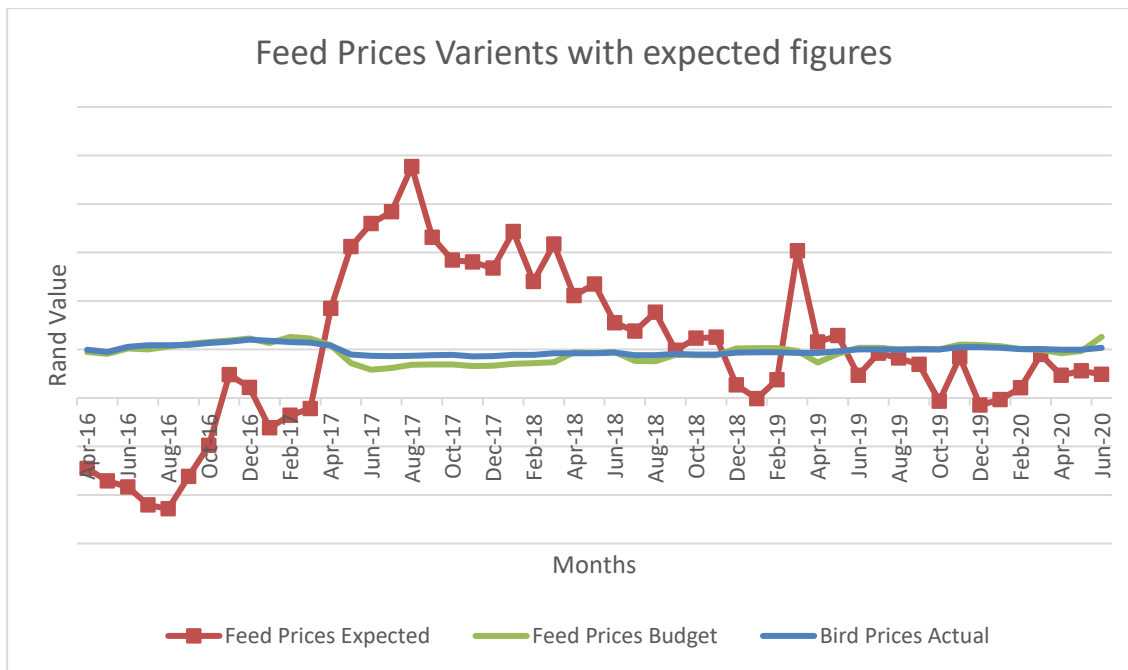


Figure 21: Feed prices variants with expected figure

Because the expected feed price is calculated making use of the PBIT figure, the calculated feed prices figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT. Note how close the feed price budget line is to that of the NSV actual line on this graph, with only the period from June 2017 to April 2018 that was significantly lower.

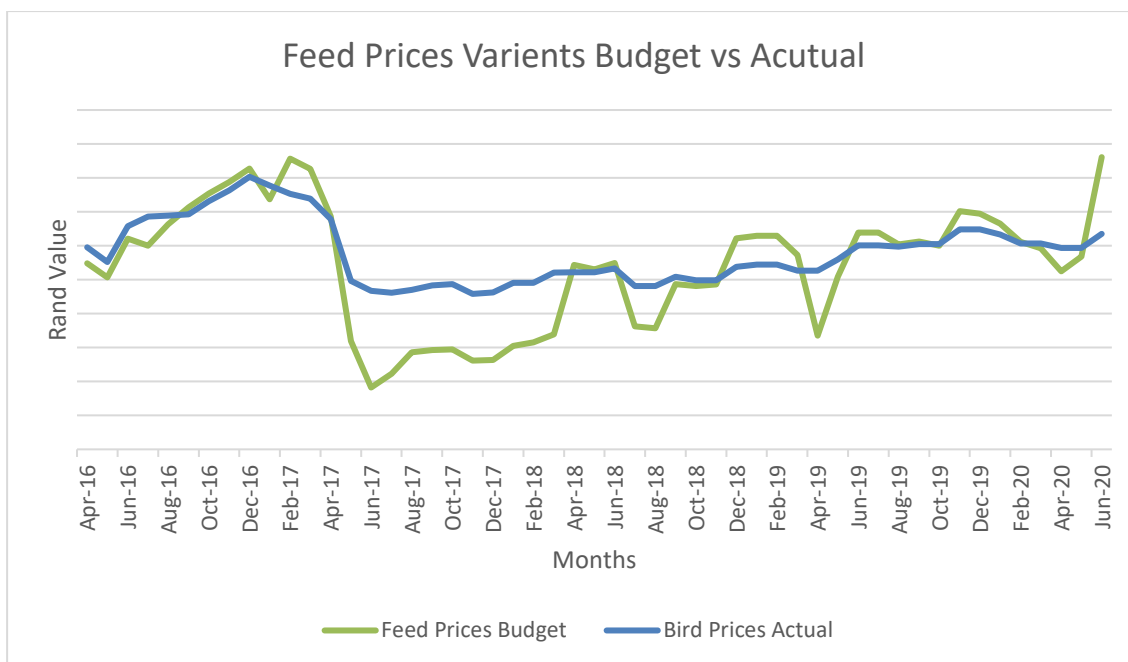


Figure 22: Feed prices variants budget vs actual

In this graph, the feed price calculated expected values are excluded. Only the actual and budgeted feed price values are graphed. From the graph, it is clear that the budget and the actuals are mostly quite close to each other, except for the period from June 2017 to April 2018 that was significantly lower. The budgeting process of the feed prices seems to be in order. The correlation between the budgeted feed prices and the actual feed prices was found to be significant with a correlation coefficient of 0.878. The correlation between the actual feed prices and the calculated expected feed prices was found to be -0.709. This negative correlation was caused by the negative PBIT figures used in the calculations.

4.5.5 MAIZE PRICES: EXPECTED vs BUDGET vs ACTUAL

Because the expected maize prices are calculated making use of the PBIT figure, the calculated maize prices figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT. Note how close the maize prices budget line is to that of the maize prices actual line on this graph.

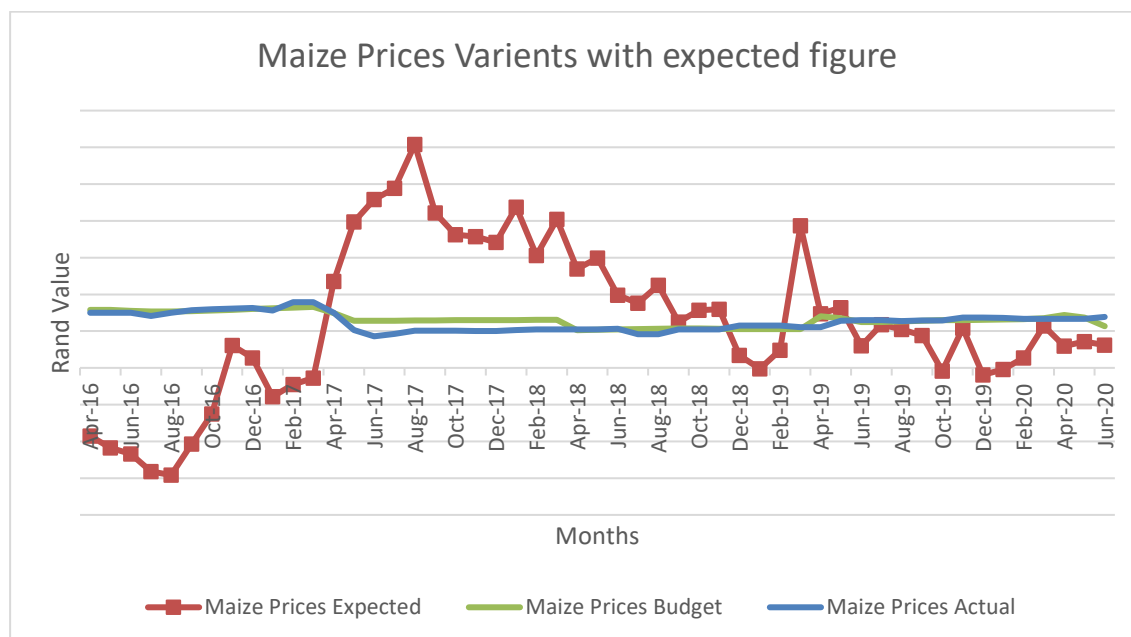


Figure 23: Maize prices variants with expected figure

Because the expected maize price is calculated making use of the PBIT figure, the calculated maize price figure is totally skew and inaccurate, sometimes being a negative figure and sometimes with huge variances, in line with that of the PBIT.

Note how close the maize price budget line is to that of the maize price actual line on this graph, with only the period from June 2017 to April 2018 that was significantly lower.

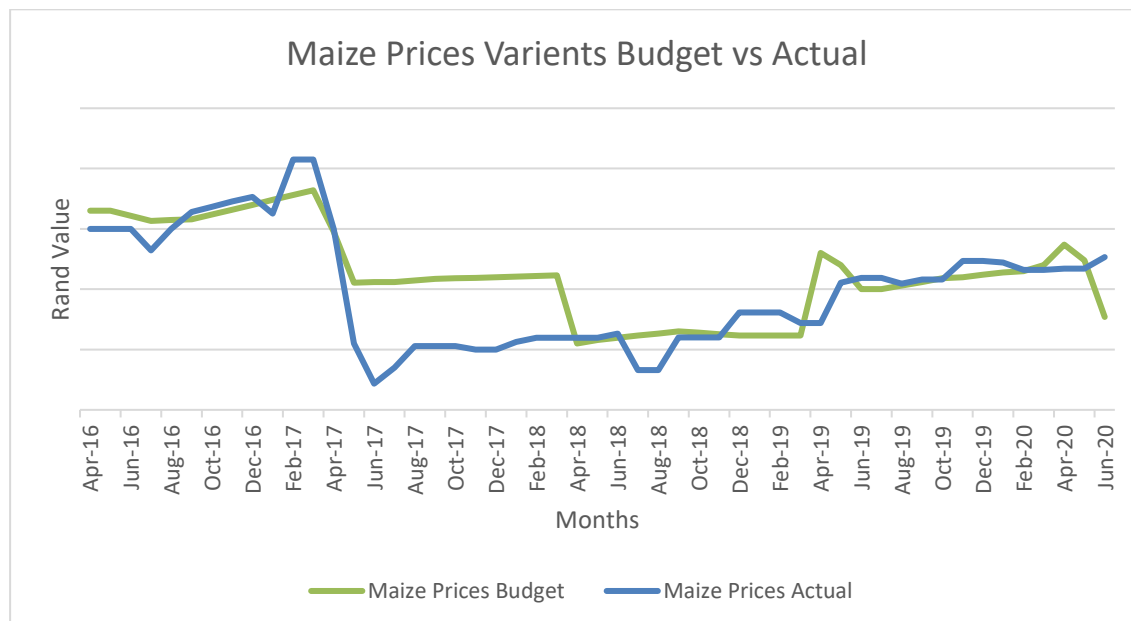


Figure 24: Maize prices variants budget vs actual

In this graph, the maize price calculated expected values are excluded. Only the actual and budgeted maize price values are graphed. From the graph, it is clear that the budget and the actuals are mostly quite close to each other, except for the period from June 2017 to April 2018 that was significantly lower. The budgeting process of the feed prices seems to be in order. The correlation between the budgeted maize prices and the actual maize prices was found to be significant with a correlation coefficient of 0.783. The correlation between the actual maize prices and the calculated expected maize prices was found to be -0.764. This negative correlation was caused by the negative PBIT figures used in the calculations.

4.5.6 CONCLUSION ON CORRELATION BETWEEN ACTUALS vs BUDGETS

Except for PBIT, most of the factors evaluated have a very good correlation between the budgeted figure and the actual figure. The PBIT, however, has a major role to play in all the calculations, as everything is measured against the PBIT. The fact that the PBIT figures are so big, as well as the fact that numerous of the PBIT figures are negative, does make the calculation of the expected figures on all factors inaccurate and not ideal to use.

It needs to be stated that the budgeted figures are based on assumptions of what will happen, which, in all practicality, is a forecasting process. The purpose of this study was primarily to investigate the influence of forecasting.

4.6 HYPOTHESES, CHI-SQUARE AND CRAMER'S V VALUES

The relationship between the two categorical variables was compared by making use of the chi-square statistic. The statistic was calculated by looking up the figure in a chi-square table. The given information utilised to look up the statistic was the degrees of freedom and the probability (Stephanie, 2020). As the data consist of 51 consecutive months, and two variables were used at a time, the degrees of freedom were calculated as 50. The probability used was 0.95. The chi-square value looked up in the table was 67.505 (NIST/SEMATECH, 2012).

The hypotheses were tested for each correlation and found to be as listed below.

4.6.1 PBIT & NSV

H_0 : PBIT and NSV are independent

H_1 : PBIT and NSV are NOT independent

Chi = 4.467

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between PBIT and NSV

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.000126

4.6.2 PBIT & CHICK PRICES

H_0 : PBIT and CHICK PRICES are independent

H_1 : PBIT and CHICK PRICES are NOT independent

Chi = 2.07

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between PBIT and CHICK PRICES

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 8.588

4.6.3 PBIT & FEED PRICES

H_0 : PBIT and FEED PRICES are independent

H_1 : PBIT and FEED PRICES are NOT independent

Chi = 3,864.36

Degrees of freedom = 50

Critical value = 67.505

Chi stat > Chi crit: REJECT H_1

There is therefore NOT a relationship between PBIT and FEED PRICES

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.003971

4.6.4 PBIT & MAIZE PRICES

H_0 : PBIT and MAIZE PRICES are independent

H_1 : PBIT and MAIZE PRICES are NOT independent

Chi = 1,879.15

Degrees of freedom = 50

Critical value = 67.505

Chi stat > Chi crit: REJECT H_1

There is therefore NOT a relationship between PBIT and MAIZE PRICES

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.002685

4.6.5 PBIT & TOTAL STORE VALUE

H_0 : PBIT and TOTAL STORE VALUE are independent

H_1 : PBIT and TOTAL STORE VALUE are NOT independent

Chi = -3,744,726,738.53

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between PBIT and TOTAL STORE VALUE

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.832575

4.6.6 PBIT & STOCK AVAILABILITY

H_0 : PBIT and STOCK AVAILABILITY are independent

H_1 : PBIT and STOCK AVAILABILITY are NOT independent

Chi = -125.92

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between PBIT and STOCK AVAILABILITY

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.832575

4.6.7 TURNOVER & STOCK AVAILABILITY

H_0 : TURNOVER and STOCK AVAILABILITY are independent

H_1 : TURNOVER and STOCK AVAILABILITY are NOT independent

Chi = 0.33

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between TURNOVER and STOCK AVAILABILITY

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 5.68

4.6.8 PBIT & PERSONNEL

H_0 : PBIT and PERSONNEL are independent

H_1 : PBIT and PERSONNEL are NOT independent

Chi = -200,657.92

Degrees of freedom = 50

Critical value = 67.505

Chi stat < Chi crit: REJECT H_0

There is therefore a relationship between PBIT and PERSONNEL

Numbers of rows: 51

Numbers of columns: 2

q: 2

Cramer's V: 0.026685

4.7 CONCLUSION FOR CHAPTER 4

In conclusion, it can be said that some unexpected correlations arise, but there were also some expected correlations established. At the same time, there were some causal relationships established. The statistically significant levels were also established.

The correlations and regressions are in line with what the interviewees said, and it was established that the feed price and more specifically the maize price had the biggest influence on profitability in the poultry industry. This correlation and influence are so strong that the inventory levels and the % stock availability do not show any correlation to profitability in the data used. Although a large beta-coefficient was found, it was not statistically significant.

Although the correlation between stores value and % stock availability toward PBIT and turnover is unexpectedly negative, it does not void the principal that lower costs will increase profits. In theory, the profits would have been much lower if the inventory levels were extra ordinarily high and/or if the % stock availability was extra ordinarily low. The other factors that have very strong correlation with profit, such as feed price and specifically maize prices, overshadow this correlation.

Although the lagging effect was also investigated during the analysis of the correlations, no mentionable lagging effect of different factors could have been established compared to each other. It can therefore be said that the data used are a true reflection of accurate cost allocation by this company's financial department in the month of occurrence.

It was also established that, overall, the budgeting process is fairly accurate as most of the factors looked at correlated very well between the budget figures and the actual result figures, with the only exception to be the PBIT.

In conclusion, three themes of concern, which were not expected at the start of this study, were identified during the analysis process. Theme 1: The importance of forecasting in inventory management is underestimated as, to date, no formal forecasting model has been introduced to be used in the business. Theme 2: The staff at the procurement function need to be upskilled to be able to utilise more complex forecasting models as, to date, all forecasting has only been done on normal Excel spreadsheets. Theme 3: Forecasting of other factors than that of inventory control needs to be improved, as these factors have a major influence on the business.

CHAPTER 5: RESEARCH FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

The results and findings of the different analyses will be discussed in this chapter. The problem statement and study objectives were evaluated and compared to the findings of this study. In the end, a conclusion will be drawn to establish to what degree the study reaches its objectives and answered the problem statement.

The literature review gave a solid basis to work from as the literature study was done using reputable sources with good insight. This can now be weighted up against findings made in this study by comparing the literature to the interviewees' responses and the technical analyses' results done on the reports and figures that were gathered.

Explanations of why all the technical analysis correlations are not in line with literature were given and further investigation on this was done. Maximising profitability will always be the main focus of any business and ways to do that will be established and striven towards at all times.

In the study done, the impact of inaccurate raw material forecasting could not have been established, as there are other factors that have a far greater influence on profitability than inventory levels and out-of-stock situations. The influence of over-stocked situations is discussed, but even that bears a minimal effect on overall profitability in comparison to other factors. This does not mean one should not focus on these factors as, in the end, it all adds up and only when all are aligned, then profitability will be maximised to the fullest.

5.2 ANALYSING AND DESCRIBING RESULTS

With the technical analysis done, it was found that there are strong correlations between PBIT and numerous factors. The factors with the highest correlation to PBIT were chick prices, feed prices (which include maize prices) and NSV. The store value of the dry goods store and the engineering store does have a positive correlation (this is against expectation), but it is much lower than other factors – indicating that the profitability of the company is therefore more dependent on other factors rather than inventory levels. In fact, the other factors have such a big influence on profitability that the inventory levels' influence is almost not mentionable. This is not supported by literature.

The objective of this study was to determine the potential influence of accurate raw material inventory forecasting on profitability. From literature, there is a potential influence between these factors. From this analysis, the correlation can be seen, but as mentioned by all the interviewees, there is a stronger correlation between profitability (PBIT) and highly correlated input costs (such as chick prices and feed prices) as well as NSV.

5.3 ANSWERING THE RESEARCH QUESTIONS

It is well established by the analysis done that accurate inventory forecasting does not have a significant influence on profitability in this company as there are other factors that have a far greater influence. Nonetheless, the research questions need to be answered and evaluated.

5.3.1 What are the general raw material inventory forecasting tools currently in use in the selected company?

It was established that this company does not make use of any formal forecasting model or program. Forecasting is based on making use of historical sales/usage data, considering minimum production run quantities of the suppliers. This is also influenced by minimum and maximum stock levels dictated by available storage space. This forecast is then compared to the production plan/sales forecast as supplied by the marketing team, and promotions, which might have a large impact, are then considered. This is all done manually on Microsoft Excel®.

Based on the literature study and the way the company approaches inventory forecasting of its raw materials, it can be said that the company makes use of the FIXED-PERIOD SYSTEM, as this system corresponds the closest to what is applied in practice in this company.

5.3.2 Which raw material inventory forecasting tool best suits the fast-moving consumer goods industry and more specifically, a poultry abattoir?

This research question will be best answered from the literature study, as there are no well-established forecasting tools in the company used in this study. Although it was not indicated in the correlation analysis, the carrying of inventory does have a negative effect on profitability.

Therefore, in theory, the less stock is carried in storage, the better – from a profitability point of view. In that case, the suggestion is made that the best model to use for inventory forecasting will be the JUST-IN-TIME model. This will keep the stock levels at the minimum level and will therefore have a positive effect on capital lying dormant in stores. *In practice and taking numerous aspects and factors into consideration, this will not be the best model for this specific company, for the following reasons:*

- Reitz, where this study was conducted, is situated in the rural area of the eastern Free State of South Africa.
- No supplier is close by to do small and quick deliveries.
- The local/provincial roads are not in good condition, often resulting in vehicle damage and breakdowns of delivery vehicles.
- The local distribution network of trucks is not trustworthy and more often than not, does not keep to delivery slot times.
- Bringing production to a standstill, because of raw material out-of-stock situation, has an enormous financial implication.
- Unreliability of suppliers, not delivering order in full as ordered.

It is the opinion of the researcher that the best model for raw material inventory forecasting to be used by this company used in this study will be the PROBABILISTIC MODEL.

5.3.3 Why does the identified raw material inventory forecasting tool work best in the poultry abattoir industry and more specifically, Grain Field Chickens?

There were several factors taken into account in order to recommend this raw material inventory forecasting tool for this company. *The researcher believes that the PROBABILISTIC MODEL will best suit the company as it has the following advantages that fit well with this company:*

- The demand for raw material is unknown, unstable, and difficult to predict with accuracy on a constant basis.
- Lead times from suppliers to the company are not always constant.
- Although this model makes use of difficult calculations, software programs can be purchased and used to make it easier to use.
- This model is a good fit where influencing factors are changing continuously – typical of the poultry industry.

5.3.4 What are the pros and cons of each raw material inventory forecasting tool that was identified/discussed in this study?

A variety of raw material inventory forecasting tools and models were discussed in detail in Chapter 2. *The following pros and cons were identified for the few raw material inventory forecasting models and tools that were evaluated in this study:*

- Economic order quantity (EOQ)
 - Advantage:
 - This model can practically be used for backordering
 - This model can handle different operational constraints
 - Disadvantage:
 - This model does make use of complex nonlinear calculations, which may be difficult to understand and apply by the user.
- Economic production quantity model (EPQ)
 - Advantage:
 - This model is relatively simple to understand
 - This model makes use of relatively less and simple calculations
 - Disadvantage:
 - This model does not take into account reworking of products that might be defective and do not conform to standards
- Just-in-time (JIT)
 - Advantage:
 - No storage is needed for inventory items, as it will be used as it is delivered.
 - The firm will make more money in the long term if it can get this to work correctly.
 - Disadvantage:
 - If the ordered inventory is not delivered just when needed, the total manufacturing unit comes to a standstill because of the lack of raw material.
 - Big losses may result in the total manufacturing line coming to a standstill
 - Reliable transport, distribution and deliveries are of the utmost importance, which is a general problem in South Africa.

- Production order quantity model
 - Advantage:
 - This model is good to use where and when there is a constant movement in inventory.
 - This model is also good to use when raw materials are received while finished products are been sold.
 - Disadvantage:
 - This model does not consider reworking of products that might be defective and do not conform to standards
- Probabilistic models
 - Advantage:
 - This model is used where the demand for a product is not known.
 - This model is ideal to use when lead times are not always constant.
 - Disadvantage:
 - This model is based on calculations of probability distribution, which may be difficult for some people to do
- Fixed-period models
 - Advantage:
 - Continuous inventory monitoring is not needed when this model is used as an order is only placed at the end of a specific, predetermined fixed period.
 - Disadvantage:
 - The order quantity is not always the same and out-of-stock situations might occur as stock is only counted after a fixed period.

5.3.5 What is the potential influence that different inventory forecasting models can have on profitability?

Given the different attributes of each inventory forecasting tool as discussed in Chapter 2, as well as the analysis of the data done in Chapter 4, with specific reference to the correlation that was drawn between store value, % stock availability and PBIT, it can be concluded that the accuracy of the raw material inventory forecasting does not play a pivotal role in the profitability of this specific company.

Although only theoretical, the cost of the inventory can be determined and the cost of carrying that inventory can be quantified. Under other circumstances and if the company could have made use of a JUST-IN-TIME model, the theoretical benefit on profitability could have been calculated as follows:

Table 24: Potential saving if JIT is used

	Avg Total Store Value per annum	Interest on overdraft	Potential saving if JIT is used
2016	13,261,805	10%	1,326,181
2017	17,092,982	10%	1,709,298
2018	19,229,090	10%	1,922,909
2019	21,319,378	10%	2,131,938

This is a purely theoretical and mathematical calculation and not obtainable for this specific company as explained earlier.

5.3.6 Is Grain Field Chickens utilising inventory forecasting effectively to maximise profitability?

NO, as Grain Field Chickens is not using any formal inventory forecasting model it can therefore not maximise profitability through inventory activities. It is believed that there is an opportunity to do this, although this study finds that there are numerous other factors that have a far greater influence on profitability than inventory levels.

These research questions are the study aim in question format. The aim of the study was achieved by answering the research questions. The researcher must state that the course of the study did lead to a new direction, with the result that additional factors were analysed and considered, which were not part of the original aim or research questions. After the primary financial analysis, it became important to conduct interviews with relevant employees of the company, and after the interviews, it became important to do a secondary financial analysis – the data were already available. From the company point of view, and to add value towards the company, this additional analysis was important to do to establish what is actually driving profitability.

5.4 LIMITATIONS OF THE STUDY

Inventory forecasting and inventory management are a critical role and part of the company used in this study as well as the industry that this company is situated in. The researcher found it fit to mention the following limitations that were experienced during this study.

- The poultry industry is in the FMCG (fast-moving consumer goods) field. To some degree, it is therefore expected that circumstances change often and quickly. This is then also the case in this company used in this study, but even more so, the supply and demand of products are ever changing, making accurate forecasting even more unpredictable. This changing demand happens at short intervals and without any warning. This results in overstocking on some items when the demand is not there anymore and a shortage of raw material when the demand suddenly is abnormally high. The only way to then prevent out-of-stock situations is to keep enough buffer stock and thereby increase inventory for raw materials.
- The outcome of this type of study might be different if using/studying another company, as this company is situated in a rural area of South Africa. This does not only influence lead times for orders, but also order quantities, as a big enough load first needs to be made up before delivery can be done.
- Much theoretical information is available on the topic researched, but only a limited quantity of practical research is available on this topic. Limited research leaves this researcher with limited direction and guidelines on how to perform in- depth research on this topic in a practical sense.
- The poultry industry was forced to stand together on issues such as product dumping, but at plant level, it is all for itself and the different facilities are not eager to share information such as financial statements and other figures that the researcher used in this study. Therefore, the researcher only made use of one company's figures.
- In the poultry industry, profitability is influenced in a much larger degree by other factors than by inventory levels, making it a difficult topic to research in this industry, leading to no clear conclusion as theoretically expected.
- The results presented would have been much more explicit if the actual values were used, but this was unfortunately not allowed by the mandate given by the company to the researcher.

5.5 FINAL CONCLUSION

In conclusion of this study, the researcher needs to consider whether inventory forecasting does influence profitability. The immediate, logical and gut-feel answer will be an overwhelming YES! In retrospect, it was learned that this is not easy to prove or to establish the impact that inventory forecasting has on profitability – for the poultry industry, anyway, as it pales against the influence that many other variables have on profitability.

During this study, three approaches were followed. The first was a thorough literature study to learn the different forecasting models and what the impact of inventory is on profitability. The researcher found this insightful. The second approach was open-ended interviews with strategically identified stakeholders in the company as well as an expert opinion of a well-recognised person in the industry. All these interviewees have vast experience and knowledge of the poultry industry with many years of experience. During these interviews, the researcher came to realise that there are more factors that influence profitability than just inventory levels. The third approach was the analysis of the financial figures. During these analyses, the researcher came to realise to what extent other factors influence profitability, much more than inventory levels.

It is the opinion of the researcher that inventory forecasting will influence profitability, but in the poultry industry, and more specifically for Grain Field Chickens, situated in a rural area, the influence on profitability is much bigger from other factors than that of inventory forecasting and inventory levels.

Given the fact that the poultry industry is a high-volume low margin industry, it is important to save all costs where possible. With that said, it is important to control and manage inventory levels to the lowest possible level to maximise profitability, even if it is only the case from a literature point of view, as well as managing the other larger contributors to profitability at the same time.

The researcher believes that the PROBABILISTIC MODEL will best suit this specific company in order to do accurate raw material inventory forecasting. *This model is ideal, as it fit the circumstances of the company the best, taking into consideration:*

- The demand for raw material is unknown, unstable and difficult to predict with accuracy on a constant basis.
- Lead times from suppliers to the company are not always constant.
- Although this model makes use of difficult calculations, software programs can be purchased and used to make it easier to use.

- This model is a good fit where influencing factors are changing continuously – typical of the poultry industry.

5.6 RECOMMENDATIONS FOR FURTHER RESEARCH

Numerous factors influence the profitability of a business in the poultry industry. Although there is no doubt that inventory forecasting will influence profitability for a business, there are other factors that do have a much larger/bigger influence. Further research on this topic can be undertaken on an abattoir that is not situated in such a rural area such as Grain Field Chickens is, to see the effect that lower inventory levels have on profitability. An abattoir that is situated in or close to the city will be able to carry much less inventory as delivery lead times and delivery lot sizes will be significantly lower.

Another interesting topic to possibly investigate is the influence of inventory on cashflow, and not just profitability as such. This might be a more applicable approach than the influence of inventory on profitability, especially because there are so many directly influencing factors on profitability in the poultry industry.

Further research on the current topic can also be undertaken on a business that does not have so many other influencing factors on profitability – a business that is largely influenced by inventory levels in terms of profitability; a business that is in the storage of goods industry. In such a study, a more direct and clearer conclusion of the impact of inventory levels will be seen.

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ANNEXURE A – LANGUAGE EDITING CERTIFICATE

To whom it may concern

Cecile van Zyl
Language editing and translation
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11 September 2020

Dear Mr / Ms

Re: Language editing of mini-dissertation: The potential influence of inventory forecasting on profitability

I hereby declare that I language edited the above-mentioned mini-dissertation by Mr JH Dorfling (student number: 33468974).

Please feel free to contact me should you have any enquiries.

Kind regards



|

Cecile van Zyl
Language practitioner
BA (PU for CHE); BA honours (NWU); MA (NWU)
SATI number: 1002391

ANNEXURE B – TURNITIN REPORT

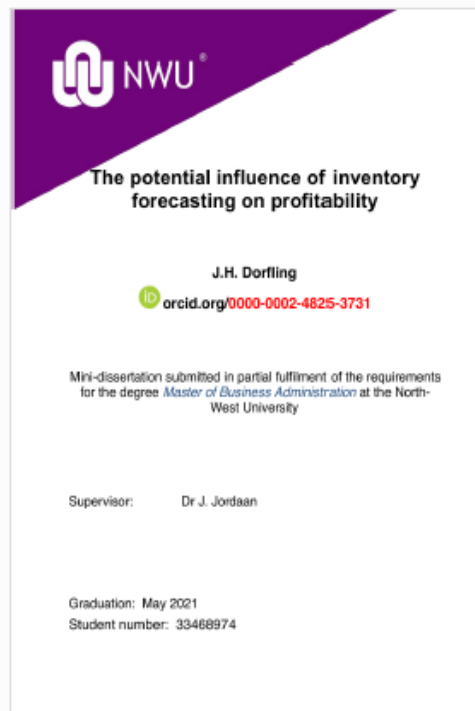


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