

**A STUDY OF MODERN METHODS OF BROILER PRODUCTION AND ITS IMPACT ON
EFFICIENCY IN ZAMBIA**

A QUALITATIVE CASE STUDY

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ABSTRACT

Title of Study: A STUDY OF MODERN METHODS OF BROILER PRODUCTION AND ITS IMPACT ON EFFICIENCY IN ZAMBIA

Background

Zamchick Ltd is a private limited company located in Zambia and incorporated in 2013. The company's principal business consists of rearing and processing chickens for sale to the public. In 2014, the company upgraded two sites at Kachele to semi-controlled houses by converting existing ordinary poultry houses. Kachele has three sites consisting of 10 poultry houses, each.

Purpose of Study:

The purpose of this qualitative case study was to explore strategies that Zamchick could use to increase the benefits including profit margins from implementing modern methods. The results of this study are aimed at assisting the company improve performance and ultimately increase productivity. The increase in productivity is expected to lead to the achievement of the management preset performance indicators. This situation arises from the upgraded poultry houses that were fitted with modern facilities in 2014 in Chisamba District that were not achieving reduced production costs and improved efficiency.

Method:

A qualitative case study approach was adopted to gain experiential knowledge insights from the accounts of 16 members of Zamchick employed at four rearing sites as participants. The study also relied on company records that provided results of feed conversion ratio (FCR) mortality, and live weights of each of the four studied sites.

Findings:

The findings from this study revealed that placement density in modernised facilities was 66.67% more per square meter than old facilities. Additionally, workers in the same facilities managed 2.7 times more birds than their counterparts using the old facilities. FCR, mortality, and live weights were better in modern houses, whereas weather conditions did not impact performance. The study also revealed the importance of training that equips the employees with knowledge about the new techniques. The study further demonstrated that there was lack of a formalised in-house continuous training program that should improve and upgrade the skills of the employees on new methods in the industry which could have helped improve performance.

Limitations:

The study has been specific to the performance measurements at Zamchick, and no consideration has been given to other organisations involved in poultry rearing methods of measurements. As a result, the study has been deprived of these other organisations' experiences and learning. However, the study will generate knowledge that will be useful to all

poultry farmers. The action research cycles were not completed in full as the researcher could not implement all the recommendations.

Implications:

The implications of this study are aimed at assisting farmers gain knowledge about modern techniques and the ability to understand what to look out for in their business. With this newly acquired knowledge, they will engage the manufacturers/suppliers more objectively in requesting for more information and clarification on their products and how these products will support their bid to improve efficiency.

Recommendations:

Training of workers operating the equipment should be implemented and be continuously reviewed to ensure that it remains relevant and specific. The strategies for addressing heat stress in the birds should be considered alongside the cost of mortality and the negative impact of feed breaks, and the suggested reduced placement density. This is because feed breaks and reduced placement density as methods of dealing with heat stress have cost implications whose impact must be measured against the birds' cost of mortality.

DEDICATION

This is dedicated to two women in my life: my mother whose understanding of academics was very deep and focused even though she did not have any of it; and my grandmother, a person I have never seen, who fled apartheid seeking peace and whose sacrifice for life was so profound that she was able to do it for her only son in a place she considered so peaceful and remote from her origins.

To my four wonderful children whose being has provided the motivation and my wife whose constant presence made this possible.

To my late, father who I wish was still here to provide his usual checks and balances

List of Acronyms Used

Acronym	Description
AGM	Annual General Meeting
ANOVA	Analysis of Variances
DEG	German Investment Corporation
EU	European Union
FCR	Feed Conversion Ratio
IFC	International Finance Corporation
Kgs	Kilograms
PAZ	Poultry Association of Zambia
PLC	Public Limited Company
RCL	Rainbow Chickens Limited
SDS	Sudden Death Syndrome
SPSS	Statistical Package for the Social Sciences
Sq. Mtr.	Square meter
UK	United Kingdom
ZEMA	Zambia Environmental Management Agency
ZNFU	Zambia National Farmers Union
#	Number

CHAPTER 1

Purpose of Study

1.1 Introduction

This study examines the practice of broiler chicken rearing in the poultry industry in Zambia. The study has used Zamchick as a study area to undertake this exercise. Zamchick is a private limited company located in Zambia and incorporated in 2013. The company manages numerous sites (see appendix 17 for the sites) in Chisamba where poultry houses are situated, and they also have a chicken abattoir where the chickens are slaughtered and processed for distribution to the public for sale.

At the time of incorporation, the holding company Zambeef transferred over its poultry division to Zamchick in a bid to optimise the operations and improve the performance of the poultry business. The holding company appointed dedicated managers to ensure effective management and supervision of the operations.

The layout of this chapter begins with the background of the study, followed by the problem statement and purpose of the study as it relates to Zamchick and its chicken-rearing business. The chapter further discusses the motivation for undertaking this study using the evidence that will be collected to advance practical recommendations and gain insights into the operations of the organization's chicken rearing section. The insights that will be gained from this study will assist in providing collaborative measures that can help improve the operations of the chicken-rearing business. The study will further contribute to the body of knowledge in the poultry rearing business in Zambia.

A brief discussion on the methodology and the assumptions will be had to guide how the study will explore and examine the evidence that will be collected, and this will include the experiential knowledge of the participants (employees of Zamchick) in the study.

1.2 Background: The Zamchick Case.

The Poultry Association of Zambia (PAZ) at its AGM of 2014 reported that Zambia recorded increased poultry production of 140% between 2010 and 2014. This increase was firstly attributable to increased disposal incomes as the country was before this period (2010 and 2014) upgraded by the World Bank from a lower-income nation to a middle-income nation. Secondly, the association reported an increase in the national population which might have contributed to the increase in the demand for poultry products. Additionally, PAZ also reported that the nation's cheapest source of protein is chicken as compared to pork, lamb, and beef hence the preference for chicken meat by the consumers.

At the time of incorporating Zamchick, management of Zambeef Products Plc had noted the increase in poultry demand and positioned themselves to take advantage of the increased business. In a bid to achieve the goals of the holding company, Zamchick engaged third-party chicken growers (outsourced production facilities) as an immediate step to increase

production. They also embarked on a modernization program immediately after incorporation in 2013 by converting ordinary poultry houses to semi-controlled houses. Kachele sites were selected as suitable areas to undertake this exercise of modernization. At the same time, the company entered a partnership with RCL of South Africa for purposes of knowledge and technology transfer in the poultry business industry. This was done with the realization of the fact that the performance of the company could be enhanced by adopting new technology and ensuring that all the employees possess current and updated knowledge and skills in the industry. This was also done in recognition of the criticality of business growth, production, efficiency, and sustainability.

The partnership with RCL was significant as it brought on board a player in the poultry business who had a lot of experience with the new techniques and had the knowledge and skills to pass on to the Zamchick employees. With their experience, RCL were knowledgeable about the latest technology in the industry and were competent to guide on which technology to adopt with its possible potential competitiveness and benefits to the company.

Resulting from the modernization program, two sites B and C at Kachele were upgraded and this led to an increase in production of about 33% for the two sites. At the time of the upgrade, the suppliers of the equipment provided the following as the features of the newly refurbished/upgraded houses:

- a. Temperature in the houses would be regulated through computer software that would trigger the extraction fans to draw air from the house if the temperature was high. If it was cold, the software would automatically switch on the coal heating facility to blow warm air into the house to provide warmth.
- b. Feed would be automatically fed into the house using a pump that was mounted just below the bulk feed tank.
- c. Water would be automatically supplied through pressured pumps that supply water using the nipple system in the houses.

In comparison, the old ordinary houses had the following features:

- a. Temperatures were manually monitored using thermometers and where there were adverse changes in the temperatures, interventions were done through opening of the curtains that cover the open spaces to allow more air into the houses to provide cooling or closing the curtains and providing heat to the houses using charcoal braziers.
- b. Feeding was done through feeders spaced out in the houses where feed is manually filled into the feeders and the attendant (poultry man) had to monitor on a regular basis to top up on the feed if it ran out.
- c. Water was manually supplied to the drinkers spaced out in the poultry house, and the attendant has to monitor on a regular basis to ensure that water runs out.

Zamchick recorded increased production of 56% between 2013 and 2014 achieved in part by engaging third-party growers (also called contract farmers or out growers) and modernization of Kachele B and C.

1.3 Motivation of the study

Poultry farming is a business that should generate income to sustain its operations and re-investment for the growth of the business. Zamchick's initial strategy in 2013 and 2014 to grow the business through modernisation of its existing infrastructure coupled with outsourcing by engaging third-party growers is what motivated this study. The researcher was keen to learn and understand how companies respond to a situation where modernisation despite delivering increased production fails to achieve efficiency as was the case for Zamchick.

This approach to problem solving that was adopted by Zamchick, is the traditional approach that does not consider the human resource factor, given that problems in real life situations evolve, and so do the issues that are encountered and intended to be resolved. The initial motive of increasing productions levels was achieved by the two methods that were employed of modernizing the two sites and outsourcing of production facilities that resulted in the engagement of third-party chicken growers. However, the expected improvement in efficiency that should go along with modernized facilities were not achieved, and this was seen through higher-than-expected mortality; poor FCR and comparatively lower weights of the birds. From the perspective of Zamchick, modernization was failing them.

At the time of implementing the modernization program, management was aware that they needed to train the employees on the new equipment but were not knowledgeable that this training program required the input of the employees at planning, design, and implementation stages. Further that the training program should have been planned and designed to be on a continuous basis than a one off. Additionally, the program should have been designed to provide for re-training to continuously upgrade the skills of the employees with new methods as well as ensure that in the event of employees leaving employment, the replacements were trained as well as everyone else on site and ensure retention of the knowledge gained in the process.

Furthermore, management was not aware that programs of this nature require a collaborative approach as the changes that result from such would lead to learning. Learning and improvements, which is what modernization achieves, go along together, and are related. In this regard, Coughlan and Coghlan (2009) suggests that improvements are possible in learning just as much as learning is possible in improvements, provided that in each case, reflection on the experience prevails, such that there is an opportunity to explore and take advantage of the learning that results there from.

This study will contribute to the improvement of management practice in the poultry sector, beyond intuition and experience to an evidenced-based approach to assess and analyse organisational learning initiatives so as to provide feasible and sustainable recommendations for the improvement of the operations of the business. Furthermore, the study will depend on empirical evidence collected from the employees running the operations, which evidence should facilitate collective learning and knowledge creation that is critical for helping to resolve problems faced by the company.

The researcher, being an executive member of the holding company, will gain experiential knowledge from the engagement in the study. Additionally, the study offers him the opportunity for critical reflection and questioning of long-held assumptions and thoughts of being a leader.

1.4 The Case for Modernisation

Brown et al., (1999) state that in predominantly low-income societies, increases in income lead to a remarkable change in dietary preferences with a favour for livestock products. Further, transformation is more visible in areas where the population is increasing. Cobb et al., (1999) also state that rising population numbers and the apparent changing weather patterns have increased the calls for enhanced food production to meet the demands of the people. This brings in the aspect of food security, to which Cobb et al., (1999) add that food should be produced efficiently with minimum use of natural resources.

The need to increase food production to meet the demands of a rising population in the face of adverse weather patterns has been addressed through modernisation (Sahai 2010). Improvements in the agriculture industry have been targeted towards increased production, improved yields and the ability to control diseases (Sahai 2010). In addition, Sahai (2010) advances that genetic modification has led to an increase in the production yields and the resistance to diseases. Also, in response to the Rio Conference under agenda 21 (Cobb et al., 1999), member countries in an effort to address anticipated food shortages, proposed the following:

- a. That member countries should strive to efficiently provide good quality food;
- b. That in doing so, there should be minimum utilisation of natural resources;
- c. That soil, water and air quality should be safeguarded and;
- d. That efforts should be made to enhance biodiversity and landscape quality.

Improved agricultural practices have been identified as the driving force in the development of the poultry sector in the UK (Yakovleva and Flynn 2004) as the modern methods of bird management with reduced human involvement accounted for increased output and productivity. The poultry industry is a subsector of the agriculture industry, which is made up of two sections; poultry meat production (broilers) and egg production (layers) (Corkery et al., 2013). The increase in output facilitated by using modern techniques enhanced the management of larger volumes of birds, which is what resulted in increased production.

The adoption of modern technology has been enhanced by the nature of poultry production (Corkery et al., 2013). This is because there is worldwide acknowledgement in this sector that poultry farmers are under constant pressure from increases in production costs and that requires production facilities to be managed efficiently and cost-effectively (Corkery et al., 2013). Corkery et al., (2013) further add that the ever-rising energy and commodity prices are the main reason for the pressure on production costs. This has led to development of modern techniques in the industry to optimise production proficiency and improve cost efficiency to make the industry more competitive (Sahai 2010; Cobb et al., 1999; Corkery et al., 2013). Additionally, as stated by Christensen and van Bever (2014), efficiency should result in reduced

production costs that should help in lowering selling prices for the poultry products and hence improving the competitiveness of the sector.

While adoption of improved methods may help to optimise production and employees' skills, modernisation of production facilities follows the presence of the "technology treadmill" (Kusz 2014). The technology treadmill requires constantly keeping up with technological progress and sometimes spearheading the technology race (Kusz 2014). Therefore, as much as the adoption of modern technology is intended for improved production efficiency, there is also a tendency to be caught up in the technology treadmill as stated by Kusz (2014). This then implies that the focus of modernisation shifts from optimisation of the production process and the learnings that will result there from, to constantly keeping up with technology advancement. This approach also ignores the objective method of cost benefit analysis that evaluates the benefits against the costs before implementing a new technique. Additionally, Kusz (2014) suggest that the process of modernisation that is appropriately implemented can lead to an improvement in management, working conditions and job satisfaction of the employees. This is because an appropriately designed process will ensure the up scaling of employees' skills through training and include their input in the implementation process. Employee job satisfaction will result from the training and knowledge that will be passed on during the training process. The training and knowledge transfer will create belief in the new methods and help in making the methods work. On the other hand, a design and implementation process that is not appropriately done will have unfavourable consequences as the employees will not have the relevant skills to manage the new equipment (Kusz 2014; Truong and Yamada 2002).

Animal welfare activities have insisted on the inclusion of poultry welfare in modern techniques and these inclusions have resulted in the recommendation for reduced placement of birds per square meter (Sassi et al., 2016). Increased placement as highlighted above has been the hallmark of modernisation, which is to increase production and use enhanced volumes to mitigate costs besides the promotion of production proficiency.

1.5 Problem Statement

The general business problem is that modern techniques in the poultry rearing industry do not provide the perceived cost savings and enhanced efficiency (Corkery et al., 2013 (a); Corkery et al., 2013 (b)) when compared to the facilities that they replace. According to Yakovleva and Flynn (2004), modernisation facilitates increased production through higher density placements of birds per square meter (Strbic et al., 2009), but there is no information as to the extent that these new methods increase FCR, live weight, and mortality of the birds when compared to the old methods (Corkery et al., 2013). "Increases in fuel and feed prices have placed a significant burden on poultry farmers globally" (Corkery et al., 2013 pp1), and to address this, farmers have to optimise performance on broiler production. To do this, they require information on bird performance and energy consumption when they apply modern methods, but this is unknown hence leading them to make uninformed management decisions on their investment (Corkery et al., 2013).

According to Yakovleva and Flynn (2004), poultry farmers have turned to modernisation to address inefficiency challenges and ever-rising production costs. Cobb et al., (1999); Costa et

al., (2008) add to this argument in a different way by suggesting that farmers' employment of modern techniques has increased production to meet increased demands arising from the increase in population. On the other hand, Kusz (2004) suggests that farmers' situation is of optimizing production efficiency coupled with population increase resulting in increased demand for poultry products. This increase in demand has pressured poultry farmers to use modern methods to increase production and, at the same time, efficiency. However, the impact and effect of these modern methods of production on how the birds perform in response, are not known, and farmers, as a result, face the dilemma of making investment decisions without full information on the benefits that would accrue to them (Corkery et al., 2013). This situation is further compounded by the globally increased commodity prices that have led to increased feed costs. This aspect has compelled poultry farmers to manage their production facilities efficiently and cost-effectively (Fitzgerald et al., (2013); Corkery et al., 2013). Silbergeld (2016) looks at this issue differently and suggests that increased urbanisation leading to enhanced affluence and changes in food preference and consumption pattern has increased demand for poultry products, which has compelled farmers to look for methods of increasing production without incurring additional costs.

Cobb et al., (1999), however, argues that the quest for modernisation is due to the anticipated food shortages arising from the increase in population and the adverse changes in weather patterns that threaten food production. What may compound the situation is the nature of the poultry industry's production process that requires poultry farmers to run their facilities efficiently and cost-effectively. In this regard, Corkery et al., (2013) stress that in the face of high energy and rising production costs, it becomes imperative that the industry operates to its highest efficiency standards if it is to remain competitive with other meat products and producers. Additionally, and as suggested by Christensen and Bever (2014), efficiency in the production process should reduce costs and improve the poultry sector's competitiveness. Arising out of this situation, farmers are under many pressures to increase production and at the same time increase or maintain efficiency and cost control, but have little opportunity or information to assess new technologies. This implies that they are often compelled to adopt new technologies simply to make sure they continue to compete without knowing their actual benefits.

The specific business problem is that the newly upgraded poultry houses fitted with modern facilities in 2014 in Chisamba District were not achieving reduced production costs and improved efficiency, resulting in reduced profit margins compared to the old houses. Zamchick undertook a modernisation program in 2014, which resulted in the upgrade of two sites at Kachele. Zamchick upgraded the facilities by converting ordinary houses to semi-environmentally controlled houses.

1.5 Purpose of the Study

The purpose of this qualitative case study is to explore strategies can be used by Zamchick to increase the benefits from implementing modern methods. One goal is increased productivity that may lead to efficiency and achievement of performance targets of FCR, live weight and mortality (as prescribed by management) of the birds delivered to the poultry abattoir for slaughter and processing. Furthermore, to understand why the implemented technology is not

delivering the benefits and how to optimise its usage. The strategies will therefore be aimed at performance improvement that should lead to increased profit margins.

1.6 Research Question

Creswell (2012), states that a good research question in a qualitative study should consist of a central question and sub-questions. And Britten (1995) and Creswell (2013) further add that good questions should be open-ended, and, in this regard, the general research question will be: **“What strategies can be used by Zamchick to increase the benefits including profit margins from implementing modern methods?”** To this question, three sub-questions will be added as follows:

- a. **What factors are preventing Zamchick from realising the benefits of modern methods?**
- b. **What actions need to be taken to realise the benefits?**
- c. **What strategies can Zamchick implement to be more ready for future change?**

The research is focused on generating data and conclusions from the above general research question and the three additional sub-questions.

1.7 Research Methodology

The study uses a qualitative case study method using face-to-face semi-structured interviews, observation of work processes, focus groups and company records. Arising out of observation will be action research that will facilitate the engagement with the participants to provide a rich description of real-life experiences and learning. The focus group meetings will bring out group dynamics where group discussions will be used as a source of primary data.

The study seeks to find practical solutions by examining real-life events and situations coupled with company records as it relates to poultry rearing. It will also apply action research in a bid to enhance action learning. Some acceptable suggested solutions would be implemented on-site while others would be left to management to implement.

The characterisation of this study can be classified as applied research that has generated actionable knowledge and it will provide an evidence-based approach to implementing strategies that will make performance improvements to the organisation. The study will also provide specific evidence-informed recommendations for action by Zamchick. Greenwood and Levin (2007) argue that experiential knowledge gained by being involved in an action research exercise will enhance learning as a result of tackling real-life organisational problems. Action research deals with social processes that involve individuals and groups interacting and their behaviour is often altered through these interactions (Coghlan and Brannick 2014). The interactions within the group and those of individuals form a systemic relationship such that one level affects the effectiveness of the other groups and the inefficiency and efficiency of one affects how the other groups perform (Coghlan and Brannick 2014).

Coghlan and Brannick (2014) state that the learning that takes place in an action research project will occur at all the four levels of individual, group, intergroup, and the organisation

and will be in the form of the ability to reflect on the experience. It will also be in a way to enhance the understanding of how things work and to be able to communicate and manage conflict within the group and develop the ability to critique long-held assumptions. This learning will result in a change in the attitude and work culture of the individuals in the organisation (Schein 1993).

McNiff and Whitehead (2011) state that action research aims to contribute to new practices or new knowledge and theory. The focus of management research is to examine and re-examine current work practices in such a way as to find solutions to identified problems in the current practices and these solutions should help in improving the current work practices resulting in increased productivity (Wainer, 2010). This study will, therefore, in part, examine work practices in a bid to make improvements by identifying the areas that enhance that aspect. As such, by focusing on the areas that result in efficiency and contribute to better practices, knowledge will be created, and the benefit will be skills enhancement for the employees running the operations.

1.7.1 Use of Case Studies

Yin (2014) states that case study research is classified into three categories:

- a. Exploratory
- b. Descriptive
- c. And explanatory

With the purpose of this study in mind and as outlined under 1.4 above, this research project will be exploratory. However, as stated by Yin (2014), there is no exclusivity between the three categories mentioned above as case studies can be either of the three at any given time. Similarly, case study designs and applications can be varied (Yin 2014) and can be used in any of the three mentioned categories and can take the form of typical, critical, or deviant approaches.

Bennett (2004) states that there are two classes of case study research. The first type focuses attention on theory testing cases and not theory building. This type is crucial case study research that has the potential to produce generalizable conclusions. The other type is that of a Heuristic case study that seeks to generate new hypotheses inductively. Bennett (2004) further advances that these deviant cases or cases whose outcome cannot be predicted or explained by the existing theories can be useful in identifying new variables or explanations. As such, heuristic case studies tend to offer guidance about where to look for new knowledge and are less about approving theoretical claims but more about developing new approaches (Bennett 2004).

The use of a case study is preferred where there is a requirement for a holistic and in-depth inquiry (Tellis 1997). Crowe et al., (2011) acknowledge this view on the case study and further suggest that it allows for multi-faceted exploration of issues of a complex nature in their real-life settings. Besides, this approach provides insights into the gaps that might exist in the matter being studied and offers the ability to choose between the available implementation strategies (Crowe et al., 2011). The rearing of chickens can be considered to be a complex matter as there are so many variables at play, among which are feed, water, drugs,

environment, human intervention, and the bird itself and these factors must be combined to produce a bird that should meet the parameters set by the company. An in-depth inquiry as it would be if a case study was applied will facilitate the exploration of these variables at play and their review would help in formulating the strategies that would help in improving the performance of the upgraded poultry houses.

This research exercise will be more focused on identifying strategies that can be used and will therefore be primarily inclined towards being heuristic to further understand how to make and use improvements in addressing the identified problems of poor performance in the recently upgraded poultry houses. To gain an understanding of how improvements can be made will require a collaborative approach that will entail interviews and observation of work processes. Further understanding of how to measure performance, will require company records of FCR, mortality, and live weights from batch results that the company compiles. It is as a result of this requirement of how interrelated the work methods are on the final results, that the four methods of data collection of interviews, observation, focus groups and company records will be used in this research project.

1.8 Contribution of the Study

This study is to review the modern methods of poultry rearing as compared to old methods and assessing their impact on efficiency and productivity and how improvements can be made to enhance the proficiency of the human resource operating the equipment. The research findings align in many instances with literature in terms of the motivation to modernise which is production increase and modernisation as a cost-saving initiative. However, the most profound contribution of this research is the impact of training of employees on new techniques and the formalisation of inhouse training programs that should upgrade and improve employees' skills. Such inhouse training programs should be structured to be in a continuous manner so that as and when new techniques come on the market, this is passed on to the employees. The other contribution is the influence of animal rights activists that advocate poultry welfare and how this negates production increase promoted by modernisation.

The findings illustrate the complexity of poultry farming by suggesting that it's a complex interaction of many interdependent factors that have to operate within the environment setting and be in a position to be synchronised to produce the intended output. The findings also show the importance of planning for modernisation to ensure that this is appropriately designed and implemented in collaboration with the users of the new methods. Additionally, waste from the houses require planning as with time, the company will run out of disposal space. Consideration for turning this waste into biogas should be planned for as it will help in reducing the cost of providing heat to the birds through use of internally generated gas. Further, the findings also show that the weather did not have an impact of the rearing process at Zamchick.

No study of a similar nature has been done in my country and as such, this study provides valuable insights to poultry farmers, leaders and academics on the dynamics inherent in the sector as well as the impact of modern techniques. It will also provide significant input in strategy formulation to the practitioners in the sector as they will have acquired the knowledge

on which factors to pay attention to in their field and how to enhance knowledge creation and its retention.

1.9 Chapter layout and Design of the Write-up

This research study follows a standard structure. It has six chapters and begins with an introductory chapter that provides a background of the case with discussions of the purpose, motivation, and contribution of the study. The chapter briefly discusses the methodology and gives an outline of the thesis and layout of the subsequent chapters.

Chapter 2 presents the literature review with a focus on the theoretical grounding based on modernization in the poultry industry that provides the foundation for the study. The chapter explores the motivation to modernize whether as a cost-saving or production increasing initiative. The chapter also reviews the channels through which modernization has been delivered and the challenges involved in adopting modern techniques. The activities of animal welfare activists are explored and how their acts impact modernization and how these new techniques have had to include measures for assessing compliance with animal standards. These compliance measures have cost implications and may operate as a deterrent to modernization.

Chapter 3 discusses the philosophical consideration that guides the research with the review of methodology and methods that have been adopted to answer the research questions. The chapter provides an analysis of the research study in terms of the justification for using qualitative case method, selection of the participants, analysis, and interpretation of the collected data. There is also an examination of the application of action research and its cycles, evaluation of the results of action research and taking corrective action. Measures were also outlined as to how Ethics and protection of participants were addressed.

Chapter 4 provides the findings of all the four data collection methods that were used and were organized according to the research instruments that were used for each source. The data analysis indicates concurrence with literature on most factors and departs from the literature on other factors as well. However, the impact of modernization on the poultry industry is definitive in terms of increases in production and addressing the challenges that had been faced in the industry. The chapter further outlines the findings and their relationship to the research questions and draws conclusions on the key findings providing an opportunity for actionable recommendations for the strategies that could be implemented by the company to improve the performance and profitability of the business.

Chapter 5 provides a reflection on learning in action, and outlines benefits that will accrue to the individual participants and the company arising from action research. The researcher outlines his own reflection on the outcomes as well as his self-reflection building on the critical areas that were identified in the study.

Chapter 6 provides directions for future studies and the de/limitations of the study recommendations and the implications of the study on the poultry industry in Zambia.

CHAPTER 2

Literature Review

2.0 Introduction

Modernisation or improvements are described as the implementation of new or significantly improved products, processes or services and this could be something that is new to the company or can be the adoption of business practice or processes that have been developed elsewhere (Kemp and Pearson 2007). Modernisation and improvements are incremental and are an on-going process that aim to improve on existing products or services and are distinguishable from innovations that are often radical. Products or services go through a process of improvement to help resolve existing difficulties with their usage and results in the creation of efficiency and advancement further leading to improved yields/productivity (Sahai 2010; Santini et al., 2013).

The process of identifying literature that was relevant to the study was influenced by the general research question that demanded the exploration of strategies that could help with realising more benefits out of modernisation. Based on this research question, a search was done to identify literature that researched on modernisation in the poultry industry. This search identified the research done by Yakovleva and Flynn (2004) from whose themes was derived the sections headings such as 2.1 and 2.2. The forementioned research provided the motivation for modernisation, which is about cost and volumes increase. Other related research such as the ones by Cobb et al., (1999); Sahai (2010); Corkery et al., (2013); Gilani et al., (2009) cemented the views of Yakovleva and Flynn (2004) and added varying views on modernisation and formed the main themes of the literature review. Review of first sub-question helped to identify areas that could help with the sustainability of modernisation as well as that which could lead to failures. The research by Kusz (2014); Wynarczyk (2013); Serhat et al., (2016); Bartel and Lichtenberg (1987) helped in explaining the reasons why Zamchick was facing problems and how these problems could have been avoided. The second sub-question speak to the first sub-question but in a rather different way by working on the factors preventing the company from realising the benefits, these could amount to actions that should be taken to address the situation. Prominent among the actions is training and planning for modernisation. The third sub-question helped in identifying areas such as the influence of animal welfare activists and challenges that could be faced in modernisation and provided an avenue for preparing for such challenges in modernising the facilities such as the recommendation to reduce placement numbers per square meter and to factor-in the planning and design of the effects on the environment arising from increased production volumes and the concentration on humans in small places and how such could be mitigated to ensure that the business goes on. This approach made the themes and debates in the researched papers relevant to the study as they were specific and related to the subject area and connected to what was later observed in the field. To ensure credibility of the cited

research papers, The University of Liverpool online library was preferred in the search of the research papers.

This literature review will critically investigate the impact of modernization on the broiler poultry sector. The focus will be to identify factors that result in the increase in production and efficiency, which leads to reduced production costs and the ability to manage larger flocks of birds. Yakovleva and Flynn (2004), while tracking the development of the poultry sector in the UK, identified channels through which improvements in the production facilities had been made over time. These improvements were said to have contributed to the development of the poultry sector and were the reasons for the increase in production. Santini et al., (2013) also identified the genetic modification of the birds as the reason for the improved performance of the birds and the industry in general. Lastly, Gilani et al., (2009) identified feed as the other factor in the modernization process that has helped in the development of the sector. This literature review will, therefore, be structured on the lines of the rationale to modernise, which is to improve efficiency (Corkery et al., 2013); the channels through which modernisation has been delivered (Yakovleva and Flynn 2004; Santini et al 2013; Gilani et al., 2009); modernisation as a cost-saving measure (Corkery et al., 2013; Sahai 2010; Cobb et al., 1999); the adoption of modern methods (Just and Zilberman 1983; Teklewold et al., 2006; Serhat et al., 2016), sustainability of modernisation (Kusz 2014; Serhat et al., 2016) and challenges to modernisation and the advocacy for poultry welfare (Sassi et al., 2016; Fusz 2014; Yakolveva and Flynn 2004). In discussing the adoption of modern methods, challenges that arise in the process of accessing the new techniques should be discussed. The aspect of animal welfare advocates should also be considered as their agenda arise from the modernisation of production facilities. The effect of establishing standards for measuring compliance to welfare standards is an on-going matter as technology has not advanced enough to accurately measure the set parameters (Sassi et al., 2016). Further, the issue of sustaining modernisation through training and regular updates on new techniques and appropriate design and implementation, is a matter that would determine the successful implementation of modernisation in collaboration with employees (Kusz 2014; Serhat et al., 2016). It is also a matter that is of critical importance to modernisation because it is critical to ensuring the eventual realisation of the benefits of new methods, if sustained to the industry.

Business enterprises formulate strategies on the goals of surviving in good and bad economic times and the need to meet the ever-changing customer requirements and do this better than the competition (Zalewski and Skawinska 2009). In order for the businesses to ensure that their enterprise strategies succeed, they have to consider changing their market position and innovate new product lines or redefine existing products. They also have to find new distribution channels and new value chains as well as create an enhanced understanding of competition. In this regard, Zalewski and Skawinska (2009) suggests that the business needs to understand the new rules of competition to reposition themselves better. In order to create a new product and redefine existing product lines, the business requires investing in new production systems. Investment in new production systems requires the ability of the organization to seek new technologies and knowledge. This ability for seeking new knowledge requires that the organization absorbs the knowledge and invests in research and development (Zalewski and Skawinska 2006). Shah et al., (1993) argue that the institutional environment in the organization plays a significant role in the adoption of modern advancements.

Where the organization uses internal capacities to develop new technologies, Zilberman et al., (1996) suggest that this development must be a two-way process with some technologies developing from bottom up, while others will be those of the product of cutting-edge scientific knowledge. This approach of using internal capacity requires intensive human capital investment and may not suit small businesses (Zilberman et al., 1996).

According to Silbergeld (2016), modernization in agriculture was seen through the invention of chemically enhanced crop production, biotechnology and the confinement of animals. The arability of land was improved through fertilization and pesticides. This was the chemically enhancement part of crop production. This aspect of improving the arability of land increased the capacity of the land to support the growing of crops for consumption and forage (Silbergeld 2016).

The Confinement of animals brought about the aspect of industrial food animal production that reduced the requirement for pasturage, arable land and water to grow crops in the same locality that the animals were being raised (Silbergeld 2016). Concentration of production facilities came after confinement and led to the production of large numbers of animals in smaller areas. This aspect of concentration was found to be economically critical and beneficial as it supported the investment in large scale production facilities while at the same time keeping prices of the products low for the consumers (Silbergeld 2016). The disadvantage of keeping animals in this way is that they are separated from their natural habitation and are constrained from their natural movements and behaviours (Silbergeld 2016). Animals by their natural behaviour position themselves in areas where they have access to water and food and always move to places where the natural resources are easily accessible. The confinement therefore deprives them of this natural behaviour.

Modernisation of agriculture in the broader context, is the process of transforming the sector from the traditional labour based to the more technologically based agriculture (Fusz 2014). Replacement of the human factor in the production process brings about concerns of unemployment as machines replace humans in the production process. However, humans are still needed to implement this transformation. The result of this aspect demands that the process is properly planned and designed to ensure its successful implementation. Several issues will have to be considered in this regard such as employee training, employee motivation to generate job satisfaction and a process of continuous upgrade of knowledge for the employees. In this regard, Serhat et al., (2016) suggests that unskilled human resources tend to fail to detect, assimilate and manage external know-how and this can lead to failure in the implementation process. Additionally, a design and implementation process that fails to recognise the importance of appropriate planning and implementation may bring about unfavourable results leading to failure.

Focusing on the company where this research study was conducted, Zamchick, it was observed from the research exercise that the company uses Feed Conversion ratio (FCR), live weight, and the mortality of the birds as performance measurements in assessing the performance of the sites where the birds were being reared. The analysis of data from company records, therefore, will also follow this pattern being the method of assessment in use, while that from interviews, observation and focus groups will have a thematic approach based on the topics,

ideas and the pattern of meanings that kept coming during the study. The result of this position is that the literature review will have to undertake these three critical aspects of performance measurement, and this will be covered towards the end of this chapter. Additionally, factors that result in failure or indeed those that can enhance successful implementation of modern methods will be discussed under adoption and sustainability of modernisation and these will thereafter be related to events at Zamchick.

2.1 The Rationale to Modernize

As outlined by Abernathy and Clark (1984), technological advancements and industrialization have resulted in modernization, which has improved living standards and changed people's dietary conditions and demands. Additionally, this has also enabled the production of a substantial variety of products in the most efficient ways possible. This aspect of modernization has also led to concentration and specialization of production facilities resulting in the change in production processes leading to increased production volumes and raising the possibility of feeding a higher number of people, hence addressing the anticipated food shortages resulting from the expected population increases (Kusz 2014; Cobb et al., 1999). The transformation of models of production coming out of modernization has led to the development of new products and also raised productivity resulting in the efficient utilization of natural resources (Costa et al., 2008; Cobb et al., 1999). These changes as regards the poultry sector have seen production facilities' transformation in the form of poultry housing that is environmentally or semi-environmentally controlled; this being, the way heat, water, and feed were delivered to the birds in the houses. Yakovleva and Flynn (2004) highlight that the result of these changes has been to enhance the ability to manage larger volumes of birds, leading to increased capacity and production. This aspect is, as outlined by Yakovleva and Flynn (2004) what leads to the reduction in production costs through automation and the decline of the human element in the production process leading to production efficiency and an increase in production as a result of the ability to manage larger volumes of birds.

The aspect of production efficiency is further advanced by Fitzgerald et al., (2013), who state that companies face a digital imperative where they are compelled to adopt new technologies effectively or face the prospect of being overtaken by the competition. In this way, preference for modern methods is intended to improve production efficiency to continue to retain the competitive edge over the competitors. Additionally, Corkery et al., (2013) (a) state that the nature of poultry production is such that the facilities require efficiency in the production process and effective cost control. The ability to control costs is critical, given the rising commodity and energy prices, which have resulted in increased stock feed prices (Corkery et al., 2013) (a). Moreover, automation has led to the reduction of the human factor in the production process, thus reducing labour costs and human error at the same time, increasing efficiency.

In addition to production efficiency, Yakovleva and Flynn (2004) state that modernization in the poultry industry has helped enable the ability to manage larger flocks of birds leading to increased production. The ability to handle larger flocks of birds in environmentally controlled poultry houses has been made possible by the automation of the facilities of providing heat, water, and feed to the birds (Yakovleva and Flynn 2004) and increased stocking density. In this regard, Strbic et al., (2009), states that the possibility of regulating environmental conditions

in the poultry houses with the use of modern equipment, has resulted in the increase in the stocking density of the birds (birds can be placed at higher densities as long as the appropriate environment of temperature, ventilation and humidity are provided in the houses). This aspect is what modern houses provide through air conditioning or fan ventilators. This increase in the stocking of the birds per square meter results in higher volumes of birds stocked in the houses compared to non-modernized houses and is in itself an increase in production numbers of the birds. Dawkins et al., (2004) citing welfare standards state that these standards recommend the reduction of placement density. This has been suggested owing to the reduction of welfare standards in the houses as a result of high-density placement of birds. Collins and Dumpter (2007) look at this differently by suggesting that some studies have reported that a certain threshold of birds density is necessary to increase feeding through socially facilitated behaviours.

The increase in production is in alignment with the current debate on global warming and the anticipated food shortages which have instigated modern production methodologies that are inclined towards increased yields and output through the use of, for example, food additives in poultry feeding programs (Cobb et al., 1999). Further, this inclination towards increased yields has also emphasized the minimum utilization of natural resources in the production process while at the same time, maximizing productivity and increased production (Cobb et al., 1999). These improvements have also tended to address the effects arising from the threats of global warming and the related anticipated food shortages through increased production (Cobb et al., 1999).

Technological advancement has been used to address existing problems in the products in use, such as the genetics of the bird. As outlined by Santini et al., (2013), improvements in the genetics of the birds had been focused on the return of the chest meat, resistance to diseases, and improvement in bird feathering. It has also been through selective breeding to ensure that the resultant breed that is put out on the market is that which farmers can handle to produce the required weights for the market (Santini et al., 2013). In this way, modernization has been incremental. As such, these advancements have been to improve the existing performance of the bird in terms of converting the feed into muscle as well as being resistant to diseases.

Additionally, this aspect of genetic modification has been more prominent in situations where the birds are being raised in areas not indigenous to the breed in use (Santini et al. 2013). Another aspect of improvements in the genetics of the birds has been bird feathering. Bird feathering helps in regulating the body temperature of the birds, and those with smaller quantities of feathers tend to lose weight very quickly in colder conditions than those with more feathers resulting in the birds with a higher number performing far much better (Santini et al., 2013).

The aspect of genetic modification in livestock was further advanced by Sahai (2010), and is essential in increasing yields in the agriculture sector as well as increasing the resistance to diseases. Improved genetics have seen the increase in the average yield of dairy cows in the US, and this has also accounted for the development of strains that are resistant to specific pests, thus helping in improving the yields as the animals become more resilient to diseases (Sahai 2010). In the poultry sector, this has seen the enhanced resistance to diseases through selective breeding (Santini et al., 2013). This aspect has to lead to improved performance

through increased feathering for the birds and increased chest meat (Santini et al., 2013), resulting in improved weights for the birds. These factors have increased the competitiveness of poultry meat on the market compared to other meat products.

The use of modern technology has addressed topical issues on the world stage about food production. In response to the Rio conference under agenda 21 (Cobb et al., 1999), countries have responded to this effort by proposing sustainable development whose central theme has been to ensure the provision of adequate good quality food, efficiently. Secondly, efforts have been made to minimize natural resource usage and to safeguard the soils, water, and air quality further. These measures have also emphasized enhanced biodiversity and landscape quality (Cobb et al., 1999). The focus of these measures has been to use modern advancements to increase food production and at the same time, utilize minimal natural resources to improve on biodiversity to ensure that future generations will still have access to natural resources.

In this regard, therefore, and with the quest to address production volumes in the face of changing weather patterns as a result of global warming, modern methods have emphasized the minimum usage of natural resources while increasing production output (Cobb et al., 1999). It is this aspect that leads to the conclusion by Cobb et al., (1999) that modern methods incline towards mass production as a way to address the anticipated food shortages resulting from global warming and the changing weather patterns. In this regard, therefore, the motivation to employ modern methods has been production increase and minimum usage of natural resources resulting in improved biodiversity (Cobb et al., 1999).

Modernization in the formulation of stock feed has helped reduce the time it takes for the birds to be matured and be ready for the market (Yakolveva and Flynn 2004). With stock feed making up more than 70% of the production cost of landing the bird at the abattoir (Gilani et al., 2009), efforts in improving the performance of the bird through stock feed have been made possible through modernisation programmes. These programmes have been made to utilise feed additives that have resulted in efficiency and cost-effectiveness (Gilani et al., 2009). Efficiency in the application of stock feed to the birds has been achieved through the reduction in the number of rearing days that it takes for the birds to mature and be taken to the market. Furthermore, cost-effectiveness, in this regard, is achieved by the reduced rearing days (rearing period), which results in the improvement of profit margins for the poultry farmers as they use less feed for the birds.

However, modernization also leads to specialization and concentration of production facilities in confined areas, and this has tended to harm the ecological balance (Kusz 2014). Further, modernization results in a radical increase in the size and number of farms leading to increased employment levels concentrated in smaller areas. This increased population of humans and their lifestyle activities, as well as the increased production levels, exerts pressure on effluent management in terms of the disposal of the liquid and solid wastes. This human activity is what leads to the ecological in-balance as outlined by Kusz (2014) in a situation where modernization has resulted in a higher population concentrated in smaller areas.

According to Corkery et al., (2013), the success of modern technology depends not only on the technological advancements in the field but also on the structural technical support and business models. Equally important is the support of the industry and the farming community

that will be operating this new equipment and the ease with which they will relate with resolving their existing challenges with the use of the new equipment. This is because existing problems in the sector have been addressed through modern technology (Santini et al., 2013).

The rationale to modernize has firstly been incremental, which is to make improvements to the existing products. Moreover, this improvement is achieved through genetic modification resulting in the bird being improved to withstand diseases. The adjustment has also been to increase the bird's feathers making the bird more versatile to withstand adverse weather conditions resulting in improved performance. Modernization has also been radical in changing the way the birds are managed in the poultry houses, through automated feeding, provision of water, and heating/cooling. This revolutionary change has provided the opportunity for the management of larger flocks of birds and in increasing production numbers by increased stocking density. This aspect has been the result of the managed environment of the poultry houses. However, Kusz (2014) looks at this differently and suggests that this is more of the aspect of a technological treadmill. This aspect requires a constant update of technology to keep up with modern technology irrespective of the anticipated benefits of modernization. This aspect of the treadmill resonates with the suggestion by Fitzgerald et al. (2013), though somewhat differently, that companies face a digital imperative that compels them to adopt new technology effectively or face being overtaken by competition. As a result, the driver for modernisation, in this regard, is the bid to keep up with competition through modern methods. This concept results in the constant need to keep up with technological progress, first as a way to keep up with competition and secondly as a way to spearhead the race. The need to spearhead the race is in an effort to be the first farmers to embrace modernisation and hence benefit from being the first movers (Fusz 2014). The expectation is that this will reap economic benefits given that modernisation is associated with increased income arising from increased production. Secondly, there will be reduced costs of production in comparison with the old type of technology and this will make the business more competitive than before (Kusz 2014). The need to keep up with competition in this way is a departure from the normal traditional cost benefit analysis that go with new project evaluation, is often a basis for project implementation as regards modernisation.

Modernization, therefore, has been applied to address existing problems with the products through either genetic modification or making incremental changes. Modernization, in this regard, has been used to increase production as outlined by Yakolveva and Flynn (2004). This aspect facilitated the ability for the management of higher stocks of birds. At the same time, it has been used to address increasing production costs arising from increased commodity prices by employing modern methods that are efficient and cost-effective (Corkery et al., 2013). The advanced techniques of improved feed have allowed for the birds to mature earlier than before through the use of feed additives as outlined by Gilani et al., (2009), thus reducing production costs for the poultry farmer as a result of the reduced production days. While production increase has been made possible by the use of modern methods, control and regulation of the environment in the poultry houses have provided for the increase in stocking densities allowing for the placement of higher numbers of birds per square meter and this in itself facilitating production increase (Strbic et al., 2009).

Two particular aspects emerge with regard to the motivation to modernize. On one hand, Cobb et al., (1999); Costa et al., (2008), suggest that modern techniques have been used to increase production. This aspect of increasing production is enhanced by the use of environmentally controlled housing that leads to the increased number of birds that are placed per square meter, as stated by Strbic et al., (2009). On the other hand, Corkery et al., (2013); Yakolveva and Flynn (2004) suggest that modernisation has been the key driver to cost control. Furthermore, Fusz (2014); Fitzgerald et al., (2013) suggest that modernisation and the quest to keep up with modern technology has been to keep up with competition and ensure that they are not over taken in the digital race. The other driver as outlined by Santini et al., (2013) has been to address existing product challenges through the improvement of genetics to make the bird more robust and disease resistant thus reducing on drugs usage.

Global warming and efforts to address its devastating impact may have influenced the position that was taken by Cobb et al., (1999), given that efforts were focused on addressing the anticipated food shortages. Kusz (2014) also addressed this aspect of the increasing global population numbers and challenges of providing food by suggesting the use of modernized techniques. Two main issues emerge from this discussion, that of addressing the effects of global warming with its challenges on the production facilities in use and the growing global population and the challenges that arise from providing food to them. The use of sustainable production methods and minimal utilisation of global resources are some of the suggested methods proposed by Cobb et al., (1999) to address the challenges of global warming. Alongside the aspect of sustainable methods and minimal usage of natural resources has been the use of feed additives to stock feed to increase production yield and reduce the number of days that it takes for the chickens to mature. Increased yields have resulted in increased production levels.

Zamchick undertook the modernisation program as a production increase or growth strategy and this was achieved in two ways; firstly through upgrade of Kachele sites A and B, and, secondly, the engagement of out-growers (contract farming).

2.2 Channels through which Modernization has been delivered

Three main channels have been identified as being the main areas through which modernization has been delivered in the poultry sector. Yakolveva and Flynn (2004) identified the facilities used in the poultry industry while Gilani et al., (2009) identified the feed that is fed to the birds while Santini et al., (2013) focused on the genetics of the bird. The combination of these three areas covers the sector insofar as modernization is concerned.

Yakolveva and Flynn (2004) focused on the facilities of the poultry houses being the actual housing and the delivery of feed, heat and, water to the birds as being the main medium through which modernization had been channelled. This aspect was done in the process of tracking the development of the sector in the UK.

2.2.1 Poultry Housing

The Poultry Housing model is based on providing an environment that facilitates a controlled climate in the houses that should ensure that the birds are safeguarded from adverse weather conditions (Yakolveva and Flynn 2004). Birds, when exposed to colder temperatures, tend to eat more to sustain their body temperature; in this way, the feed consumed is used to keep the birds warm (Corkery et al., 2013). On the other hand, when it is too warm, energy is expended as the birds try to cool themselves and as such in colder conditions, the feed conversion rate (FCR) will be poor while warmer conditions tend to result in better FCR (Corkery et al., 2013). As a result, when birds are protected from adverse weather conditions, by controlling the environment in the poultry houses, the FCR is improved. This is because the prevailing conditions help the birds that are kept in this type of controlled weather conditions to utilize the feed intake from either cooling or warming themselves to converting this feed into flesh which is what results in improved FCR and hence better weights of the birds that are delivered to the abattoir (Yakolveva and Flynn 2004).

Additionally, and apart from exposure to adverse weather conditions, the poultry houses should be built in such a way that they facilitate the removal of excess heat in hot circumstances and retain heat during colder conditions (Al-Chalabi 2015). At the same time, this condition should ensure that the birds have access to fresh air, excess moisture is removed and the build-up of harmful gases is limited and enough oxygen for their well-being is provided (Al-Chalabi 2015). The afore-mentioned aspects will be achieved by building houses that will have funnel ventilation, evaporative cooling, pad/fan systems, or open-sided house that are fitted with curtains that can be closed or opened depending on the weather conditions (Al-Chalabi 2015).

In tracking the development of the poultry sector, Yakolveva and Flynn (2004), using the UK as their case study, were able to follow the progress of the industry from open-sided houses to houses fitted with extraction fans. Moreover, later on, fully air-conditioned houses (controlled by computer programs) as a way to demonstrate how modernization in the building of poultry houses had progressed over time. This type of advancement has been mostly incremental, that is, by building and improving on the already existing way of building the houses. This aspect has also been by making improvements at each and every stage to ensure that the birds are protected and safeguarded from adverse weather conditions.

The other aspect to consider is the way houses are built. Such structures help in disease control and provide the opportunity to disinfect and adequately clean the houses. In this regard, Abreu et al., 2011 recommend the use of concrete floors. Abreu et al., 2011 further stated that broiler performance is not influenced by the floor type although lower mortality was observed in birds raised on a hard-packed dirt floor. Additionally, most farmers in the area where the research was conducted (Brazil) used dirt floor due to the high building cost of concrete floors. While Fiorentin (2006); Abreu et al., (2011) confirm that dirt floors are difficult to disinfect, the research work done by Abreu et al., (2011) found that the litter from dirt floors presented less humidity and lower fermentation and less ammonia compared to the concrete floors. According to Yalcin et al., (1996) concrete floors compared to dirt ones were found to be easier to clean and improve the consistency of FCR, while dirt floors were found to tend to, cause thermal discomfort and impair the performance of the birds.

However, Mesa et al., (2017) confirms that there has been no consensus on the preferred type of floor (between concrete and hard-packed dirt floor) that could ensure maximum growth while maintaining bird welfare. Mesa et al., (2017) also concede that while on one hand concrete floors improve consistency of FCR, on the other hand, dirt floors provide much better results regarding mortality than concrete floors. The result of this aspect made Mesa et al., (2017) recommend the use of dirt floors as they provide a better environment for the welfare of the birds.

Lighting also plays an essential part in broiler management, but its importance is also dependent on the genetic type of the bird (Glatz and Pym 2015). The lighting of the poultry houses is determined by the type of housing, being naturally ventilated (open side houses) or the controlled environment (which may be completely closed without windows and is air-conditioned), as well as the season of the year (Glatz and Pym 2015). However, during brooding, lighting is used to stimulate the feeding of the young birds. Additionally, withdrawal of light affects the feeding of the birds and is often used by farmers as a feed-break mechanism. This withdrawal of lights in the houses can also operate as a relaxing time for the birds (Corkery et al., 2013), and this aspect of withdrawing lights was found to have the ability to improve their health and provide more normal behaviour opportunities for the birds (Blatchford et al., 2009). Cordeiro et al., (2010) on the other hand suggests that there are several factors such as feeder type, drinker type, type of lighting and even curtain colours that might also have an impact on the environmental quality affecting both performance and welfare and not just one factor.

2.2.2 Feeding and Watering Equipment

Gates (2002) states that there are two types of feeders available to the poultry farmers, being the linear near the feeder and the feed-hopper. In large-scale poultry farming, automated feeding equipment has been used successfully. While the automatic feeders have been an improvement over the linear and feed hoppers, the size of the set up determines the type in use with the feed hopper and automatic feeders saving on labour in large-scale operations. Feed hopper saves labour by reducing the repetitive filling of the feeders and also reduces feed waste (Gates 2002), which occurs in the process of repetitive filling of the feeders. Modernization in this regard has been to automate the feeding process resulting in the removal of human involvement, thus reducing labour costs.

The most common methods of providing water to the birds are through the use of drinkers that are the pan or jar methods (Gates 2002). The automated watering system over time has become more popular due to its ability to ensure throughout supply of fresh and clean water to the birds and reduction of labour, effort in the process (Gates 2002). Modernization in the watering system has been the automated system that has had the effect of reducing human effort in the process but also ensuring the continuous supply of fresh water to the birds.

Advancements in both the feeding and watering systems could support higher levels of the bird population in the poultry houses, and this is the aspect that led Yakovleva and Flynn (2002) to conclude that these modern systems increase the ability to manage larger flocks of birds.

2.2.3 Heating and Cooling of Poultry Houses

Heat stress tends to reduce productivity levels in poultry (Corkery et al., 2013; Bonnet et al., 1997; Baracho et al., 2011). This aspect is so, because when birds are younger, they fail, by their body metabolism, to adjust their bodies to surrounding temperatures and as such tend to suffer from acute heat stress if exposed over a shorter period and chronic heat stress if over a more extended period (Corkery et al., 2013). Further, as advanced by Yahav et al., (2001), poor and uncontrolled conditions in the poultry houses can lead to reduced growth and performance of the birds as the birds tend to reduce feed consumption under such circumstances. This aspect can also result in higher stress and higher mortality of the birds (Ferreira et al., 2011). It is in this regard that Aviagen (2009) has guided the management of the birds that the first two weeks are very critical for determining the excellent performance of the birds and better results. After the two weeks critical period, Corkery et al., (2013) advance that the birds will have learned how to regulate their body temperature. However, there should be minimal variation in the house temperatures to ensure that the feed consumed is used more for growth rather than the birds generating heat or cooling from the feed (Corkery et al., 2013). In this way of regulating the temperature in the house, the performance of the birds can be improved for better economic and financial results.

The British Standards Institution (1990) has issued instruction standards for poultry buildings to ensure the maintenance of acceptable temperature levels in the houses (Corkery et al., 2013). Zambia was a colony of the British government until about 57 years ago, and as such, the building standards have mostly been adopted from the UK. As a result of these guidelines, poultry houses are supposed to be constructed with the intention of maintaining the correct heat in the houses by providing ventilation, and this also ensures cooling in the event of excessive heat. Yakovleva and Flynn (2004) state that some of the modernization in poultry housing concerning heating and cooling include insulation and a controlled environment with fan-assisted ventilation. This aspect has now been improved to fully environmentally-controlled houses that are air-conditioned and temperature-controlled by computer programs (Corkery et al., 2013). The fourth site, Maridadi uses fully environmentally controlled houses that have computer programs to regulate temperature in the houses.

2.2.4 Nutrition for the Birds

Birds are required to be fed with Stockfeed that meets the nutrition requirements of the age and strain of the bird (Chadd 2007). Much research in the effort to modernize Stockfeed has been centred on establishing the optimal inclusion of the nutrients that are commercially important with desirable outcomes such as improving feed conversion and lean tissue deposition (Chadd 2007). Alongside improvements in the feed formulation, has been the genetic modification of the birds. This modification has increased the potential for birds to grow very quickly (Zuidhof et al., 2014). Additionally, improved nutrition has also resulted in the reduction of the feed quantity required to produce chicken to the maturity stage resulting in savings in feed costs to the producer (Zuidhof et al., 2014).

Chadd (2007) states that the level of accuracy in dietary macronutrient and micronutrient provision has the effect of enhancing bird performance through improved FCR. This aspect has also been supported by the genetic selection that emphasizes linkage to nutrition and that of

feed conversion efficiency, leading to enhanced bird growth (Chadd 2007). Also important in this argument is the enhanced ability for the bird to adapt as a result of the genetic modification and as such be robust in growth.

The issue of climate change has had an impact on feed production, given the numerous ranges of raw materials that are included in modern poultry diets (Kersten et al., (2005). Production of feed is affected by price fluctuations and the non-availability of raw materials and the ever-changing poultry diets to counter raw material prices and availability (van der Barneveld 2001). Additionally, adverse climate conditions leading to a drop in crop yields are also affecting feed production (Shane 2002) as prices tend to spike where lower yields of crops are experienced. The effect of such a situation is a compromise of the ideal feed formulation resulting in lower quality of the feed that is produced.

Improvements that have been made to the feed formulations include the use of feed additives and these have contributed to efficiency that has led to the maturing of the birds earlier than before (Gilani et al., 2009; Yakovleva and Flynn 2004). The current practice in the feed industry is to produce the feed that specifies the age at which it should be supplied to the birds and at which stage it should be withdrawn (Aviagen 2009; Corkery et al., 2013). As a result, the manual by Aviagen (2009) gives guidelines to the poultry farmers as to which feed to apply to the birds and at what age of the birds (Corkery et al. 2013).

Improvements in feed formulation coupled with genetic modification of the birds have had the effect of making the birds more robust in performance, thus improving the FCR leading to improved weights and shortening of their maturing time. These improvements are dependent on the feed being of higher quality. However, in situations where there are difficulties in procuring raw materials as a result of climate change, this situation compromises the quality of the feed. Compromised feed quality will not perform as expected to the birds.

2.3 Modernization as a Cost-Saving Measure

Corkery et al., (2013) state that poultry farmers have turned to modernization as a way to meet financial targets of increased performance and production efficiency. This aspect of production efficiency has become more pronounced with the continued global rise of commodity prices and energy costs, which have impacted significantly on production costs. Nevertheless, and more importantly, poultry production by its way of operation has to be managed efficiently and cost-effectively (Corkery et al., 2013). This aspect of efficient management is so because poultry meat is considered a cost-competitive food item resulting in the producers facing resistance from the consumers to pass on the increased production costs through selling price increases (Corkery et al., 2013). This resistance also arises from the price competition with other meat products (Corkery et al., 2013). It is this resistance combined with increased production and energy costs that have compelled poultry farmers to turn to modernization, as stated by Corkery et al., (2013), to remain competitive with other meat products.

According to Yakovleva et al., (2004), technological advancements in the food system contributes to the economic efficiency of the system through the reduction in production costs. This situation arises from the fact that modernization involves the reformation of the existing systems and the development of new models of production that are better and more

efficient than the old models (Yakovleva et al., 2004). Wilkinson (2002) noted changes that had taken place in the consumption patterns from the 70s, and these patterns have resulted in the change in consumer preferences leading to the food industry transforming from single to multi-products. This has also seen the food system move away from individual goods and products to sophisticated foods that are branded as well. Consumer demands that have resulted from their changed preferences have been the trigger to modernization through retailers and manufacturers (Yakovleva et al., 2002).

In the same connection, Sahai (2010) states that modernization in the agriculture sector has resulted in increased production and improved yields. Increased production and improved yields result in reduced production costs, as for the same input costs, more is realized as a result of the increased yield hence increasing the margins for the farmers. This approach to increased production levels and improved yields is the central theme in modern food production. It is also in response to the changing weather patterns that threaten global food security, leading to modern production facilities that often emphasize mass food production while ensuring efficiency and productivity at the same time (Cobb et al., 1999). Furthermore, this approach in food production has inclined towards the minimum utilization of natural resources and the promotion of biodiversity while increasing production at the same time (Cobb et al., 1999). Christensen and van Bever (2004) use the term efficiency innovations to describe the approach of the ability to retain the competitiveness of the industry that results from reduced production costs that arise from increased productivity as a result of modernization.

Ollinger et al., (2005) consider the impact of modernization on costs differently by suggesting that modernization has resulted in the structural change of production facilities. This change has led to the abandonment of inefficient production equipment in preference to the more modern, thus resulting in improved yields and the realization of economies of scale. This aspect of abandonment of inefficient production facilities agrees with the position taken by Wilkinson (2002) who stated that changes from consumer preferences had instigated the change in food production systems resulting in modernization, which has brought about more efficient production facilities that have improved the yields and reduced the cost of production.

Modernization in the quality of the day-old chick has been done through genetic modification. This modification has been targeted at improving the uptake of the feed and making the bird more robust. This aspect has also seen the focus on feed conversion efficiency and maximal growth and the robustness of the bird to adapt to the environment (Chadd 2007). It has also been to increase the bird feathering to improve the birds' protection against adverse weather conditions. Another area where advancements have taken place has been that of feed nutrition and medication. In this area, Chadd (2007) states that nutrition has been focused on the nutrient requirements of the bird to promote growth and the appropriate feeding strategy that optimizes the immune system of the bird.

Improvements that have been made in Stockfeed have had far-reaching consequences in the poultry industry because of the considerable component that stockfeed occupies in the production cost of the bird. Gilani et al., (2009), in this regard, state that stock feed make-up about 70% of the cost of producing the bird, and as such, any works that would make stock feed less costly would have a significant impact on the cost of producing the bird. Furthermore,

Gilani et al., (2009) advance that the use of modernized feed programs in stock feed production through the use of feed additives has resulted in efficiency and cost-effectiveness. This aspect has been enhanced through the usage of feed additives in stockfeed production. This method of stock feed production has led to the ability to take the birds to the abattoir/market much earlier than before (Yakolveva and Flynn 2004). The impact of this is the saving in the number of days that the birds will be in production rearing resulting in cost savings in labour, feed, energy, water, and other production resources. This aspect has helped the industry manage costs and the period it takes for the birds to be mature for slaughter, thus enhancing competitiveness and increasing profit margins for the poultry farmers. With this stated, however, Chadd (2007); Ollinger et al., (2005) highlight the challenge that arises from the continued usage and dependence on traditional protein and energy-yielding ingredients of soya bean meal and maize cereal in feed production. There are moves to divert cereals such as maize to production of fuel such as ethanol. This aspect will create an alternative usage of the proteins and give rise to difficulties in procuring the commodities.

Yakolveva and Flynn (2004) state that modernized methods of production that have resulted in the automation of processes of delivering feed, water, and heat have facilitated the ability to manage larger volumes of birds and at the same time reduce the level of human involvement in the production process. This aspect has resulted in the reduction of production costs as a result of reduced labour and marginal costs resulting from increased production levels using the same costs of production as compared to the lower production levels (Yakolveva and Flynn 2004). Additionally, Strbic et al., (2009) identified the aspect of improved stocking densities resulting from regulating environmental conditions in the poultry house, a feature of modernized houses where air conditioning or fan ventilation is provided. Birds can be placed at higher densities as long as temperatures in the houses are appropriately regulated through air conditioning or fan ventilation (strbic et al., 2009). Other factors to consider when determining stocking include bird size, drinker and feeder space, housing dimensions, nutrition, performance breed/genetics, and economic return (Biligili and Hess 1995). The result of this is higher volumes of birds placed in the house using the same amount of labour, thus resulting in increased production numbers compared to ordinary houses. In this regard, Yalcin et al., (1997) state that assuming no reduction in the performance of the broilers, increasing the density should reduce production costs significantly. To the poultry farmer, this translates into increased revenues as the revenue base increases due to increased volumes and production costs are reduced as labour costs reduce as a result of the number of employees declining with the application of modernized methods of production. The reduction in production costs are also the result of the costs being recovered on higher production levels leading to increased revenues. Additionally, economies of scale will also apply to the increased production volume.

The aspect of improvements in the genetics of the birds as outlined by Santini et al., (2013) has led to improved chest meat for the birds, resistance to diseases and increased feathering. These aspects of disease resilience and improved feathering have improved the welfare of the birds and reduced their mortality. Genetic modification of the birds resulting in the return of chest meat results in bigger birds than before, and given that birds are sold per kilogram, this would translate into increased profit margins for the farmer. The aspect of resistance to disease and increased feathering provides the opportunity for better management of the birds with reduced drug application as a result of the improved resistance to infections. Increased

feathering makes the management of the birds easier as they do not get adversely affected by exposure to colder temperatures (Santini et al., 2013). Reduced drug usage also results in the reduction of the production costs of the bird.

Additionally, Yahav et al., (2005) discuss improvements in the genetic selection of faster-growing broilers, thus reducing the number of days that it takes for the bird to mature. Modified genetics, combined with improvements in feeding regimes, results in the reduction in the number of days that it takes for the birds to mature for slaughter. This aspect further results in the reduction of production costs. Additionally, the reduced rearing days, as well as increased margins arising from the improved weights that result from the improved chest meat, are the benefits that accrue to the farmer as a result of modernization.

Corkery et al., (2013) state that increases in production input costs for the poultry industry is the primary driver in modernizing. This aspect is critical in optimizing the management of the sector in the face of rising energy and commodity costs. The quest to meet financial targets has enhanced the modernization of the performance of the bird through genetic modification, which has made the bird more robust in terms of resilience to diseases and faster growth. In this regard, therefore, modernization has been focused on bird performance and welfare improvement through such features as increased feathering. Increased bird feathering allows the bird to have the increased ability to withstand adverse weather conditions and thus reduce mortality. The aspect of increased density of the birds through the regulated environment in the poultry houses has reduced the cost per bird as a result of the volume increase while using the same facilities such as labour. This increase translates to increased revenue for the farmer.

Additionally, increased production volumes while still using the same production costs levels translate into reduced cost per bird. Modernization of feed, through increased nutrients and additives, has resulted in the reduced rearing days for the birds. This aspect means that the birds will spend less time in the poultry house but will grow faster. The savings in the cost of production in this regard address the main driving factor for modernization in the poultry industry, as stated above. With regards to the reduced rearing days, this has been achieved in two different ways, one that modifies genetics to faster-growing birds and the other that improves feed with added nutrients and provides the opportunity for the birds to have robust growth and mature much earlier than before. The aspect of the bird being more resilient to diseases reduces drug application to them, and this saves the drug costs.

Two critical aspects arise from the genetic modification of the bird. These are: that which has facilitated increased FCR and therefore promoting robust growth of the bird, and the feed which makes the bird more nutritious. But more importantly is the modification of the bird itself to increase its adaptability to the feed that results in the enhanced growth while being resistant to diseases and adverse weather patterns through feathering. Arising out this, the expectation is that when modern techniques are deployed, there should be a reduction in the cost of production and an increase in revenue that result from enhanced bird weights and improved production levels. Improved production levels will be facilitated by increased placement density of the birds. With the fore-mentioned, the upgrade of kachele sites of B and C was expected to have resulted in lower production costs, better FCR and higher weights. But to achieve would not only be dependent on equipment but also the human resource involved in the management and running of the equipment.

The subsequent sections will discuss the human factor in modernisation. While the previous sections identified channels and the motivation to change to new techniques, these new methods require management to ensure the full realisation of their potential. Additionally, the human resource should have the competence to combine the facilities in the sector in a way that makes it efficient and sustainable, and to achieve this, this resource requires training and skills upgrade in order to cope with the modern methods.

2.4 The Adoption of Modern Methods

Adoption of modern methods can affect the level of output, product quality, employment, and profits; as such the approach to modernization offers both economic opportunities as well as challenges (Teklewold et al., 2006). In addition to this, Just and Zilberman (1983) state that the process of technology adoption is dynamic and requires continuous research and development programs that take much time to be realized. With this in mind, therefore, the adoption of these improved technologies should not be seen as a one-off success (Just and Zilberman 1983). The offer of achieving increased production works as an incentive to modernize. However, as Just and Zilberman (1983) state, there still exists a large gap between technological potential and the actual technology performance that should result in improved yields/production. As such, this potential is yet to be fully realized. This aspect is also why the adoption of technology requires continuous research and development programs to bridge the technological gap, as identified by Just and Zilberman (1983). David and Foray (1994) offer a different view of this discussion, suggesting that the adoption of modern methods of production is also dependent on diffuse externalities. Diffuse externalities are the capacity of the organization to innovate, as being dependent on its ability to adapt knowledge from other organizations to its own and being able to find new ways of doing things in the process (David and Foray 1994). In this way, therefore, modern methods are viewed as being beneficial as they are used to enhance internal organizational abilities, which may have been acquired internally or copied externally.

Serhat et al., (2016) suggest factors that motivate the adoption of modern methods as being the level of reduced bureaucracy in adopting the new methods. Another suggested factor was that of the size-related advantage over larger enterprises; smaller companies tend to have shorter decision-making processes compared to larger ones. The ability to migrate from the system in use to a new one influences how new technologies are perceived as companies fear to stick to a particular method when news ones come on the market (Serhat sag et al., 2016). Limited resources can also be a factor in this regard. Companies that display the ability to adapt to new ways of doing business also have the potential to change to new methods as they come on the market. As a result, the ability to change and adapt to new and ever-changing environments influences the adoption of modern methods. While bureaucracy may not have impacted Zamchick in their modernisation program, the partnership with RCI bridged this gap as they were able to work with people that had a lot of experience in using modern techniques.

Further, Serhat et al., (2016) suggest the aspect of detection of valuable ideas as some of the barriers to adopting modern technology. They also advance the management of collaboration among technocrats to enhance knowledge and technology as the other factor that inhibits the adoption of modern advancements

Zilberman et al., (1996) look at the motivation to adopt modern methods differently. Zilberman et al., (1996) suggest that while the new methods may be motivated by the increase in production and productivity, resulting from adoption of the new technologies, these benefits, maybe nullified by additional taxes that will be imposed. In this regard, environmental regulatory agencies may impose additional taxes on the new production facilities that will dilute all the benefits realized from adopting these new technologies. This, therefore, nullifies all the benefits that may have been realized by the new technologies. In addition to this, Zilberman et al., (1996) also state that the new advancements can increase the returns to scale and may also require additional human resources and physical capital. These requirements may result in a structural shift in the sector, leading to increased capital requirements and resulting in capital cost entry barriers in the sector.

Truong and Yamada (2002) have a slightly different approach to what factors influence farmers in adopting modern technologies/methods. They state that in the farming industry, there is a complex interaction of several interdependent components of water, soil crops, livestock, and other resources within the setting of the environment. As such, various factors impact the farmer's approach to adopt new methods and in some cases, these factors are interdependent and thus complicated to be isolated from each other. As a result of the fore-mentioned, factors that influence adoption are many and not limited to one and their interdependence makes the choice of adopting even more complicated. For the case of Zamchick, the initial motivation to modernise was production increase, but this lead to cost reduction considerations. This is because the hallmark of modernisation is cost reduction but has other implications such as that of production increase as well as enhanced profits and better product quality as advanced by Teklewold et al., (2006).

For modern methods to appeal to the farmers, Rodgers and Shoeman (1974) identified essential variables that determine the rate of adoption. These critical variables were identified as firstly, the relative advantage that the new methods have on the currently existing methods. Secondly is the compatibility of the new methods with the existing methods in use. Thirdly is the complexity of the new method and what this advancement will achieve. The other aspect is that of trialability and the ability for the new ways to be tested without much difficulty by the new users. The last consideration is the observability of the new ways and the possibility of being subjected to trials in action as opposed to the prospective users just being told about them. Though the argument presented by Rodgers and Shoeman (1974) appears different, the meanings are the same as those presented by Teklewold et al., (2006); Serhat et al., (2016) to the extent that new methods ought to present something new and that which can be related to the existing challenges that the users are facing. These challenges can be in the form of difficulties in increasing production or reducing the costs as the case maybe.

In discussing factors that help in the adoption of new methods, Truong and Yamada (2002) further identified age as one of the elements, with the older generation being hesitant to change to modern techniques that they are not too familiar with them. The younger generation being progressively minded and better educated, are more often able to quickly adapt to the new methods in comparison to the older generation (Truong and Yamada, 2002). Additionally, the two authors also found out that technical training and meeting with the people introducing the methods helped clear the doubts and built confidence in the new techniques. Furthermore,

oral presentation, familiarity with the presenters, and the belief in the technology exhibited by the presenters were considered to be factors that helped the farmers in decision making with regards to the new methods.

Wozniak (1984) looked at the aspect of adoption in a somewhat different way by advancing that the decision to adopt new techniques is dependent on the availability of interrelated inputs. This aspect is to suggest that any decision to change to new methods is dependent and conditional on the utilization of the previously available complementary inputs. This aspect agrees with Teklewold et al., (2006), who advanced that farmers learn about technology through their own experiences, and those with more experience tend to have higher adoption levels. This position also means that having prior experience before adopting the technique makes the farmers more efficient in carrying out the tasks necessary to expand the intensity of the technology such as interpreting of information relevant to their choice in adopting the new methods (Teklewold et al., 2006) This is in agreement with suggestions made by Truong and Yamada (2002) who noted that human resource is critical and can be enhanced by training and meetings with promoters of the new techniques as mentioned above. Farmers and their workers can see their daily challenges being addressed through these new methods and as such the success of their implementation is dependent on how well these people understand them, and how the methods relate to the concerned people's daily business and operational challenges.

The adoption of modern technology takes an element of significant risk where other farmers have not proved the benefits. Farmers (poultry farmers included) are usually risk-averse (Zilberman et al., 1996), and therefore, the ability to take such risks can be taken up by the government and private organizations who would want to patent the product and hope to realize the benefit shortly. As stated by Just and Zilberman (1983), the adoption of modern technology is a continuous process. It takes time with development programs that have to be tested, and the risks and challenges evaluated before adopting these new methods. Therefore, abilities should be developed to reduce the risk and shift it from the risk-averse farmers to organizations and government agencies that will be able to accelerate the change to modernization and enhance the adoption (Zilberman et al., 1996). The focus then in this regard shifts from the private sector and individual farmers to the government, which should implement the process of policy design to ensure that the uncertainties associated with these modern methods are studied and investigated and the implications clearly outlined (Zilberman et al., 1996). This way, the farmers will have information available regarding these modern technologies, and with this information, they can plan. This position is so because uncertainties result in farmers delaying to invest in these new methods and wait until the information was made available before making the investment decision (Zilberman et al., 1996). So adoption is dependent on the availability of information on the product as well as the benefits of using them that are readily available and proven. This position was different from Zamchick as they had a vendor and a partner with proven experience in the field. They therefore relied on the expertise and knowledge of the partner in fostering modernisation. What Zamchick did not plan for, was the termination of this partnership with which went the expertise and the knowledge. Furthermore, training of workers was not planned for after installation of the equipment and when the partnership terminated, there was no resource to take up the gap that was created by the departure of the partner as well as the workers that were initially trained.

2.5 Sustainability of Modernisation and the Role of Learning

As earlier mentioned under 2.0, modernisation in agriculture is the process of transforming the sector from the traditional labour based to the technologically based activity (Kusz 2014). This therefore means that in the process of transforming, change will have to take place and this change will have to be managed with and by the people who may have the prospect of losing employment resulting from the deployment of new methods. At the same time to make this transformation more appealing, a collaborative approach will have to be adopted to secure the 'buying in' of the people that will be affected by the change.

The goal of sustainability in modernisation is to ensure the attainment of the greatest possible gains out of it (Kusz 2014). Additionally, it is the dissatisfaction with the existing situation that motivates the change but equally important and more appealing is the apparent benefits that will arise from the implementation of the modern techniques that will ensure that it is sustainable (Kusz 2014). However, for this to happen, an environment that does not hinder this change should prevail. In this regard Wyncarczyk (2013) suggests that small organisations are negatively impacted by the capacity of management, the skills available in the organisation as well as access to external knowledge. The structures in the organisation as well as the internal capacity to overcome these challenges can hinder modernisation. The result of the forementioned is that the design and implementation of modernisation should be carefully and appropriately planned for, taking care of all the relevant factors that will ensure its success.

Modernisation in the agriculture sector is a continuous process with products and services becoming more complex as new techniques come online to overtake the old ones and it is in this regard that knowledge integration is required (Serhat et al., 2016). There is also a requirement for additional resources of internal and external knowledge and the capabilities to internalise the knowledge and technology and assimilate them to ensure this works for the organisation (Serhat et al., 2016). This then means that there should be careful assessment of the human resource in the organisation.

The aspect of employee skills and knowledge is an important factor in ensuring the successful implementation of modernisation. This is because inadequately skilled human resource often tends to fail to detect, assimilate and manage knowledge thus creating difficulty in appreciating new techniques (Serhat et al., 2016). Furthermore, Bartel and Lichtenberg (1987) state that highly educated employees tend to have a comparative advantage over their colleagues with less education with respect to learning and implementing new technology. As a result, it then becomes important that the planning of the design and implementation of modernisation should consider the skills available in the organisation. This then should be used in planning for training to upgrade the skills of the employees running the equipment. Additionally, given that modernisation is a continuous process with new techniques being introduced regularly, plans should be put in place to ensure that a program of regular training is implemented alongside modernisation.

The concept of sustainability in the broader perspective has over the last couple of years become a guiding principle for organisations and social movements as well as a rule, ideal for social change (Adloff and Neckel 2019). However, this study will not dwell on the models of

sustainability but will use the concept to highlight and demonstrate how it can help foster change. It can also be used in making change more appropriate, palatable, and suitable in the process of making improvements in the organisation through modernisation.

The sustainability and adoption of modern techniques in an organisation are two distinguishable factors that should be considered separately with varying effects on the organisation. The example of Zamchick can best explain the difference. While management acquired the equipment and brought in the installers to train the employees on the workings of the equipment, the after-effects of this installation displayed a clear lack of planning. After the installation was done, there were no plans for further training of the employees nor was there any human resource planning in the event of the trained employees leaving the organization. Furthermore, when the equipment required maintenance, this failed as no plans were in place to ensure regular maintenance of the equipment. Over the time and with most of the trained employees leaving the organisation, the equipment went into a state of disrepair and was later abandoned as the employees on site could not manage nor run it. This was the situation that the researchers found at Kachele B and C. The adoption of the new techniques was achieved, and the equipment successfully installed, but the sustainability of it could not be achieved owing to lack of appropriate planning on the part of management. The result of this also displayed the impact of under-skilled human resource that fails to detect, assimilate, and manage knowledge resulting in failure (Serhat et al., 2016).

Operations strategy outlines the plan that specifies the design and usage of resources in support of the business strategy. In this regard, Coughlan and Coughlan (2009) suggests that in a competitive environment the development and growth of the business will be limited by its ability to efficiently manage and adapt its operations. Management in this regard is faced with the requirement to reconcile the market demands with the capabilities and the available resources in the operations. To achieve this reconciliation, Coughlan and Coughlan (2009) suggests continuous and collaborative improvement. Further that there is a relationship between improvement and learning suggesting that where there is improvement, there is learning and that where there is learning, improvement will occur for so long as in each case, there is reflection on experience and opportunity both to explore and exploit. The use of action research in pursuit of resolving the issues at Zamchick is appropriate as it is rooted in learning from experience and is collaborative in approach. Its adaptive in nature as the participants work on real life/organizational problems that have no clear solution in sight and that they are responsible and in control of their own learning.

Operations strategy concept is aimed at making improvements and creating efficiency; action research on the other hand has a similar aim though in a more focused and specific to the identified business problem, but both advocate collaborative engagement to make improvements. Furthermore, both are inclined towards learning as a critical tool that ensures sustainability of the knowledge gained in the process. The knowledge achieved through this engagement and its retention is more beneficial to the individuals and the organization when the collaboration and improvement is done on a continuous basis (Coughlan and Coughlan 2009). Operations improvements has the potential to result in change, however minor it may

seem, action research has a similar effect and they both aim at making improvements leading to efficiency in the organization.

The aspect of continuous and collaborative improvement introduces learning in operations strategy which is a key component in action research leading to knowledge creation that equips the employees/participants with the knowledge to ensure the sustainability of modernization. Modernisation as outlined earlier (under 2.1) has been used to address existing challenges in the products in use, however in a situation where there is inadequate knowledge resulting from lack of training as mentioned above, the employees will fail to appreciate the new methods. This failure will be cemented when they fail to see any positive impact of using the new techniques and they will, as a result, default to what they know from experience, which in this case, will be the old methods, as was the case at Kachele B and C.

When considering how to develop continuous improvement and learning, it is also important to distinguish between explicit and tacit forms of knowledge. Kothari et al., (2012) attribute tacit knowledge to practice and experience and suggest that it is multidimensional and context specific and that it is often embedded in organizational routines. McAdams et al., (2007) add on to this in a different way by stating that it is knowledge-in-practice that is developed from direct experience and action, and that it is highly pragmatic and situation specific. It is also difficult to articulate and is usually shared through interactive conversation and experience. In contrast to the other type of knowledge, called explicit which is publicly and widely known and is knowledge that is used and shared in the form of data, scientific formulae, and manuals (Nonaka et al., 2000). In the business context, patents are an ideal example of explicit knowledge.

Tacit knowledge is personal and often hard to formalize as it is rooted in procedures, values, and emotions (Seidler-de Alwis and Hartmann 2008). It is acquired through interaction, sharing, observation and imitation, and with explicit knowledge, they complement each other as they are both essential in knowledge creation. As a result, knowledge creation is achieved through interactions between tacit and explicit knowledge (Nonaka et al., 2000).

By its nature, tacit knowledge forms the foundation for building sustainable competitive advantage given that explicit knowledge can be known by others unlike tacit knowledge (Nonaka et al., 2000) as it is often very difficult for competitors to imitate and therefore to transfer. The knowledge that will be created in the action research process will be tacit as it will emerge from the interaction and collaboration between the participants and the researcher. Furthermore, and given that organisations operate in a systematic relationship (Coghlan and Brannick 2014) this knowledge that will be created will influence the various levels that exist in the company. This is because of the systemic relationship that operates in organisations such that whatever happens at any one level affects the entire organization.

2.6 Challenges to Modernization and Advocacy for Poultry Welfare

Modernization leads to mass production as advanced by Cobb et al., (1999). Strbic et al., (2009) further suggest that where the environment in the poultry house is regulated, the stocking density of the birds can be increased. This aspect of increased stocking density, according to Yalcin et al., (1997), should reduce production costs significantly while the motivation for increased production numbers by Cobb et al., (1999) is the expected food shortages resulting from climate change. For Strbic et al., (2009), this aspect looks like that of the strategy of reducing production costs. Reduced production costs should result in poultry meat becoming more competitive, given that poultry meat is a cost-competitive food item (Corkery et al., 2013).

Additionally, Yakolveva and Flynn (2004) advance that improvements in modern technology in the food systems contribute to the economic efficiency of the system through reductions in production costs. This aspect of reduced production cost is the result of the transformation that takes place in the production facilities that lead to the reformation of the existing infrastructure. The reform of the existing system also leads to the development of new models of production that are more efficient than the old models (Yakolveva and Flynn (2004). The drive to cost reduction is the introduction of feed additives that have increased the performance of the birds. According to Chadd (2007), modernization of feed has centered on the establishment of the optimal inclusion of nutrients that are commercially important for the growth of the bird. This aspect of modernization has resulted in the improvement of the feed conversion ratio and lean tissue disposition. In addition to this aspect, Zuidhof et al., (2014) suggest that besides feed improvements have been the genetic modification of the birds that have increased the potential for the birds to grow quickly. The improvements have not only increased the growth potential of the birds but also reduced the feed quantity required to produce a chicken to maturity. This aspect leads to savings arising from reduced production costs arising from the reduced feed quantities and days of rearing (Zuidhof et al., (2014). The articles cited above all relate to improvements leading to reduced production costs for the producer. Cost reduction has therefore been the primary motivation for the producer to adopt modern techniques considering increased energy, commodity, and labour costs that have pushed production costs (Corkery et al., 2013).

Animal welfare activists have promoted the inclusion of poultry welfare in the development of modern techniques of poultry production. These new techniques have led to the development of methods to verify minimum animal welfare standards (Sassi et al., 2016). The World Organization for Animal Health defines animal welfare as a situation where an animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well-nourished, safe, able to express innate behavior, and if it is not suffering from unpleasant states such as pain, fear, and distress (Sassi et al., 2016). However, Sassi et al., (2016) concede that the set parameters are difficult to prove and verify in practical terms. Several factors in sizeable commercial poultry production influence the welfare of the birds. These factors are environmental deterioration, stocking density, thermal-stress, unsuitable social environments that can be sources of stress that can lead to welfare deterioration and reduced performance of the birds. The challenge is further compounded by the currently available equipment that cannot assess welfare levels in the poultry houses. In the absence of the capacity of the existing

machinery to evaluate the welfare of the bird, it is challenging to determine which of the mentioned factors may have a critical influence on their well-being.

According to Sassi et al., (2016), there are innovations in the industry that are potentially adaptable to commercial poultry that can help assess the welfare of the birds. However, their practical implementation on a commercial basis is still yet to be defined. The result of this position is that welfare standards cannot be accurately measured with the existing equipment.

Additionally, high stocking density, the control of temperature, and humidity required to minimize the occurrence of welfare problems may not be easy to achieve (Sassi et al., 2016). This aspect is because even if the equipment was available, it might be inadequate to perform this task, given that it is still in its development stages. Welfare assessment intends to verify the conditions under which the birds are kept, to confirm that these conditions satisfy welfare standards as set by the World organization for Animal Health. The non-availability of equipment that assesses the welfare of the birds in the poultry houses makes this exercise challenging and difficult to undertake.

This measure of assessing the welfare of the birds can be an additional cost to the producer if made compulsory and made commercially workable. It would potentially wipe out all the benefits that might have been gained through modernisation (companies that borrow from international leaders such as IFC, DEG etc. have been subjected to environmental guidelines. Zamchick has been given a timeframe within which they will be required to comply with EU poultry placement density failing which they will be sanctioned).

Ollinger et al., (2005) assessed the progression of the poultry industry for over thirty years. They noticed a change from one sector of numerous small plants producing whole birds to one consisting of much larger plants producing many products. This shift accounted for the structural transformation of the production system with newly processed products increasing production costs, and new production technology reducing production costs (Ollinger et al., 2005). The reduced production costs were achieved by the increase in line speeds, improved yields, and economies of scale. Increased new products such as processed foodstuffs, tray-packs, and deboned poultry meat raised production costs due to the various products that had to be produced. This aspect contrasts with whole bird production that did not require any further work and therefore had lesser production costs. Thus, while modernization leads to reduced production costs, through automation, the proliferation of product lines also increases costs as opposed to the earlier single product line of the whole bird.

Yakovleva and Flynn (2004) tracked the development of the poultry industry in the UK and the impact that modernization had played on the industry. They confirmed that the industry was becoming increasingly complicated with industrialization, which was inclined towards mass production. With this increased level of manufacturing driven by modernization, have come challenges from the public such as concerns about the social and environmental impact associated with food production. These concerns have brought about discussions of sustainability of the environment, which should result in the conservation of the environment, minimization of environmental impact, and the protection of the natural environment (Yakovleva and Flynn 2004). Sustainability should be looked at in terms of economy, environment, and society (Tushman and Rosenkopf 1992). Sustainability in economic

conditions should lead to sustained economic growth that should see technology that is energy efficient with standardized products and food safety. Sustainability in social terms should result in the improvement of life and the quality of employment. The downside of this discussion has been the introduction of regulation, which has brought in environmental legislation targeting animal welfare, food safety, and sustainable development. These measures have resulted in fees that have increased the cost of doing business. Zambia Environmental Management Agency (ZEMA) an agency formed by act of parliament has been mandated to oversee environmental issues in Zambia and have prescribed fees that organisations must pay on an annual basis or when applying for approval of a new project.

Zilberman et al., (1997) bring a different dimension to the impact of increased agriculture activities and produce on the environment. Increases in agriculture production have resulted in the ability to provide food to the entire world population despite the population increases. These increases in agriculture production have resulted in adverse effects on the environment seen through soil erosion, deforestation, contamination of underground water, and the severe reduction in wildlife population (Zilberman et al., 1997). Clearing land for agricultural production has led to deforestation, and this activity has deprived wildlife of their natural habitation and so they have moved to areas where they can be sustained. Fusz (2014) states that the modernization of agriculture has resulted in the structural change in the factors of production in the poultry sector. This structural change has also caused a substantial increase in the specialization and concentration of production facilities in confined areas. According to Fusz (2014), modernization has led to a radical change in the sizes and numbers of farms, with the number of farms becoming fewer and farms themselves getting bigger. These more prominent and more modernized farms resulted in increased employment numbers which have led to an increased population of humans in smaller areas.

Human activity, through their lifestyle, as well as increased production, produces both liquid and solid waste. It is this waste that exerts pressure on effluent management in terms of disposal. How the solid and liquid waste is disposed of causes ecological imbalance as outlined by Fusz (2014), if not properly handled. It is this aspect that also results in the contamination of underground water, as stated by Zilberman et al., (1997). This is the same water that will have to be used in the production system, supplying it to the birds and the humans running the facility. This development as regards the contamination of underground water violates the proposals that were made at the Rio Conference under agenda 21 (Cobb et al., 1999), which stated that soil, water, and air quality should be safeguarded to provide good quality food and preserve biodiversity in the process of conserving natural resources.

According to Zilberman et al., (1997), current production facilities and patterns cannot last forever as they are dependent on exhaustible natural resources, and it is this recognition that has prompted the debate on future production facilities being made with sustainable agriculture systems. The quest for sustainability is motivated by the concern and dissatisfaction with the existing production systems that are solely dependent on natural resources (Zilberman et al., 1997; Cobb et al., 1999). Sustainability should be looked at in terms of changing the quality of growth, meeting the essential needs of energy, water, sanitation and conserving the natural resource base, and reorienting modern technology (Bartelmus 1994).

Yakolveva and Flynn (2004) state that regulation, markets, and society influence modernization. This influence has the potential to change the course of modernization and technological development. With regards to regulation, most countries are subject to two levels, EU, and local regulation (Yakolveva and Flynn 2004), this is so especially where they supply the EU and local market. The influence of the market is the result of the power of consumers and the retail market. In this regard, Yakolveva and Flynn (2004) state that corporate retailers dominate the UK retail market and the entire supply chain and influence the players in the market to modernize in a particular way. Concerning society, increased concerns about health, nutrition, animal welfare, and environmental awareness in the production facilities have resulted in the influence in the way modernization is structured. These concerns have been expressed through health and nutrition, quality of life, environmental awareness, and animal welfare (Yakolveva and Flynn 2004; Chadd 2007). This aspect is because consumers have become increasingly concerned about the health aspects of salt, sugar, and fat levels in their diets. Concerning the quality of life, the concern is that food should not only be for nutritional value but should also be for purposes of improving the quality of life. Environmental awareness relates to consumer demands for improved environmental performance, especially where food production and agriculture, is concerned. Where animal welfare is concerned, consumers have become interested in the welfare of animals and the way they are bred, grown, transported, and slaughtered. These concerns will affect aspects of the way modernization is structured, as they will be required to adhere to as the minimum standards that will be set (Chadd 2007).

Additional legislation will significantly affect the benefits that have been realized from modernization (Chadd 2007). Regulation affecting environmental protection arising from the realization that modernization methods of production rely on the use of exhaustive natural resources and those of consumers for food safety, health, and quality will affect all aspects of the food production system. Zamchick is subject to regulation through ZEMA, an organization that is mandated to oversee environmental issues and have set guidelines that have to be complied with.

Modernization leads to more significant production facilities being in confined areas. These facilities employ people to manage production. Humans by their lifestyle require facilities such as water for drinking and for disposal of waste. Being in confined places, their lifestyle results in contaminated underground water. This contaminated water affects the products from these production facilities as well as the health of the human population that consumes the water. Given that there are increased concerns for environmental awareness, this may result in increased legislation. As pointed out by Chadd (2007), increased legislation increases the cost of production.

Farmers have a wait-and-see attitude to technology, and that they can only adopt it once they have evidence of the results. Given the suggestion by Just and Zilberman (1983) on the issue of the technological gap between the potential and the actual results arising from modernisation, this makes new technology adoption a challenge. This is because there is this technological gap and as well as the time that it takes to the realisation of the potential of new techniques that disqualifies farmers (medium and small scale) as they do not have the capacity to do this. This is what makes the government more relevant in this aspect as they have the financial resource to do this while individuals and the private sector such as Zamchick may not

have this ability. This aspect restricts the involvement in research and development to the government.

Modernisation imposes disruptions on the traditional ways of doing things. This disruptive behavior of modern technology also applies to the agriculture industry. In this regard, Silbergeld (2016) states that the confinement of animals refers to management practices of raising animals for food by keeping them in buildings for management efficiency purposes. This aspect results in improved productivity. This way of raising animals also leads to the separation of animals for production from the limitations of space availability of natural resources.

2.7 Feed Conversion Ratio/Rate (FCR)

Yakovleva and Flynn (2004) state that chicken growers established the efficient feed-weight ratio as it translates into the ability to convert feed into edible meat. It can also be described as the rate measuring the efficiency with which the body of the bird converts stockfeed into the desired flesh. Given that chicken meat is sold at a price per kilogram, the weight of the bird then has a significant impact on the revenue and how the cost per kilogram of the bird is computed. Zuidhof et al., (2014) in their study of the growth, efficiency, and yield of commercial broilers from 1957 to 2005 were able to establish that, over the 50 years of research, the broiler industry had been able to reduce the amount of feed required to produce chicken meat by 50%. Given that feed accounts for about 70% of the cost of producing chicken (Gilani et al., 2009), the savings to the consumer and the producer are substantial. Selective genetics and modernization in the industry, including the use of additives in the production of feed, have resulted in modern birds that grow quicker, therefore, reducing the period of rearing and improving on the FCR.

The environment in which the birds are reared affects the resultant FCR and, as outlined by Corkery et al., (2013), when birds are subjected to colder temperatures, they tend to feed more to sustain their body temperature. As such, the feed consumed in this way will be used to keep the birds warm. Similarly, when it is too warm, Corkery et al., (2013) state birds will use up their energies to try to cool themselves, resulting in the FCR in colder conditions to be reduced compared to warmer conditions.

Modernization of the poultry houses has been focused on safeguarding the birds from adverse weather conditions, and this has been achieved by regulating the environment in the houses. Birds that are raised in controlled weather conditions tend to utilize the feed consumed to converting it into flesh, unlike in adverse conditions where this is expended on either cooling or warming themselves. The result, as stated by Yakovleva and Flynn (2004) is that birds that are reared in such controlled conditions tend to achieve improved FCR, hence better weights that are delivered to the abattoir. The better the rate that the bird converts into body mass, the better will be the resultant weight of the bird. FCR is therefore directly related to the live weight of the bird.

2.8 Live Weights

Santini et al. (2013), state that improvements made in the genetics of the birds have been centred around increasing the chest meat, resilience to diseases, and improving the bird

feathering. These improvements have been achieved through selective breeding that is focused on enabling farmers to produce birds that achieve weights for the market requirements. Zuidhof et al., (2014) state that modern birds can grow quickly because they have been genetically modified to achieve the tremendous potential to grow. This ability has been achieved through breeding efficiency that has resulted in the successful strategy of high production with a shorter rearing period. The robust growth of the birds results in increased live weight of the birds that provide a return for the farmers when taken to the market.

Additionally, and as outlined by Corkery et al., (2013), improved FCR results in better weights for the birds, and FCR is determined by the quality of the feed that is given to the bird. To this argument, Gilani et al., (2009) state that modifications to the feed formulation by the use of additives have contributed to the reduction of the rearing period while at the same time achieving the required weights for the birds. Live weight is directly related to FCR. Live weight and FCR are two of the three performance measurements that Zamchick uses. These two factors have also been used in assessing the performance between modernised and the old houses. Additionally, better FCR is a sign of efficiency as it is the measurement of conversion of feed to flesh resulting in higher weight of the bird. This efficiency would also imply reduced wastage of feed resulting in the reduced feed cost. Increased weight of the bird implies more revenue as the payments or rewards are computed per kilogram of the birds reared.

2.9 Mortality of the Birds

Tabler et al. (2002) state that the mortality of birds during the rearing period presents a significant economic loss for the poultry producers as there is lost income on the birds that had consumed feed and labour time. The problem is further compounded by the challenges of disposal of the dead birds as they would have to be disposed of in the most environmentally friendly way.

Given the negative impact on the business that mortality has, it is imperative to come up with accurate descriptions of mortality patterns within the houses. This aspect can be beneficial in formulating management strategies that can help minimize these losses during the rearing period. In this regard, Brigden and Rioddell (1975); Tabler et al. (2002) identified the following as the leading causes of mortality:

- a. Ascites
- b. Sudden death syndrome (SDS)
- c. Leg problems, and
- d. heat prostration

Ascites is the accumulation of edematous fluid within the body cavity of the bird (Tabler et al., 2002; Brigden and Rioddell 1975). This disease can be caused by atmospheric hypoxia or housing environment or respiratory diseases or rapid growth rates, high energy diets, toxins, or feed additives.

Sudden death Syndrome (SDSs) usually occurs towards the end of the growth cycle of the bird and is often caused by heat stress and increased stocking density (Tabler et al., 2002).

From the above-stated predominant causes, and, as identified by Tabler et al. (2002), mortality can result from a variety of causes. Further, the causes mentioned above have been resolved through improved genetics, but heat prostration and SDS have continued to be significant problems for the industry. Tabler et al., 2004 in discussing mortality and its effect on the industry state that mortality is a normal part of broiler production and further proposed that growers should devise management programs that should reduce the overall impact on the flock performance. The other proposal that was advanced was that of an aggressive culling program that should be undertaken early in each flock. This exercise of removing substandard birds can have the potential to improve flock uniformity and resultant performance with a minimum negative impact on the FCR. This reduction in the negative impact of FCR, is because the birds do not affect FCR as they will have been removed early and not taken the feed to affect the cost of providing the feed as well as FCR.

There are other causes of broiler mortality, such as coccidiosis which is caused by the infection of the protozoan parasite genus called Eimeri (Sundar et al., 2017). However, this is only problematic when it is at excessive levels or when the birds are stressed or weakened by other diseases. Sundar et al., (2017) state that despite all the advancements in technologies, coccidiosis remains the most significant protozoan parasite disease in the poultry industry costing millions of dollars per annum to manage. Under the current technologies, Sundar et al. (2017) concede that this disease is impossible to eliminate in the poultry facilities.

Mortality is the third performance measurement factor used by Zamchick. Poultry houses as outlined under 2.2.1 are designed to protect the birds from adverse conditions and ensure their welfare. The expectation from the fore-mentioned is that modernised houses are supposed to have a better mortality rate compared to the old houses. This arises from the facilities in modernised houses that safeguard the birds from adverse weather conditions and, assuming that there are no disease outbreaks, mortality therefore is expected to be better than the old houses.

2.10 Chapter Conclusion

The challenge that poultry farmers face is highlighted by the need to manage costs, increase production and productivity, and the solution as per the literature review has been to modernize the production facilities. However, the conclusion that these modern methods are not specific to the benefits of using them, and as such, farmers make an uninformed investment decision on their business highlights the suggestion by Truong and Yamada (2002) on the many factors present in the industry . This situation of uncertainty is enhanced by the risk-averse nature of farmers (Zilberman et al., 1996), who prefer to adopt a production method that has a proven track record. Establishing a particular methodology takes time and is a long process that involves development programs that have to evaluate the risks and challenges of the new methods (Zilberman et al., 1983).

In the evaluation of modern methods, due consideration has to be made of the complex nature of the farming industry. Truong and Yamada (2002), highlights the industry's complex interaction of many interdependent factors that have to operate within the environmental

setting and be in a position to be synchronized to produce the intended output. It is for this reason that it takes so long to prove the suitability of the particular production method.

The motivation to modernise and modernisation as a cost saving measure are business imperatives that aim to manage costs while increasing revenues. However, to implement, these measures require another resource, the human resource. Adoption of modernisation and its sustainability introduces this human resource as a critical factor to ensure the successful implementation of modern methods. This human resource require to be suitably trained so as to adapt to the new equipment and operate it efficiently. Training will enhance learning that will increase the competence of the human resource and improve the chances of sustaining modernisation. Implementation of modern techniques requires planning at design and implementation stage and the inability to do this results in undesirable outcomes of failure. Failure can also lead to the lack of appreciating modern techniques by the people manning the equipment.

Challenges to modernisation are more of a reaction to these new methods bringing in aspects of animal welfare and regulation as to placement densities of birds. Environmental regulation has been more on managing human activity resulting from higher human population in concentrated areas arising from big farms and impact on the environment. The management and monitoring has been taken up by environmental agencies such as ZEMA who regulate this through fees and licencing.

CHAPTER 3

Methodology and Methods of Inquiry

3.0 Introduction

The term "management" relates to improvements in performance (Thorpe and Holt 2008), and management research is centred mainly on the actions of management on the organisation and the consequences of these actions on organisational performance (Easterby-Smith et al., 2012). Easterby-Smith et al., (2012) further state that business research is differentiated from management research in the sense that business research is focused on the business and examines the determinants of corporate performance, especially as it relates to the private sector organisation. As outlined by Wainer (2010), the motivation to undertake management research results from the identified unresolved problems of management practices and procedures that can be the root causes of future problems. To have an informed understanding of what the future holds, given the issues that have been identified, current practices must be diligently examined in greater detail through management research (Wainer 2010). The most crucial aspect of management research is ensuring that during the research project, there is progress in knowing from less to more (Payne and Payne 2004) as the researcher gains more knowledge and information on the research subject in the process of conducting the research work.

This study required that strategies were formulated to help with the performance of the newly upgraded poultry houses. Achieving this needed a detailed understanding of the problem as enhanced by the information from the literature. Qualitative research was appropriate for this type of research to understand the problems that required engagement with staff at their workplaces (Creswell 2012). The engagement entailed sharing their work experiences. According to Strauss and Corbin (1994), qualitative research is focused on understanding the nature of the research problem rather than the number of observed characteristics. That is the approach this study employed.

The goal of qualitative research, as identified by Mays and Pope (1995), is to develop concepts that help with the understanding of social phenomena in natural as opposed to experimental settings. Ultimately, this gives due emphasis on the meanings, experiences, and views of the participants. As highlighted by Gerring (2004), a case study involves the intensive study of a single unit to understand a larger class of similar units. Thomas (2016) adds to this by suggesting that it is about a particular rather than the general. As a result, one cannot generalise in a case study research exercise. Furthermore, Baxter and Jack (2008) state that the nature of the case study is such that it provides an opportunity to gain a holistic view of the research problem. Therefore, it helps describe, understand, and explain the research problem. The use of a qualitative case study in finding strategies for improving the upgraded poultry houses' performance required the development of a detailed holistic view of the research problem. This understanding and the ability to describe and explain it helped

formulate strategies that should improve performance and profit margins for the upgraded poultry houses.

The qualitative research method has been preferred to the quantitative approach due to the desire to gain a deeper understanding of the matter of study and explore it to the extent of listening to "silent voices" (Creswell, 2012). Listening to silenced voices (the workers, in this case) enhanced the detailed understanding of the problem, which was only possible by talking directly to them, and allowing them to share their side of the story (Creswell, 2012). Given the purpose of the study, an exploratory approach was only possible where the procedure was not restrictive. As a result of this approach, interactions were enhanced with the people (employees of Zamchick, in this case) directly involved to understand the contexts in which these participants in the study were to address the identified problem (Creswell, 2012).

Case study research design was preferred to other approaches of Grounded Theory, Ethnography, Narrative, and Phenomenology, due to the nature of the research study, which was focused on poultry houses as a unit of analysis. Furthermore and according to Stake (2005), a case study's critical feature should first be the case study's intention, which is to understand the specific issue or problem. Secondly, according to Yin (2014), the study should present an opportunity for an in-depth understanding of the problem. It should use many forms of data collection methods of interviews, observation focus groups, and company records, as was the case in this study. To this, Crowe et al., (2011) add that this method of analysis also offers an in-depth, multifaceted exploration of complex issues in their real-life settings.

As earlier mentioned, the study focused on finding methods that could help improve the chicken rearing operation of the company. This required that the study was exploratory in nature in finding possible solutions and also necessitated engagement with the employees at their work place to ensure that planning and their participation in decision making processes was based on their experience and skill. As a result, action research was applied to explore ways that could help in finding areas that could be improved upon in collaboration with the workers.

Regarding objectivity, case study research, depending on whether it is a single or multiple case study, has varying objectives for contributing to the theory. It has its strength in creating theory by expanding constructs and relationships within distinct settings (Ridder, 2017) as in a single case study, while it can be a means to advance theories by comparing similarities and differences among cases (Ridder 2017) as it can be in multiple case studies.

This research study was a single case study that covered three sites of similar housing structures and one site of modernised poultry housing units. The unit of analysis for this study was poultry houses, whether modernised or not. This approach was appropriate as a research strategy to develop a deeper understanding of the complexities and critical issues in the way the houses are managed to come up with plans of how performance can be improved.

The study placed action research at its centre because of its appropriateness for improving practice and professional and organisational learning. According to Zuber-Skerritt and Perry (2002) action research has the capacity to develop human, social and professional competencies and through its collaborative approach generate solutions that are based on work practices. Action research by its nature promotes teamwork, flexibility, people skills commitment to learning and self-management (Zuber-Skerritt and Perry 2002) and would therefore generate solutions that will be sustainable.

The result of placing action research at the centre of this research study meant that the data that was collected from all the data collection sources was used as input into the action research exercise and applied in the process of engagement with the participants to find solutions to the identified business problem. Action research achieves two aspects, bringing about change in the organisation and generating robust and actionable knowledge. Action research is a process that evolves and is undertaken collaboratively and as such it is a research constructed with the people rather for or on them. Furthermore, Coughlan and Coughlan (2016) suggests that action research involves researching in the present tense and as such, builds on the past, while taking place in the present with a view to shaping the future.

3.1 Research Questions

3.1.1 Primary Research Question

What strategies can be used by Zamchick to increase the benefits including profit margins from implementing modern methods?

The motivation for undertaking this study is the desire that Zamchick benefits from implementing modern methods in poultry rearing. This desire is premised on the notion that modern methods are intended to improve the practice and as such, through investigations and evaluation of effectiveness of the current practices, improvements can be made that can result in Zamchick reaping the benefits of modern techniques in the industry, leading to improved performance and profit margins. The researcher is an Executive based at the holding Company's Head Office and is a poultry farmer in his own private practice and as such has an interest in understanding the workings of poultry rearing industry with regards to modern technology. In furthering this understanding, the perspectives of the research participants will have a direct impact on understanding how these new methods are perceived and what would be required to be done to enhance this perception in the process of devising an intervention that should help make improvements.

3.1.2 Secondary research questions

Using the experiences of the participants, the study will be focused on how to make improvements in performance by answering the following secondary research questions:

What factors are preventing Zamchick from realising the benefits of modern methods?

What actions need to be taken to realise the benefits?

What strategies can Zamchick implement to be more ready for future change?

The nature of the primary research problem is such that it will require the acquisition of insights into Zamchick perception of modern techniques and to apply empirical evidence that will be gathered in the study to evaluate the current position in the company and use this to develop interventions to make improvements in the application and use of modern technology. The evaluation of the current position required that each procedure and process be scrutinised and assessed based on best practice to achieve improvement. In the process of developing the interventions, measures will have to be put in place and enhanced to enable Zamchick develop abilities to respond positively to the ever-changing technological developments in the industry. As a result of the exploratory nature of this study and resulting in the engagement of the participants; the design approach therefore will be centred on seeing this study through the lens of the participants. The result of this approach will be to draw meanings from the participants' emphasis on critical aspects of their work procedures and processes in real time settings during the study. Given that there will be an interactive process between the researcher and the participants, this process will enable the researcher to understand the participants' experiences within a particular context bearing in mind their individual skills and work experiences. The obligation arising from the forementioned is that the researcher will have to capture and report the participants experiences accurately and truthfully to ensure that the researcher's own bias and role does not impact on the ultimate findings of the study.

3.2 Sampling Methods

According to Thomas (2016), the intention in a case study research is not to find a portion that represents the quality of the whole, but rather to look at the selection of the subject with two or few being focused on, without any expectation that this selection will represent a wider population. In this regard, Yin (2014) discourages sampling in a case study and instead parallels it to experimental research with the experiment-like position not being referenced to the like-experiments population.

A snap survey of Zamchick poultry houses is shown in Appendix 17, and from this schedule, there are nine sites from which this case study was done. Kachele A, B, and C have the same number of houses built in similar fashion and capacity, and that Kachele B and C were recently upgraded. However, after discovering that the two recently upgraded houses were not working as semi-controlled, a fourth site was selected. This site is on lease and does not belong to Zamchick. Zamchick managed the area with its employees and was included in the selection as a house with modern facilities. This research study was focused on the upgraded or modern houses' performance compared to conventional or old houses.

Following on from Yin (2014) discouraging sampling in a case study, this study was based more as a selection rather than a sample. One house was selected from each of the sites A, B, and C of Kachele sites (each site has ten poultry houses). Data was collected for between three to six months (an additional house from Maridadi was included afterwards). The data collection period covered the cold and hot seasons, given that broiler poultry production is influenced by the weather (Corkery et al., 2013). However, the upgraded or modern houses are not affected by the weather due to the equipment installed in these houses. As such, seeing how the weather impacts traditional houses will help understand differences in performances of the houses and help formulate strategies to improve the performance.

Sixteen employees were selected as participants from Kachele A, B, and C, and Maridadi in this project and were trained in terms of what was expected of them, before commencement of the study. The Company operates two shifts per day, and two participants per shift per site participated in this study, being the poultryman and the supervisor. Kachele A, B, and C have ten houses per site and are managed by 11 employees per site per shift, while Maridadi (the fourth site) has three houses and is managed by 5 employees per shift. From an entire complement of 76 employees, 16 of participated in this research exercise. Additionally, two senior managers were included as key informants.

According to Saunders et al., (2009), to reach a sufficient understanding of a specific topic, it is recommended to conduct between 4 and 12 in-depth interviews provided the population is homogeneous. Eighteen interviews were conducted for this study. From the initial discussions with the 16 participants, all had a minimum of two years' experience working in the field and were educated at a minimum of O' levels. They also all confirmed having been trained on the job, although one of the supervisors had a general certificate in agriculture training from an agriculture training college. The two key informants were professionals with university qualification, one being the General Manager of Zamchick and the other being the Operations and Marketing Manager. The General Manager had more than ten years' experience in the poultry industry and managed the business side of the company. The Operations and Marketing Manager is an Animal Scientist with more than fifteen years' experience in the poultry business and has a Masters' degree in Animal science and managed the technical side of the business. The two provided the technical part of the poultry business and which helped with insights in the way aspects of the industry was managed.

	Poultrymen	Supervisor
Kachele A	2	2
Kachele B	2	2
Kachele C	2	2
Maridadi	2	2
Key Informants	2	

3.3 Data Collection Methods

This section outlines the data collection methods that were used in the study. Firstly, a description of the study area is provided, followed by how the data was collected and the focused areas on gathering the data. Data collection methods that were employed were interviews, observation, focus groups, and the desk review of company records in the form of batch reports from the chicken abattoir. Additionally, the participants were provided with journals from which notes were recorded and followed up with clarifications or additional information. This additional information was included in the data from observation as the notes formed the detailed process of their work routines that were subjected to observation. Furthermore, action research which formed the critical part of this research study, provided a rich source of data from the participant's perspective and understanding of the process of poultry rearing.

3.3.1 Core and Thesis Action Research

According to Zuber-Skerritt and Perry (2002) action research is appropriate for improving practice, and professional and organizational learning compared to traditional research. This is because it can be used to resolve real life problems at the workplace in a collaborative fashion and as such can assist with organization learning.

Where the research is being done as part of academic assessment, two action research cycles operate in parallel (Zuber-Skerritt and Perry 2002). These are core and thesis action research cycles. The core action research cycle focuses on the practical problem being resolved while the thesis action research involves the planning, acting, observing, and reflecting with regards to the academic part of the research study and the resultant learning that will arise from the participation. Coghlan and Brannick (2014) in the same regard acknowledge that two action research cycles operate in parallel in an action research project. The first cycle is of constructing, planning, taking action, and evaluating with regards to the fulfilment of the research project objectives. The second cycle (Coghlan and Brannick 2014) is a reflection cycle. The first cycle is what Zuber-Skerritt and Perry (2002) also refer to as the core action research cycle and the second as the thesis action research cycle. The reflection cycle also referred to as the thesis action research cycle is the learning process of the action research cycle and is what generates meta-learning (Rowley 2003; Coghlan 2007). Additionally, Coghlan (2007) emphasis the role of meta learning in developing theory from the core action research project. Meta-learning requires practice and development as it is an art. According to Griffiths et al. (2019), meta learning is about presenting many tasks all of which have a similar character. The intention with this approach is to leverage commonalities across the tasks and to become better at resolving each task. Furthermore, this approach is helpful in developing abilities to resolve future tasks better and more quickly and efficiently. Coghlan (2007) advances the aspect of experiential learning model, which is a useful guide to the process of meta-learning. Experiential learning has for stages of experiencing, reflecting, interpreting, and taking action (Rowley 2003).

Reflection is the final stage in which the researcher and the group collaborate to review the action research project and draw conclusions about what has been achieved (Kemmis and McTaggart 1988). This stage would involve the review and analysis of the way forward and depending on the outcomes, would ignite another cycle of planning, acting, observing, and reflecting until the achievement of the agreed objectives (Davison et al., 2004)

3.3.2 Study Area

The four sites selected for this project are located in the same locality, and three have ten poultry houses, and the fourth site has three houses. Two locations, Kachele B and C, were initially installed with modern equipment, while the third site, Kachele A, was not installed with modern equipment. Kachele B and C now operate as ordinary houses as the equipment had been neglected into disrepair. The fourth site uses fully automated houses that are controlled by computer software. All the sites run two shifts per day, with each house manned by a poultryman, and the supervisor who oversees each site's activities per shift. The Company operates a two twelve-hour shift per day. As a result of this arrangement, the three sites have 60 poultrymen and six supervisors, while the fourth site has six poultrymen and two supervisors. Additionally, the fourth site has two general workers who help with offloading feed and general maintenance of the site. The supervisors for the sites report to the poultry/broiler Manager, who reports to the General Manager of the Company.

The sites' supervisors were selected as participants together with one poultry man per site, per shift. The result of this arrangement was to have the eight supervisors matched with eight poultrymen. Each of them was given a journal to record their daily activities and interactions with the researcher. The researcher also kept a journal where information from all the data sources was recorded, however for the observation part, the researcher engaged two assistants that helped out with the observations. This part was intended to improve the reliability of data from observation. The recordings from the two assistants were incorporated in the journal for the researcher to ensure that all the data collected was in one place.

3.3.3 Data Collection approach.

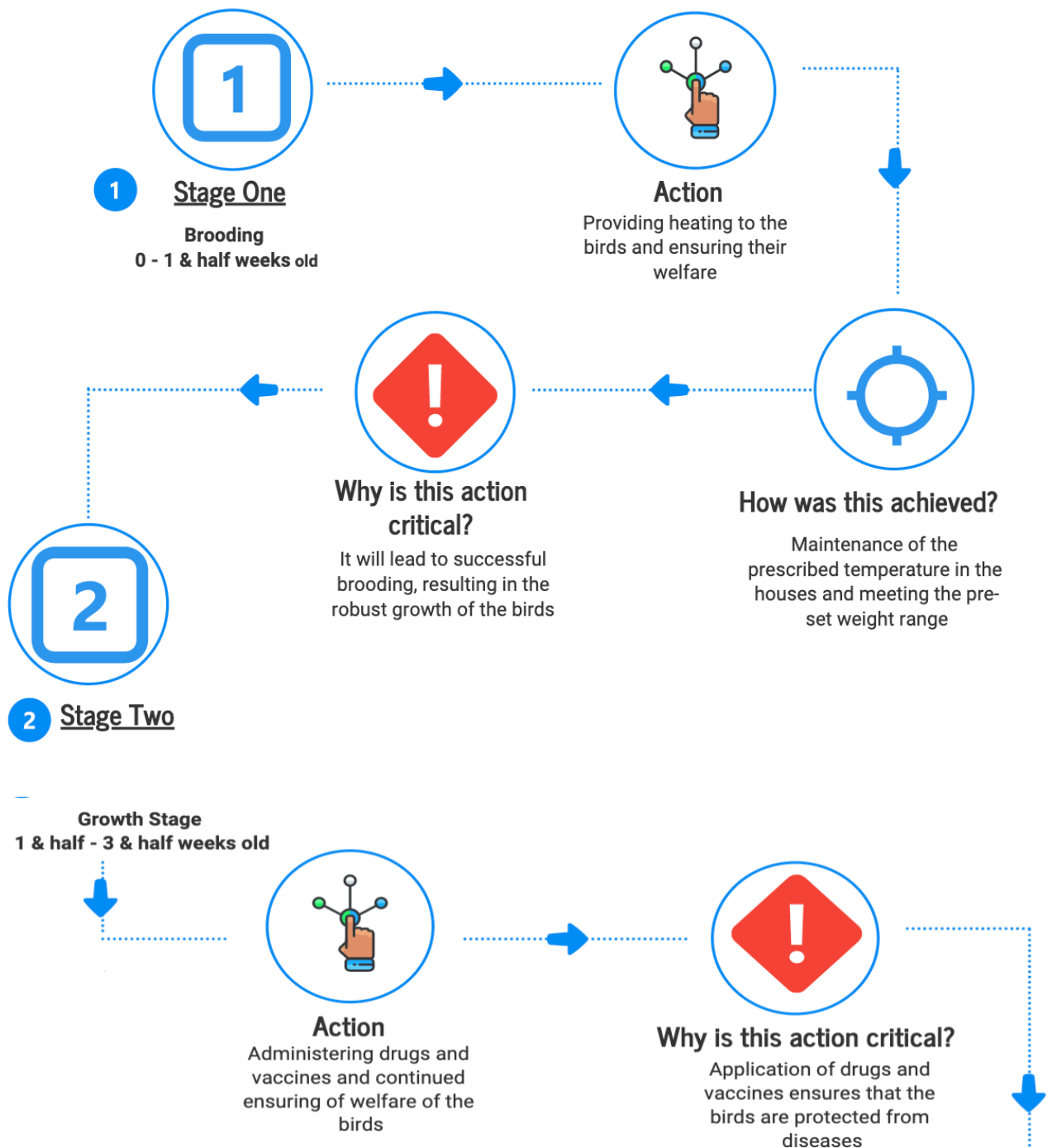
Six data collection approaches were employed in this exercise; interviews, observation, focus groups, company records from batch reports, journal entries, and weekly review of activities with the participants. In addition, journal entries by the participants as well as action research cycles provided additional data that was captured through the researcher's journal. Further, the researcher used information from the participant's journal entries to seek clarity or additional information. These data collection approaches provided a foundation for the action research exercise. Interviews with participants were done in the initial stages of the project but were later followed up for clarity. Observations were done throughout the study cycle and stages of the batch as the activities changed with the birds' growth stage. Direct observation was centred on the houses' procedures and had to be compared with the activities in the modernised houses. This aspect of the two types of housing prompted the researcher to ensure that to observe both types of houses in a comparative way to ensure that the information collected was complete and accurate. The data collected by the researcher was collaborated with the journal entries for the participants and their supervisors and compared with notes from the

key informants. This information formed part of the feedback for clarity or additional information on some of the procedures that were observed.

Focus groups provided the dynamics of group discussions different from one-on-one conversations with the participants (please refer to Appendix 16 that guided the group discussions).

Company records provided information on the sites' performance in FCR, mortalities, and live weight. This type of data was collected for an extended period in order to capture the impact of weather conditions on rearing. Review of literature show that weather conditions impacted more on ordinary houses than modernised ones.

Bird Rearing Stages





Flow chart of bird rearing stages and actions that are taken during the rearing process adopted from Zamchick

The rearing stage was broken into three phases, with each step showing what action was taken, why it was considered critical, and how this action was assessed in terms of achievement. While the data collected was preliminary and not conclusive, it helped provide the direction of the action research, learning and collaboration, with a focus set on meanings drawn from the collected data. The ultimate intention was to achieve the purpose of the study which was to understand why benefits of modernisation were not been realised and what actions needed to be taken to realise them. In mapping out the actions that needed to be taken, strategies could be formulated that make the company to be more ready for future change in terms of adopting modern techniques.

The rearing process was over a period of five weeks broken down into three stages as per the chart above. The chart was helpful in designing the action research cycles as each week had set targets as per appendix 11. In the first and second weeks, the birds had to achieve weights of 160 grams and 400 grams respectively. This was being treated like a target and a review was done the following week to assess whether the set target had been achieved. With the growth of the birds, the targets changed so did the activities and the critical tasks, as outlined in the chart above.

3.3.4 Desk Review

Company records were collected by reviewing information from the batch reports prepared for each location once the birds were cropped and slaughtered at the abattoir. These batch reports analysed the percentage of mortality, FCR, and live weight delivered to the abattoir by each location. FCR was computed by comparing the live weight as delivered to the abattoir and the amount of feed consumed by the birds. It is, therefore, a measure of the efficiency of utilization of the feed and how much of it was converted into flesh for the bird. The Company has a set mortality rate of at least 3% of the total flock and an FCR of between 1.6 and 1.8. Zamchick use these results primarily for assessing and evaluating the performance of each site.

3.3.5 Interviews with the Participants

In-depth interviews of the participants were conducted in the initial stage (this interview was different from the initial one that was used to outline the purpose of the study as well as the rights of the participants. The initial interview was also used to solicit for their participation in the study), and this was followed up by the observation that was done at each visit and was directed at the key operating areas and with focus on the activity at that time, for example, in the first two weeks, the main focus was brooding. A visit covered the entire day at the four sites during the daytime. Essential information that was collected from each participant during such interview is outlined in the interview protocol (refer to Appendix 12 for the interview protocol).

3.3.6 Key Informants Interviews

In-depth Interviews with the key informants were structured in such a way to provide clarity and reasoning for some of the procedures that were carried out at the sites. The key informants were selected based on seniority and knowledge of the industry, and the interviews were conducted in the study's initial stage. The areas covered in these interviews are outlined in the interview protocol (refer to Appendix 13 for the key informant interview protocol).

3.3.7 Direct Observation

The observation part followed after the interviews and was centred on the key activities taking place on the site and was planned to gain invaluable insights and understanding of the rearing of the birds. It involved actual observation of the poultry houses' activities, which included the application of heating to the birds or the opening of the curtains to provide a cooling mechanism. (Refer to Appendix 14 for the guide on the observation protocol).

This activity involved collecting data in a non-participatory role and taking notes in the process. It included having interactions and conversations with the employees working in the poultry houses. This interaction with the employees set the foundation for action research as the observation led to engagement with the participants through asking questions and seeking clarity.

3.3.8 Focus Groups

At the end of each five-week cycle, the researchers had initially arranged for an exit meeting with all the participants on each site. This exercise was later turned into focus group meetings. The intention was to review the whole rearing process's activities and highlight areas where gaps had emerged. The areas of coverage were identical to the key informant interview format. The intention was to get group insight and observe how the group dynamics would play out. The discussions and dynamics that emerged in the meetings were used as an additional source of primary data for the study. (Appendix 16 provided a guide on conduct of the discussion).

3.3.9 Journalising of Key Activities by the Participants

The participants recorded their key daily activities on a day-by-day basis, and it was through these recordings that the researcher was able to ask questions and seek clarity. The journal recordings were also observed for patterns to see if there was a standard pattern followed in the way the work was being done. Additionally, information from the key informants was used to cross-check the participants' work and ask for explanations as to why they performed particular tasks in the way they did and whether this was the best from their work experience. The researcher also held discussions with the participants which were used for sense-making and assessment to evaluate how knowledgeable they were about what they were doing. Additionally, the participants' notes and their responses to the questions helped shape the understanding of their knowledge in the field and whether they appreciated the impact of their actions on the business as opposed to just doing their work.

3.4 Action Research

The interviews, and observation of work processes formed the foundation of action research as the researcher engaged with the participants during or after interviews and observing their work procedures. This engagement was through interaction and seeking clarity and ideas on what was being observed and happening in the poultry houses.

In planning the design of action research, the researcher followed the research design of iterative action research cycles of construct, plan, act, and evaluate (Coghlan and Brannick 2014). The four aspects in the cycle resulted in an intervention with each process involved in the understanding, experiencing, judging, and taking-action as a result of knowing what was required of the research project and ensuring that these were achieved (Coghlan and Brannick 2014). Consideration was given to the core steps that were articulated differently by other writers, such as Stringer's (2013) basic approach of 'look, think, act' to more complex models of complex action research organisation development framework as outlined by French and Bell (1999). The researcher also reviewed Kurt Lewin's (Lewin 1948) cyclical process of identifying the initial idea of the problem, investigating this idea, planning, taking action, evaluating, and amending the plan before the second cycle of action (Lewin (1948)). However, the action research cycle by Coghlan and Brannick (2014) was preferred. It was on this basis and approach that this action research study was conducted.

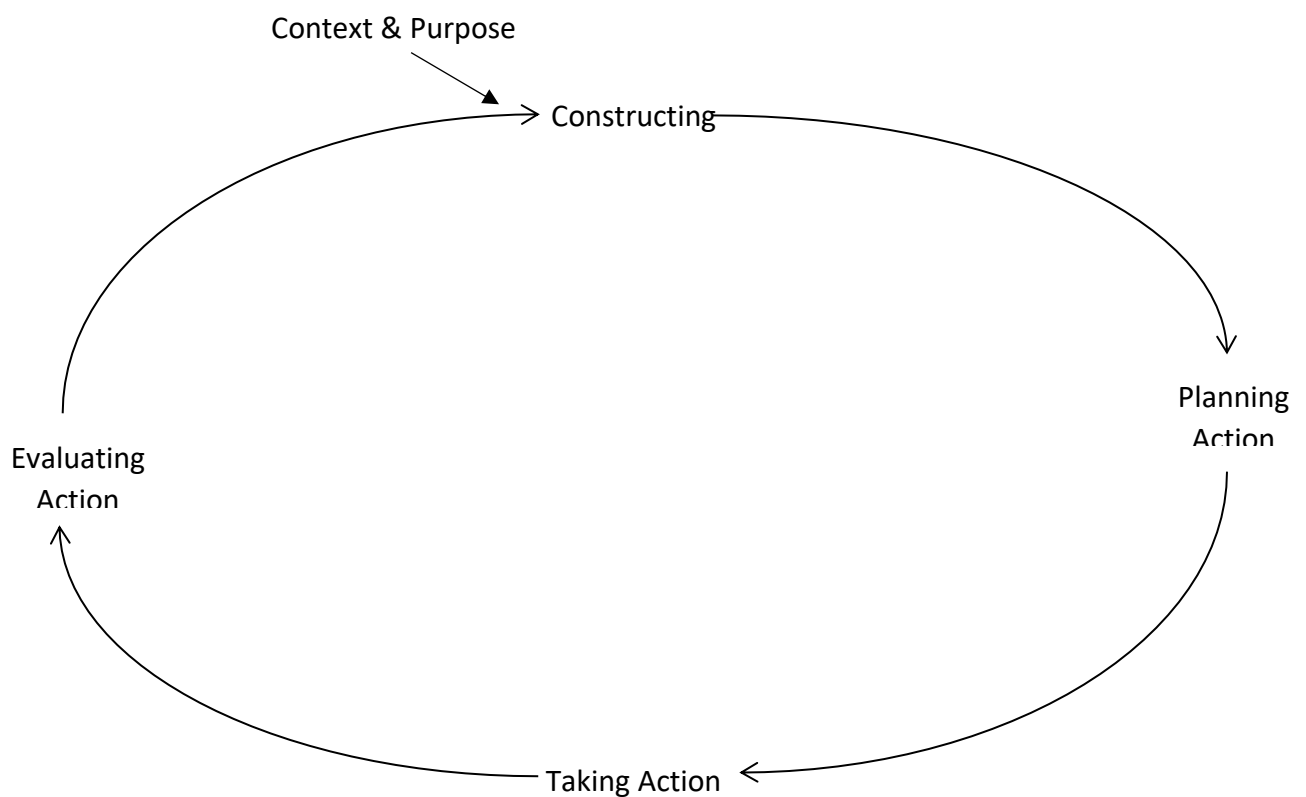
3.4.1 Weekly Meetings with the participants

The weekly meetings were arranged with each site and started with the observation of the work processes in the poultry houses. The observation led to interactive discussions about the work process and why they were doing certain processes in a particular way. It also provided an input in the critical part of the stage of the birds. These discussions evolved into action research and about the previous week's plans and actions and the results that were achieved. The results led into the review of the actions and plans and the target for the subsequent week was discussed, and plans made with actions in mind. The actions that were planned were considered together with those of the previous weeks and if the results were positive, then this was assumed to be the correct method and adopted with variations considering that the following week may have other challenges as the birds were growing (the plans and actions were made with the flow chart of the bird rearing stages in mind). Additionally, the results of their colleagues from the other groups (sites) and their plans and actions were discussed and depending on the discussions and the performance of their colleagues, the plans and actions were subjected to further review. This process was repeated the following week until cropping day.

3.4.2 Action Research Cycles

Coughlan and Coughlan (2002) advance that the action research cycle is a recurring cycle of construct, plan, act, and evaluation. The cycles are also similar to the four-step process of learning. The results of understanding the context and purpose of the problem arise before going into the cycles of data gathering and feedback, analysis, action planning, implementation, and evaluation.

The participants' initial interview provided the context of the study and the observations, and the subsequent weekly meetings set the targets for achievement, which were reviewed the following week. The review was based on the results achieved in the past week (using the record sheet Appendix 11), resulting in planning for the subsequent week. The appropriate actions were planned and again subject to review and evaluation the following week. These actions were done as per the action research cycle advanced by Coughlan and Coughlan (2002) and these actions provided a rich data source for the study.



Action research cycle adapted from Coughlan and Coughlan (2002)

3.4.3 Context and Purpose

Given that the Action research cycle tends to unfold in real-time, starting with the understanding of the context and later on purpose as well as the whether the project will be desirable (Coughlan and Brannick 2014), a meeting was held with the participants before the commencement of the study to explain what the exercise was all about. Saunders et al., (2009) add that an action research exercise can be fuzzy and complex with no clear solution at the start hence, the need to understand the context and purpose in advance of the study. Additionally, discussions were held with the participants to get their buy-in and views on what they thought could be their preferred methods of addressing the identified problems. These discussions were intended to establish a collaborative relationship with those that had ownership or needed to have the ownership of the research question(s) (Coughlan and Brannick 2014; Calton and Payne 2003). The discussions were also held to avoid a situation where a solution to the problem maybe already in place (Pedler 1997), as well as to have a variety of views to improve on the number of approaches to address the issue to ensure that the expected outcome could be acceptable (Pedler 1997). This approach addressed the aspect of sustainability of the solutions that result from this collaborative approach and provided an

opportunity for the production of legitimate and credible sharing of information (Pohl et al., 2004). During the initial interview and the interactive discussions with the participants, the aspect of poor performance was highlighted and the agreed approach was to review each and every process in the rearing stages with the intention of making improvements or indeed doing better than before.

3.4.4 Constructing the intervention

As outlined by Coghlan and Brannick (2014), the first step in action research is that of identifying the issues on which basis action research will be based. The identification was made during the interview and subsequent interactive discussions with the participants and referenced to the rearing stages as per chart above, and this resulted in constructing the steps to be followed and recorded for cross-referencing purposes.

3.4.5 Planning the Action

Having established the issues on hand and exploring the research study's purpose and context, planning the action was done. The plan was structured in terms of how the intervention would be structured. The researcher realised much early that to enhance learning from this study, it was appropriate that the study be taken in two separate batches lasting five weeks each. The intention was to explore critical areas identified during interactive discussions with the participants to ensure that intervention was structured in such a way as to address the identified issues. This approach complied with the general empirical method as outlined by Coghlan and Brannick (2014; 77):

- a. constructing the invention with the expected outcomes in mind with the participants
- b. engaging with the research team and the participants in data review of the collected data
- c. analysis of the data in a collaborative fashion
- d. taking and planning the collaborative action
- e. Joint evaluation of the results of the action, providing feedback leading to further planning.

3.4.5.1 Constructing the invention in collaboration with the participants

During the process of discussing the purpose and context of the action research exercise with the participants, information collected indicated the critical areas of focus as managing the following operations:

- a. Brooding period,
- b. Application of drugs and vaccines, and
- c. Strict observation of the birds' welfare through such measures as the withdrawal of feed during the day when the birds had reached over four weeks.

The researchers structured their observation to pay particular attention to the three mentioned processes to establish consistency and rationale for why specific procedures were done. It was identified that the provision of heat during the brooding stage was an essential

part of helping the birds in the first two weeks, as the birds cannot control their body temperature with the surrounding environment. The birds were therefore assisted with heating that was provided during the first two weeks. At this stage, the strategy was to maintain consistent heat and retain an average temperature of about 32' degrees. To achieve the consistency mentioned above, the participants devised a method of rotating charcoal filling to ensure that there were braziers in the house, providing heat while the others were being re-filled. These measures were intended to make improvements and try to do better than before. The participants were learning from their own actions in a bid to make improvements. This action only applied to Kachele sites.

The researchers used observation and reviewed interview notes to gather information on the application of drugs and vaccines. It was critical at this stage to ensure that the birds had access to the drugs or vaccines. This was firstly achieved by withdrawing water through which the drugs and vaccines were administered. At the time of re-introducing the water that was mixed with either the vaccine or drugs that were being applied, the birds would be thirsting for water and would rush to take to the water and, in the process, the drugs or vaccines. The other method was to apply colour to the water mixed with the drugs, and all the birds that would have taken the drugs or vaccines would have their beaks coloured as a sign that they had taken the drugs or vaccines.

3.4.5.2 Engaging with the participants in the review of the collected data

The participants recorded their journal activities daily. Additionally, each house kept a record sheet showing daily mortality and feed application. Every week, a sample of birds was weighed on a random basis to report weekly weights. These weights were compared to the set weekly weight target as a performance measurement.

This data was collected and discussed with the participants to look out for deviations from the set parameters and previous figures. This data was used during weekly meetings as a basis for the review of the performance of the previous week. This review helped identify areas of concern and provided input for corrective action. The weekly meeting took the position of review, evaluate, plan and set the action in motion. This process was reviewed the following week going through the same processes and learning from each week on what was needed to be done to make improvements.

3.4.5.3 Data Analysis in a Collaborative fashion

The aspect of gathering data and analysing it at each stage of the process was advanced by Anderson et al., (2015). This approach ensured feedback regarding the set goals of what needed to be achieved at each stage. In this study, each week in the rearing process was treated as a stage at which notes from the participants and the researcher were reviewed and shared. The feedback from these discussions was used to realign the action research process and provide feedback to the participants on areas that their colleagues were doing better or worse.

This stage provided the researcher the opportunity to note down key ideas from the participants' observations and comments on what was observed. It was also an opportunity to

make sense of the literature and, through iteration with the participants, review the emergence of knowledge creation. The participants' questions and comments at each stage helped them understand their involvement and learn something from the process. The results from each group was shared with the other groups with the intention of learning from their achievements or mistakes. In this way, groups learned of what their colleagues were doing and compared this to theirs, to assess where they were making mistakes or indeed where their strength was. This form of analysing data and sharing it created transparency and understanding of what was needed to be done to make improvements. The approach also created confidence in the abilities of the participants as they realised that their actions were making a difference.

3.4.5.4 Taking Collaborative Action

Each site had a team of four participants, and at any given time, two of them would be available as they operated in shifts. This team arrangement helped achieve team learning as advanced by Senge (2014). Each team had a supervisor and a poultryman who served as a learning set and study participants. The supervisor managed the site each per shift while each house was assigned a poultryman. The sharing of information across the groups ensured that the actions that they were taking was informed by their knowledge and skill in the field. Additionally, since they were aware of what their colleagues were doing and how this was impacting on their results, their confidence in taking action was enhanced as they were familiar with the consequences of their actions. Additionally, their actions were based on the review of the week's results and using their knowledge, and that gained from their colleagues, they devised action plans that they were confident could yield positive results.

3.4.5.5 Evaluation of the Results of the Action, and the emergence of action research cycle 1 and 2

The weekly results of average weights, amount of feed consumed, and mortality provided an opportunity to compare the week's actions and how they impacted the performance. This was discussed with the teams as feedback. The evaluation of the results of action research was undertaken using McNiff and Whitehead's (2011) suggestion of 'my concern, why am I concerned, and what kinds of data I will gather to show why I am concerned. As outlined above, each week was treated as a cycle and the review of the set targets provided input for what was to be done the following week. In this way, the participants were made aware of what they were doing wrong or right and what they needed to do to improve on their performance on maintain it. The weekly review and assessment resulting in making changes to the processes and the participants being made aware of their weakness or strengths, and provided learning as they are able to understand what was required. Their understanding was enhanced with knowledge of how their colleagues in the other groups were doing, and what impact their actions had on the results. The setting of the targets for the following week represented construct and plan (Coghlan and Brannick 2014) while the assessment that was done the following week represented the action of acting, leading to evaluation of the results. After the evaluation, another cycle was launched that started with constructing and planning based on the results of their previous actions that were achieved. These actions were repeated on a weekly basis with corrective action taken until the end of the batch and the chickens collected for slaughter. While the first cycle was taking place, another cycle was happening in parallel

to the first one which is about reflection or like Coghlan and Brannick (2014 pp.12) put it, “it is an action research cycle about the action research cycle”. It’s the learning that occurs from the first cycle that creates knowledge and the need to inquire about the four steps in the first cycle. It’s the learning that emerges from this process in terms of the participants realising what they need to do as they evaluate their actions and the results achieved. This action in the second cycle enables the participants in the study to develop a problem solving attitude as they resolve the issues of hand or realise what they need to do continuously to sustain good performance.

The schedule below shows the data sources and how they were to be merged to produce the findings in the subsequent chapter. This schedule presented a summary of all the data sources in the study.



A Convergence of Evidence adapted from Yin (2014)

3.5 Factors that influenced the Choice of methods

This study required the detailed understanding of what was happening as a way to formulate actions that needed to be done, to address the identified problem of poor performance leading to failure to realise the benefits of modernisation. The actions that will be planned arising from will result in strategies that could help with making the company more adaptive and ready to

change. These strategies to be arrived at would require the participants' input in the rearing process, the workers. A collaborative approach was adopted to arrive at findings that would help with resolving the identified issues. Additionally, and as outlined in the Literature Review, the rearing of chickens has multiple variable factors at play; water, stock-feed, the environment, drugs, human element, and the bird itself. These factors were required to be marshalled together to produce a bird that should meet the requirements of the Company. The use of case a study that allows for the multifaceted exploration of issues of a complex nature in their real-life settings as outlined by Crowe et al., (2011); Thomas (2016) was found to be appropriate for this study. Further, Tellis (1997) suggests that a case study is suitable for an in-depth inquiry, as was the case in this study that required exploring the multiple variables at play and their impact on the final product.

In the interview process, semi-structured, open-ended questions were used to facilitate a conversational interview and allowed for two-way communication that produced comparable, and reliable qualitative data. Yin (2014) suggests that this method of conducting interviews promotes focus on the topics to be covered and being exploratory to ensure collecting as much information as possible. The approach further allowed for flexibility, provided a more profound understanding, and was suitable for soliciting cooperation from the participants.

Creswell (2012) suggests that observation is done in two ways; in a participative or non-participative role, and taking notes in the process. Poultry rearing has stringent biosecurity measures, and, as such, observation was done in a non-participatory way, at a distance, watching and taking notes. According to Yin (2014), the opportunity for direct observation is created in a case study because it takes place in a real-life situation, as was the case in this study. The observation aspect was of a structured nature (as outlined by Thomas 2016. The observer looks out for particular kinds of behaviour in the way the poultrymen attended to processes in the poultry house). This type of evidence provided valuable data as it connected the data from interviews with the reality in the poultry houses on how the procedures played out in practice.

The third type of research evidence used was that of focus groups from which exercise the participants provided their understanding of their work processes. This evidence was used to provide group insights and their dynamics to the study.

The fourth type of evidence collected was from company records that give results of the site's performance for each batch cropped. This type of data is provided to every farmer including Zamchick rearing section after the birds are cropped, and it is the basis on which the reward to the farmer is made. The records will show the FCR (Feed conversion ratio), rate of mortality for the birds, and the average weight achieved. The record provides an overall performance of the site per batch and is used to assess the farmers generally. The information on mortality is used by management to measure the efficiency of the farmers' management practices in operation. The higher the mortality of the birds, the poorer the management practices. This aspect is also measured against the pre-set rate of 3% of the total birds placed. This data provided evidence on the success or failure of a particular method in use.

The last part of the evidence that was collected was from action research that resulted from observation. The process involved an interactive exercise with the participants and helped create knowledge as it was exploratory and developmental. Knowledge creation resulted from the participants' interest in resolving the matter at hand and their shared commitment to ensure that solutions were reached. The interaction generated sense making as the participants were able to provide reasons and justification for doing particular procedures in the house and why by not doing what were they doing could result in undesirable consequences.

To achieve data triangulation (Yin 2014) and as outlined above, multiple sources of data were used as sources of evidence and as such this allowed for the development of converging lines of inquiry to ensure that it is more convincing and accurate.

3.6 Data Analysis

Yin (2009) advances that when employing an analytical research strategy, the intention is to achieve a high level of research analysis and, in so doing, proposes three principles of research design; the focus of the investigation, focus on the research question, and expert knowledge. The intended purpose of all these propositions is to allow data to be processed in forms that permit further analysis. This additional analysis will allow for structuring the collected data and reducing this into topics through coding and labelling.

Data analysis in this study commenced immediately after data collection as themes and patterns started to emerge at this early stage (Yin 2009). This approach of looking out for patterns, abstracting ideas from the data, and providing explanations (Thomas 2016) was evident throughout the study. Data from interviews followed the semi-structured format and from this the researcher was able to note areas of emphasis and meanings. These meanings were compared with the rest of the participants to draw out the understanding for purposes of sense making.

The plan for developing data analysis, interpretation, and representation was based on constant comparative methods that offered a means of drawing themes from the data (Thomas 2016). This approach allowed for theme mapping that provided the opportunity to interconnect the various themes in the data. This interconnectivity of the themes was enhanced by adopting the matching and explanation building techniques as outlined by Yin (2014). While certain parts of the data was discussed under the various sources, repetition was avoided by analysing these views under one source. This was evident on data for the requirement for training which was gathered under interviews, observation, focus groups and action research. This was probably the most talked about issue during the study.

The researcher adopted the analytical research strategy that was intended to achieve a higher level of analysis and relied on the four principles outlined by Yin (2014) of research evidence; the focus of the analysis, focus on the research question, and expert knowledge in the field as

guiding principles that influenced the way data was analysed. The observation part was guided by the rearing stages and following the growth stages of the birds as activities and emphasis changed over the growth period. Each week had its own challenges and the researcher had to first review the stage's activities before undertaking the observation exercise. This aspect was helpful to identifying what to look out for such that at the time of interacting with the participants, the researchers could frame up their questions with reference to the stages. The rearing stages framed the themes and how data was analysed for observation and action research.

All the Qualitative data that was organised thematically in order of emphasis by the participants. Prominent topics that emerged from the discussions and action research with the participants were that of training, staff movement and management practices.

Training was broken down into (1) complete lack of it, (2) poorly planned training programs, and (3) where it existed with some form of planning, it was not focussed to address the needs of the people that were being trained. Examples are events at Maridadi, Kachele A, B and C. All these sites presented varying types of training that had to be analysed differently. These sites had different training needs but all falling under the umbrella of training. Staff movements that related to the depletion of trained and skilled individuals at Kachele B and C where there was no planning for retaining employees was categorised under knowledge retention. Issues of management practices relating to how senior management on site treated feedback from employees and the aspect of communication with them was categorised under management practices as they related to the human resource part of the business.

The above approach with regards to how qualitative data was treated and categorised is what formed the basis for the thematic analysis of this type of data.

Data from company records was firstly presented under Appendix 1 in four sets representing each season of the year and showing each site with figures of FCR, weights and mortality. Each site was individually analysed for the minimum, maximum, mean and standard deviation for FCR, mortality and average weights, thereafter the sites were compared to each other to assess which of them produced better results. This data was analysed using SPSS at a confidence level of 95%. Confidence level in statistics indicates the probability with which the estimate of the location of a statistical parameter in a sample survey is also true for the entire population. Therefore, a confidence level of 95% means that we are sure that 95% of our results contain a true mean average of the designation population. Additionally, statistical data was produced for each site showing number of employees, houses, birds capacity as well as placement density of each site. Finally, a comparative of data for the different seasons for each site was done as a way to assess the impact of weather on poultry rearing. This analysis of data was done to facilitate the comparison of each site to the other and to develop further analysis in terms of the impact of production increase on the overall performance of the site as well as the comparison of the standard and expected performance based on the three pre-set parameters to the achieved performances of each site.

3.7 Ethics in Action Research

Action research, just as all other research exercises, require ethics to be adhered to, and these affect the organisation and the individuals who will participate in the project. The University of Liverpool provided guidelines on how ethical issues were to be addressed in the research project. These have been summed up and relate to the three categories as advanced by McNiff and Whitehead (2011). These are negotiating and securing access, protecting the participants, and assuring good faith. For this study, the University of Liverpool ethical committee approved the study.

3.7.1 Negotiating and Securing Access

By its nature, action research demands action that will threaten the existing organisational culture and norms (Coghlan and Brannick 2014). To achieve any actionable outcomes arising from action research would require legitimacy. The legitimacy of this study was achieved through Zamchick's authorisation to access the sites as well as written notification to the employees of the research study. Subsequent to the approval letter, the employees were engaged to solicit their support and participation. This aspect of soliciting their support not only ensured the management of organisational politics (Buchanan and Badham 2008; Roth et al., 2007) but also ensured that the changes that would arise out this study would have their input. This engagement and the support of the employees through participation achieved credibility and justification of the research project and was helpful in the management of political relationships on the sites.

3.7.2 Protecting the Participants

The employees were informed that their involvement in the project was at their choice. While they were given journals to record the daily activities, they were only referred to by their code names to ensure that their identities were kept secret. The would-be participants were provided with a consent form and a declaration that their participation would not be subject to any reward. A discussion was further held with the participants informing them that they had the right to withdraw from the project at any time and that their participation was voluntary. Additionally, they were told that their identities would be anonymous and that their contributions to the project would not be identified with them as individuals. The consent form was submitted to the research team in advance of the interview, and the researcher ensured that the signed copies were collected from each participant. The information sheet was sent as well in advance of the interview. After these two forms were completed, the researcher held discussions with the participants to explain the project's details. All these measures were taken as per the University of Liverpool's guidance to ensure the participants' protection.

3.7.3 Assuring Good faith

McNiff and Whitehead (2011) suggest that to ensure the credibility of the research process, trust issues are essential, and they can be enhanced through the display of high levels of integrity and truthfulness. In this regard, Coghlan and Brannick (2014) add that trust with the participants can be achieved by ensuring written permission of their participation is obtained before the commencement of the research project. In this way, their interests are protected.

In this study, participants were informed in advance of their roles and their consent secured. Information sheets were given to them and explained to them in detail to ensure they understood their involvement. Time was also availed to them to reflect on the matter before committing themselves to the study. The interviews conducted after submitting the consent and information sheet provided an additional opportunity for clarity and further details to enhance their understanding of the project. The anonymity of their contributions and assurances of data security and handling provided enough confidence to the participants that there would be no 'comebacks' for them to engage in the study.

3.8 Ethics in Data Collection

Insider research exposes the researcher to the aspect of being too close to the data (Coghlan and Brannick 2014). This aspect can result in the researcher being presumptuous during interviews and not probing as much as the outside researcher could have under similar circumstances.

It is the researcher's responsibility to secure the data collected from individuals, besides making every effort to anonymise the data (Thomas 2016). Five ways of good stewardship of data are proposed by Thomas (2016):

- a. To use the collected data for the purpose for which it is collected.
- b. To keep the data for some time as stipulated by, in this case, the University of Liverpool.
- c. To use passwords, to secure the data before anonymising.
- d. To ensure that data is not passed on to other people; and
- e. To ensure that data is kept in an anonymous format.

The information sheet that is provided to the participants should be as informative as possible outlining such details as (Thomas 2016):

- a. Names of the researcher, title of the project and the affiliated institution.
- b. A brief explanation of the research project.
- c. Information about the rights of the participants in terms of their rights to withdraw at any time and confirmation that their participation in the project is voluntary.
- d. Confirmation of what is expected of the participants and whether their participation will involve audio or video recording.
- e. Information about data security and how long the data will be kept by the researcher.
- f. Information about the arrangements for confidentiality as well as anonymisation of the collected data; and
- g. Information about feedback after the research project.

3.9 Reliability and Validity

According to Kleinsasser (2000), the validity criterion is achieved in part by good data. Yin (2014); Creswell (1997) advanced triangulation whereby various research methodologies are employed to investigate the case by reviewing primary and secondary data sources. Hays and Wood (2011) suggest prolonged engagement and persistent observation as a way in which triangulation can be achieved. This study relied on Yin's (2014) suggestion of data triangulation

to create reliability and validity of the data sources. Furthermore, the researcher had to engaged in observation for a prolonged period of time in a repeated manner as a way to achieve triangulation of data from observation.

3.10 Challenges of the insider Researcher

Being an employee and researcher and a consultant to the action research process is the challenge that the researcher faces, as identified by Roth et al., (2007). The challenge is further compounded by the desire to retain organisational membership, which would require total commitment to the organisation and the researcher's detached role that would demand objectivity and neutrality (Coghlan and Brannick 2014). The dual role that the researcher performs the organisation's duties and that of the researcher can create a conflict in terms of loyalty to the employer and the research exercise whose results will have to be credible. To address this dilemma, Coghlan and Brannick (2014) propose pre-understanding the informal structures and cultures of the organisation. In addition to this, Buchanan and Badman (1999) suggest that political entrepreneurship is the way the researcher would navigate through the organisation structures to achieve credible research results. As applied to the organisation, political entrepreneurship is the ability to operate in the organisation, influencing decisions and decision-makers and enabling activities, and coping with resistance and credibility (Buchman and Badham 1999). While the researcher has valuable knowledge of cultures and the informal structures of the organisation (Coghlan and Brannick 2014), this privileged knowledge can work as a disadvantage, as the researcher is likely to be part of the culture of the organisation and may have difficulties to stand back from it and make objective assessment and critique (Colghlan and Brannick 2014).

The researcher applied Coghlan and Brannick (2014) concept of pre-understanding of the organisation's cultures and structures and the aspect of political entrepreneurship as advanced by Buchman and Badman (1999) in navigating his way around. With regards to political entrepreneurship in the study, the researcher played the role of an influencer rather than as a decision maker, this way the decisions that were made were not directly attributable to him and it helped in managing organisational politics. Additionally, by listening and acting on the advice and recommendations of the participants, this helped improve their confidence in the study and diminished the executive role that the researcher has in the organisation, in the study.

3.11 Chapter Summary

The choice of the research methods was influenced mainly by the subject of study and the fact that this investigation was to be done through action research in addition to the other methods that were used to collect evidence. This aspect was despite the initial position of the researcher, who, with his financial background, wanted to have this done through quantitative methods. The exercise intended to achieve change as a way to improve the ways things were being done. A collaborative approach that had all actors engaged that enhanced learning and had a two-way interactive process from the workers and the researcher was the only reasonable method accepted in the change process.

CHAPTER 4

Findings

4.1 Introduction

The purpose of this research study was to explore strategies that Zamchick could utilise to increase the benefits including profit margins from implementing modern methods. Through interviews of the participants and key informants, observation of their work processes, discussions with the focus groups and company records, the researchers were able to gather enough data, analyse it according to the themes and through the use of SPSS software to arrive at the findings outlined later in this chapter. Additionally, this intervention was made also through an action research exercise that involved the participation of the workers on-site, who collaborated with the researcher, to come up with possible solutions to the challenges that they were facing. The researcher applied the principles of action research and selected non-participatory action research approach using the identified stakeholders who were the managers and the workers on the sites. Additionally, the researcher applied the aspect of sense-making resulting from collaboration and shared commitment (as advanced by Calton and Payne, 2003) to ensure that the resultant solutions generated from this collaboration could be sustainable. Pohl et al. (2004), in this regard, state that solutions that result from a collaborative approach are sustainable as they are generated from the legitimate and credible sharing of information. Furthermore, and in support of the position advanced by Pohl et al. (2004), Calton and Payne (2003) state that solutions arrived at in this way are full of interdependent ideas which result in insights and enhanced knowledge and learning.

The above-outlined purpose of the study required a design that necessitated engagement with the participants who were employees of Zamchick. This required that the study complies with the University of Liverpool's (UoL) requirement that involves human participation and as a result, the researcher had to complete forms for review by the ethics committee before any data collection was undertaken. The forms were submitted, and approval granted on September 13, 2017. It was only after this that the researcher commenced the collection of data. (Data collection started on June 23, 2018 and ended on September 29, 2018). There was a delay in commencing the data collection exercise as a result of the outbreak of foot and mouth disease in the area. Resulting from this outbreak, Zamchick implemented enhanced biosecurity measures and only after these measures were reviewed in detailed was the researcher allowed on the sites. Apart from that, when the researcher discovered that certain facilities on the sites had been decommissioned, permission was sort again from the University to approve the addition of an extra site at Maridadi. This additional site had modernised facilities. Approval was granted in October 2019. (For the additional site, collection of data through interviews, observation, action research and focus groups started in December 2019 and was completed in February 2020).

The researcher adopted the case study approach for this study. The study was conducted in Zambia under Zamchick which is the subsidiary company of Zambeef Products Plc, the holding company and specifically the rearing section of Zamchick. In this regard, the country-level context is Zambia, and the industry is poultry while the organizational level is the rearing section of Zamchick. The design of this study follows the guide by Yin (2014) that four facets

should be considered: what questions to study; what data is relevant; what data to collect and how to analyse the results.

Eighteen participants (including the two key informants), who were employees of Zamchick working at the four sites of Kachele A, B, C and Maridadi, were selected for this exercise. Four from each site at Kachele, and Maridadi and the other two were the key informants. Of the selected participants, only one failed to fully participate as a result of ill health and had to withdraw. The employees at Zamchick had each a minimum of two years of experience working in poultry rearing, and as such learned on the job while two had formal training in agriculture from the local agriculture college. Of the two key informants, one was a scientist, an animal science specialist while the other was a business expert responsible for the business side of the company. The three sites at Kachele were operating as ordinary houses while the one at Maridadi operated a fully environmentally controlled house with modern facilities.

The researcher runs his own poultry rearing business in private practice and has acquired experience and knowledge about the poultry business. This exercise will increase his knowledge of the business and will help him in formulating strategies of making improvements to the performance of his business, as well as guide him for future investment opportunities in the poultry business.

The findings that will be presented in the subsequent sections will start with results from quantitative data, following by those from qualitative data. This will be followed up with the discussion section, thereafter the recommendations section ending with the conclusion of the chapter. Data from company records, quantitative data was analysed using SPSS while some of which has been presented using excel spreadsheets as statistical information. Qualitative data was analysed according to the themes that were prominent during the study. The recommendations present the strategies that Zamchick can use, arising from the study to help with addressing the problem of not benefiting from the application of modern methods. However, given that the study included old houses, some of the recommendations cover that aspect and as such maybe irrelevant to modernised facilities.

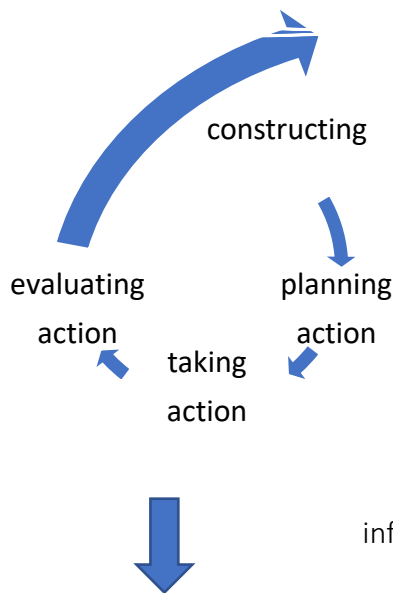
4.1.1 Action Research Cycles linked to the work that was done in this study

Action research formed the major part of the research study as the researcher engaged with the participants in their work routines. Action research goes through the routine of pre-step, main steps and the meta-step. The pre-step was established at the initial interview with the participants where the context and purpose of the study was outlined. The main-steps of constructing, planning action, taking action and evaluating the action was done on a weekly basis for the duration of the rearing cycle. The meta-step or the reflection cycle occurred within the core cycles as the participants reflected on their actions and made proposals to improve their work.

The main steps (as outlined by Coghlan and Brannick 2014) were done and conducted in the format as outlined below and based on the action research cycle and bird rearing stages as outlined in chapter 3.

Week One

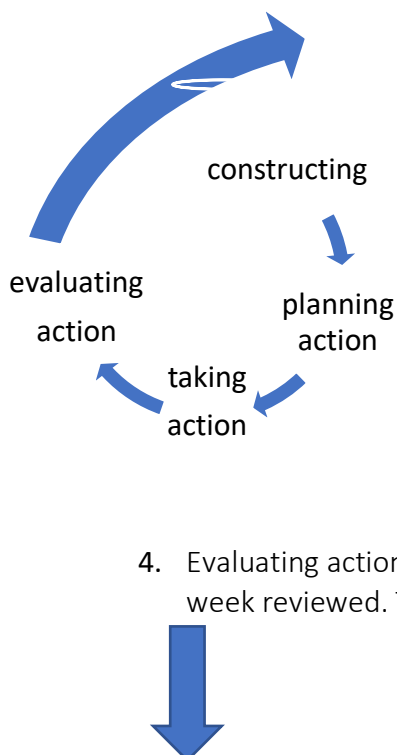
(Adapted from Coghlan and Brannick 2014)



Notes:

1. Constructing involved the review of the activities for the week
2. Planning action involved planning the provision of Heating to the birds and ensuring their welfare
3. Taking action involved maintenance of the prescribed temperature in the houses and checking the bedding
4. Evaluating action, at the end of the week, the birds are weighed and mortality for the week reviewed. This information is fed into planning for week two

Week two (Adapted from Coghlan and Brannick 2014)

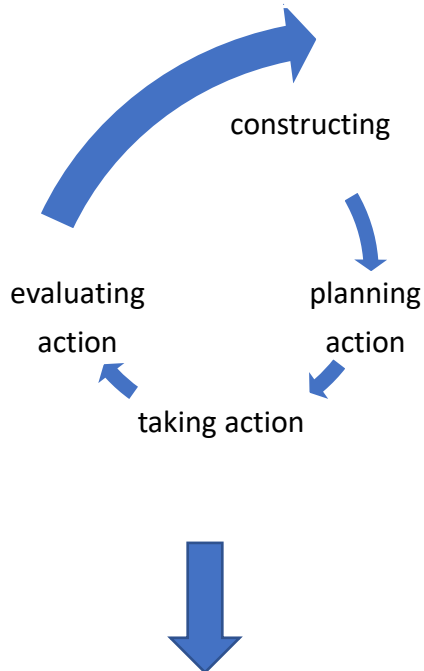


Notes:

1. Constructing involved the review of the activities for the week together with the results achieved at the end of week one
2. Planning action was as per the activities of the week that Included drugs administration and planning for remedial action depending on the results of week one.
3. Taking action involved drugs application and taking action To remedy or consolidate the results achieved in week One.
4. Evaluating action, at the end of the week, the birds are weighed and mortality for the week reviewed. This information is fed into planning for week three.

Week Three

(Adapted from Coghlan and Brannick 2014)

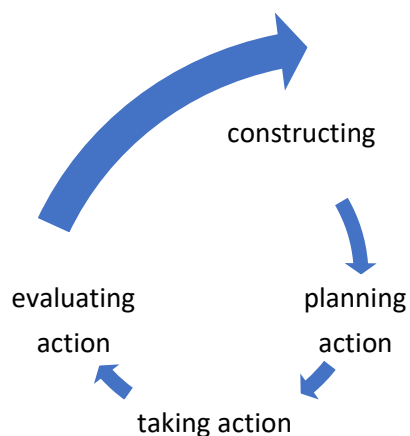


Notes:

1. Constructing involved the review of the activities for the week together with the results achieved at the end of week two.
2. Planning action was as per the activities of the week that included drugs administration and remedial action depending on the results of week two.
3. Taking action involved drug application and acting on remedial works guided by the results from week two.
4. Evaluating action at the end of the week, birds were weighed and mortality for the week reviewed. This information was fed into planning for week four.

Week Four

(Adapted from Coghlan and Brannick 2014)

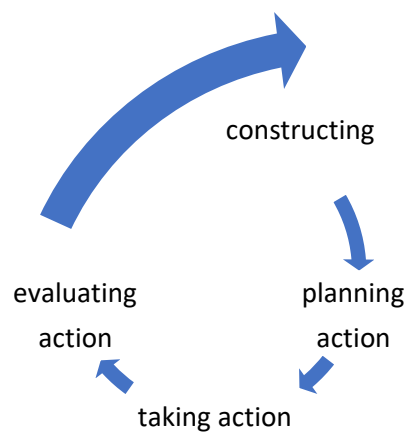


Notes:

1. Constructing involved the review of the activities for the week together with the results achieved at the end of week three.
2. Planning action as per the activities of the week and included remedial action depending on the results of week three.
3. Taking action involved safe guarding the birds from adverse weather conditions and remedial works as guided by the results from week three.
4. Evaluating action at the end of the week, birds were weighed and mortality reviewed and this information was fed in planning for week five.

Week Five

(Adapted from Coghlan and Brannick 2014)



Notes

1. Constructing involved the review of the activities for the week together with the results achieved at the end of week four.
2. Planning action was as per the activities of the week and included remedial action depending on the results of week four.
3. Taking action included safe guarding the birds from adverse weather conditions and remedial works as guided by the results from week four.
4. Evaluating action. The birds were cropped and delivered to the abattoir where they were weighed and final results of weights, mortality and FCR produced to show the performance achieved for the batch.

4.1.2 Meta- Learning

In an action research exercise, two action research cycles operate in parallel (Coghlan and Brannick 2014). The first cycle is the core cycle outlined above and the second cycle is the reflection part which Mezirow (1991) attributes to that of content, process and premise. Action research has the aim of creating awareness and this was achieved in this study by the participants becoming more aware of the purpose of the study which resulted in them making adjustments to the routines such as the rotation of the charcoal braziers to ensure that the heat in the houses was retained. Other actions that were taken to change the tactics and performance with the intention of improving the results were as follows:

- a. Applying colourants to water supplied with the drugs to confirm that the birds had taken the drugs
- b. Feed breaks in times of intense heat to help the birds deal with heat stress
- c. Proposed reduction of placements as a method to deal with heat stress

The participants were able to come up with such proposals as they had become knowledgeable about the impact of their actions and reflected on how well they could have carried out their plans and work routines and the impact that their actions would have on the final results. The ability to be more knowledgeable and apply themselves to the tasks is what results in learning and improvement of their skills during this cycle. This is because they had come to understand the intentions of their work and hence developed plans and strategies and reflected on how well these tasks would be done. The weekly results helped them to further understand the impact of their actions.

4.2. Findings from Data from Company Records

4.2.1 Site Statistics

4.2.1.1. Labour

Maridadi site with modernised facilities had three houses with a capacity of 90,000 birds in total. It had 12 employees. Kachele on the other had three sites of 10 houses each and each house had a capacity of 6,000 birds with 22 employees per site.

Site Statistics

Site Name	Employee # per site	# of Poultry houses per site	Capacity Placement of birds per site	Average Stocking density per sq.mtr per site
Maridadi	12	3	90,000	20 birds/sq.mtr
Kachele A	22	10	60,000	12 birds/sq.mtr
Kachele B	22	10	60,000	12 birds/sq.mtr
Kachele C	22	10	60,000	12 birds/sq.mtr

From the above schedule, Maridadi had 12 employees managing 90,000 birds while kachele sites had 22 employees managing 60,000 birds per site. If 90,000 was divided by 12 employees, it would follow that each employee would be managing 7,500 birds while for Kachele sites, this would translate into 60,000 being divided by 22 resulting in 2,727 birds per employee. The result of this analysis is that Maridadi would have lower labour costs as a result of employing 12 employees compared to 22 while at the same time producing a higher volume of about 1.5 times more, resulting in higher revenues.

4.2.1.2 Placements of birds per site

The above schedule shows that the modernised houses had a higher placement of birds of about 66.67% more than the ordinary houses. As a result the modernised houses had a higher housing capacity with three houses compared to Kachele sites that had a higher number of houses per site.

4.2.1.3 Number and size of poultry houses

Kachele sites have a higher number of houses compared to Maridadi. This is because they accommodate a lower number of birds and have a comparatively a higher number of employees to tend the birds. The houses at Maridadi were found to be larger in size compared to the ones at Kachele sites and fewer in number.

4.2.2 Production Efficiency Information

4.2.2.1 FCR (Feed Conversion Ratio)

The schedule below shows the average FCR, mortality and average live weights for all the four sites that were the subject of this study. FCR averaged at 1.81 for all the sites and Maridadi had the lowest FCR of 1.71 compared to the rest of the sites. The lower the FCR, the better as this shows that lesser feed was consumed to achieve the reported weight.

Average means for the Sites using variables of Mortality, FCR and Average weights

Variable	Overall	Maridadi (N=4)	Kachele A (N=4)	Kachele B (N=4)	Kachele C (N=4)
	Average (N=16)				
Mortality	9.89	7.91	7.45	12.74	11.46
FCR	1.81	1.71	1.89	1.88	1.76
Average Weight	1.75	1.86	1.8	1.58	1.75

Note. N = number of cases/occurrences

Fig. 1. Summary of the average means for all the sites. This was a collection or summary of the information presented in Appendices 3, 4, 5 and 6 and also shown in Appendix 7.

4.2.2.2. Live Weights

Maridadi achieved a higher weight of 1.86kgs per bird while it also had a superior FCR compared to the other three sites. This means that with a lower FCR, less feed was consumed to achieve this higher weight. This further means that Maridadi had a lower cost of production (feed wise), comparatively but will also have higher revenue because of the higher weights as the reward to farmers is paid per kilogram of the birds delivered to the abattoir.

4.2.2.3 Mortality

The average mortality rate was computed at 9.98% of the birds placed. Kachele A achieved a low mortality rate at 7.45% followed by Maridadi at 7.91%. It is expected that the lower the

mortality rate, the better it is for business since the birds that die will have consumed feed, drugs and labour costs which will not be recovered because of them dying before being cropped. Zamchick has a pre-set mortality rate of 3% and anything beyond that is considered as poor performance. From Figure 1 above, all the sites performed poorly with regards to mortality. However, Maridadi with modern facilities was expected to perform better but still came second to Kachele A.

4.2.3 Impact of Weather patterns on Broiler Production

Appendix 10 Anova of FCR, Mortality and Average weights for the different seasons

		Sum of Squares	df	Mean Square	F	Sig
Mortality in %age	Between groups	5.065	3	1.6880	0.1800	0.9080
	Within groups	112.7	12	9.3920		
	Total	117.765	15			
FCR	Between groups	0.037	3	0.0120	1.1950	0.3530
	Within groups	0.125	12	0.0100		
	Total	0.163	15			
Average weight in Kgs	Between groups	0.035	3	0.0120	0.4170	0.7440
	Within groups	0.34	12	0.0280		
	Total	0.375	15			

Fig 2

A review of significant difference (under Sig column) shows that in all the three factors of FCR, average weights and mortality, there are no significant differences between and within the groups. This analysis was meant to show if rearing of the birds in different weather conditions had any impact on the results. The results show that there was no impact on rearing under different weather conditions.

The batches that were picked for the data under company records were carefully selected to represent all the seasons of the year. Using ANOVA (Analysis of variances) to compare the impact of weather on the rearing of birds at 95% confidence level, the batches for this particular exercise exceeded the number that was studied for this research. This was done to ensure that all the seasons in the year were represented and to show how these seasons impacted on the performance for both modernised and non-modernised houses.

Results above and also shown under Appendix 10 assessed the effect of the weather given that the batches were selected to represent the full year weather patterns of the country. From the data analysis done, weather patterns did not impact on the results that were obtained from the selected batches covering the four sites. However, according to Yakolveva and Flynn (2004), environmentally controlled housing had the effect of equalising the adverse weather effects to ensure the birds were protected from adverse weather conditions. This idea was also supported by Corkery et al. (2013), who state that birds, when exposed to colder conditions, tend to utilise feed to warm themselves while in warmer conditions they use the same feed to cool themselves. Additionally, FCR is poor in colder conditions, but better in warmer conditions (Corkery et al. 2013).

The results of this study did not support the advancements by Yakolveva and Flynn (2004), and that of Corkery et al. (2013) with regards to the impact of weather patterns on the rearing of the birds. The impact of weather should have been observed and negatively impacted birds in ordinary houses than those in environmentally controlled housing where the temperature in the houses was controlled through computer programs as was the case at Maridadi site.

4.2.3 Impact of Increased production on Revenue

Item	Maridadi	Kachele A	Kachele B	Kachele C
Average weights (kgs) per bird	1.86	1.8	1.58	1.75
Feed Consumption (kgs) per bird	3.18	3.4	2.97	3.08
Feed Cost as a percentage of total Revenue	56%	62%	62%	58%
Number of Employees	12	22	22	22
Gross Revenue per Employee	12,846.56	4,543.36	3,760.11	4,225.77
Revenue (less feed cost) generated per employee	5,617.92	1,723.95	1,429.32	1,775.79

Spread sheet showing impact of revenues arising from increased volumes. Detailed schedule on Appendix 19

From the above results that analysed the impact of increased volumes on gross revenue per employee, gross revenue less feed costs per employee and feed cost as a percentage of the gross revenue, the following were the findings:

- a. Maridadi achieved a lower percentage of the feed cost as a result of the superior FCR which resulted in lower feed consumption. This was followed by Kachele C which also had the second best FCR and resultantly, lower feed consumption and hence second lowest feed cost as a percentage of revenue.
- b. Maridadi had the highest gross revenue per employee followed by Kachele A. At this stage, the impact of increased volumes as well as better mortality rate were the contributing factors and Kachele A had the superior mortality rate compared to the rest of the sites but for the increased volumes at Maridadi.
- c. The impact of FCR is noticed at this stage of comparing gross revenues less feed costs as Maridadi once again was ahead and only followed by Kachele C as a result of the site achieved a better FCR.

The impact of FCR is seen through feed costs while that of mortality is through the revenue. But most importantly is the impact of improved revenue resulting from increased volumes and reduced labour numbers. The impact of Maridadi handling about 2.7 times of birds more than the sites with ordinary facilities is seen though the revenue per employee which is far superior to the other sites and this can be an attraction for modernisation.

4.2.5 Comparison of the site results with the standard set by Zamchick

	Standard Results	Maridadi Average	Kachele A Average	Kachele B Average	Kachele C Average
FCR (ratio)	1.78	1.71	1.89	1.88	1.76
Live Weight (kgs)	1.8	1.86	1.8	1.58	1.75
Mortality (%age)	3	7.91	7.45	12.74	11.46
Calculated total feed Consumed	3.2	3.18	3.4	2.97	3.08

Schedule showing a comparison of the site results with the set standard.

The above schedule compared the results of each site with the pre-set standard to see how far the results diverted from the set standard. The standard is the minimum expected that any rearing operation should achieve on an average basis. The following are the findings:

- a. Maridadi and Kachele C performed better on FCR than the standard
- b. Maridadi and Kachele A performed better on the weights
- c. All the sites performed poorly and below the set standard on mortality
- d. Maridadi and Kachele C, which had better FCR than the standard, performed better on feed consumption.

While Maridadi with modern facilities was expected to outperform the rest of the sites, the fact that they marginally surpassed the three set factors and failed on the fourth should be a source of concern to management of Zamchick. The modern facilities are supposed to demonstrate improved results which should show the impact of these new facilities and not to marginally surpass the standard, which standard was initially set for ordinary houses.

4.3 Findings from Qualitative Data

4.3.1 Factors that are preventing Zamchick from realising the benefits of modernisation

4.3.1.1 Lack of feedback and Communication Lapses

One of the profound findings that was made during the study was that of the employees complaining that their supervisors and senior management did not listen to them. As one of the participants remarked in confidence “we know what needs to be done to improve the operations, but our suggestions are always met with threats of disciplinary action as our supervisors feel challenged”. Another one also said, “some of the people that left cited this problem as the reason for leaving”. The second part was with reference to Kachele B and C. Another employee made the following remark, “it is difficult if not impossible to make suggestions different from that of the supervisor as that is often treated as insubordination”.

This type of management deprives decision makers of valuable information that can be used for decision making purposes. The employees operating the system have the skill and knowledge acquired over time and understand the system requirements and through feedback can relate events in production with the resultant FCR, mortality and average weights that are reported. The attitude of not paying attention to the views of the people operating and running the operations denies management the opportunity to get varying views that could help with identifying the problems of poor performance.

4.3.1.2 Failure in the Implementation of new technologies

The implementation of new technology at Kachele B and C did not display any planning. While at installation employees were trained on the new equipment, there was no plan for future training to ensure the knowledge acquired is entrenched in the employees. Further, no plans were in place for manpower replacement of the trained employees as a result, when the trained employees started leaving, there was no mechanism in place to either retain them till suitable individuals were found or indeed train the existing remaining employees to take the roles of those that left. The result of this is that even the trained ones that remained became frustrated with the situation and left the company. The employees that remained over time did not have the skill and knowledge to manage the facilities, and these facilities, as a result, went into a state of disrepair and was later abandoned. Some of the participants stated, “we

had to abandon the system because it malfunctioned several times, and we had difficulties operating and maintaining the equipment”. They could not have managed the facilities as they did not have the skill nor knowledge to do so, resulting in them reverting to a system that they were confident and familiar with, which was the ordinary houses.

Maridadi site presented a slightly different position as it is a leased property with modern facility and on takeover, the employees were trained and subsequently, a program for continuous training was implemented. However, with time, this training program was never subjected to review to ensure that it served the interest of those that were trained to operate and manage it. One of the participants commented, “we can’t intervene or make changes to the way the system is working because that can only be done by the consultant”. The participants cited the example of malfunctioning sensors which would give wrong signals to the computer operating the system. The wrong signals would lead to an instruction whose action would be contrary to the existing environment. Other participants said it in a different way: “this equipment operates by itself and cannot be adjusted in the event that we notice a problem.” The modern methods are supposed to make work easy and should not operate in isolation of the people operating it. The fact that the equipment operated independent of the operators is a sign of a poorly planned and designed implementation programme that does not consider the required skills of the people operating the system. Additionally, this position does not allow the employees to see the benefits of operating such a system and could lead to failure and undesirable results.

4.3.1.3 Human Resources issues

The study did not find any evidence of programmes for upscaling the skills of the employees prior to implementing the modernisation program. At both sites, Kachele and Maridadi, training of the employees was not planned pre acquisition of Maridadi or before the acquisition and installation of the equipment at Kachele B and C. However, training was only done after equipment installation at Kachele B and C and after the acquisition of the Maridadi site. This approach did not consider the human resource factor at planning stage and is often referred to as the traditional approach. The modernisation program was intended to resolve the issues associated with the old facilities and in doing so, the human resource that would be managing the facilities needed to be prepared in advance and prior to installing the equipment. This is because the installation of modern techniques is supposed to resolve real life problems which evolve over time and so do the problems that modernisation is intended to address. As such, equipping employees with prior knowledge and upgrading their skills regularly prepares them in advance with the skills necessary to address the issues that emerge from the modernisation program.

4.3.1.4 Retention of skilled manpower

Review of employee data as well as data gathered from interviews revealed that the employees at Kachele B and C sites had been there for less than three years. This meant that they were not part of the group that was trained on the equipment (in 2014 and 2013) at the time of installing modern equipment at sites B and C. This showed a lack of human resource planning that neither reviewed nor assessed the level of skilled manpower operating the equipment. Additionally, there was no evidence of a re-training and retention program of employees who

had been initially trained at the time of installation of the equipment. The review of the employee data records also revealed numerous transfers in and out of the sites without reference to the skills or knowledge of the employees that were being moved. This demonstrated a lack of control on the movement of employees as no employee should have been allowed to depart from one site without ensuring that a suitable replacement with the required skills and knowledge was in place. This is because skilled and trained employees are assets to the company and they ought to be retained to ensure the company continues to gain from the employee's skill and expertise.

4.3.1.5 Other Findings

The findings outlined in the subsequent sections are mainly general and one is specific to the ordinary houses while the others relate to good practice.

4.3.1.5.1 Dealing with Heat Stress

Heat stress issues were observed at the Kachele sites and not at Maridadi. This was because Maridadi had an automated cooling and heating system as a result of it being an environmentally controlled housing unit. This matter was prominent during the last days of rearing and amounted to huge losses as the birds would have consumed feed and labour costs incurred and all that would be lost due to heat stress. At this stage in the rearing cycle, there was an element of over-crowding as the birds would have grown in size and occupying bigger spaces than before. While in the ordinary houses, cooling was by way of opening the curtains and allowing natural flow of air in and out of the houses, the houses at Maridadi were automated and once the sensors picked up excessive heat in the houses, the cooling system was deployed automatically and the excess heat removed from the house.

4.3.1.5.2 Quality of Day-Old Chicks

The participants on all the sites complained of the quality of the birds that they received from the hatchery. Some birds had deformities while other developed weak legs in the first week of their delivery. These birds that had deformities and those that developed weak legs were treated as culls and were recorded separately as most of them failed to grow up to cropping or maturity. However, these birds consumed feed, drugs and labour costs and no revenue was generated in return. A further check revealed that a higher proportion of recorded mortality of the birds at the sites was made of culls. While there was an arrangement that the hatchery replaced the culls identified in the first week, no compensation was made for any that survived the first week and this loss together with the production costs for the ones in the first week all went to the account of the rearing section.

4.3.1.5.3 Disposal of Waste from the Poultry Houses

It was observed that the waste from the houses (bedding for the birds) once removed after cropping was disposed of a couple of kilometres away from the poultry houses. The bedding mostly made of wood chippings, wheat straw or Number 3 maize meal was used as a cushion

to insulate the birds from direct contact with the floors and also prevented them from getting scratches. The bedding was also used to prevent injury to the feet of the birds and was helpful in absorbing the moisture in the house and keeping the environment dry. This also worked as a deterrent to the accumulation of diseases and ammonia. Ammonia if allowed to accumulate worked as a growth depressant and accounted for the corrosion of the birds' respiratory tracts causing respiratory complications. The bedding removal and disposal is done in this way to ensure effective biosecurity and prevent re-entry of diseases into the poultry houses. The disposal was mainly by dumping the waste in a selected area or selling it off to vegetable growers who used it as manure. On inspection, the researchers found a huge dump of the waste that appeared only to grow bigger with each disposal.

4.4 Discussion on the Findings

The findings outlined under 4.2 (quantitative data) show results that portray a picture whose explanation can be derived from the findings under 4.3 (Qualitative Data). This is because actions and plans that management put in place have their effectiveness displayed through the results that will show the success or failure of the plans put in place. The quantitative data analysis shows the capacity of modern equipment and the same time the efficiencies that were derived from its application through FCR, mortality and live weights. Furthermore, the comparison with the set standard demonstrated (refer to 4.2.5) the output that can be achieved depending on the effectiveness of the implementation process while the impact of increased revenue (under 4.2.4) demonstrates the capacity increase and how this impact on numbers. The failings of modern methods highlighted under 4.2.5; 4.2.3; 4.2.2.1; 4.2.2.2; and 4.2.2.3 show the impact and effectiveness of a successful or unsuccessful implementation programme and these issues will be discussed in the subsequent sections.

4.4.1 Ability to support larger volumes of birds and Increase in Production

Yakolveva and Flynn (2004) state that modernised methods of production that result in the automation of processes of delivering feed, water, and heat have facilitated the ability to manage larger volumes of birds while at the same time reducing the level of human involvement in the production process. The ability to manage larger volumes of birds is facilitated by automation of the production processes where feed, water and heat and air supplies to the bird is done through a system that is faster and more reliable than a human being. This aspect is supported by the evidence collected under 4.2.1.2 that shows that Maridadi had a placement capacity of 20 birds per square meter compared to Kachele A, B, and C which could only place 12 birds per square meter, a difference of about 66.67%. In addition to this and according to Strbic et al., (2009), where temperatures in the houses are controlled, birds can be placed at a higher density than where this is not the case. As such, the ability to manage is enhanced by the equipment while the increase in quantities is by the facility capacity to regulate temperatures in the houses.

The results under 4.2.1.1 show that a smaller number of employees manage a larger quantity of birds to the extent that Maridadi employees were able to handle 2.7 times more birds than their colleagues at Kachele sites. The benefit in this regard is at two levels: a comparatively smaller number of employees resulting in reduced labour costs and a higher level of production

leading to increased revenues. This further results in production costs being recovered on higher revenues leading to increased profit margins.

4.4.2 Modernisation leads to improved efficiency

Yakovleva and Flynn (2004) describe FCR as the rate at which the body of a bird can convert stock feed into body flesh. It is also considered as the efficiency at which this conversion takes place. Given that feed costs account for more than 70% of the cost of producing a bird (Gilani et al., 2009), savings that can be made on feed can be substantial. The poultry houses at Maridadi had facilities to regulate temperatures in the houses allowing for the birds to utilise the feed consumed predominantly for growth and not for cooling or warming themselves as would be the case in houses that did not have the facility to regulate temperatures (Corkery et al., 2013; Yakovleva and Flynn 2004). The importance of FCR is evidenced by the study conducted by Zuidhof et al. (2014) who tracked the growth, efficiency and yield for broiler farmers for fifty years. They were able to establish that the industry over this period had been able to reduce the feed required to produce a bird by 50%. This, coupled with the genetic improvements of the bird, has resulted in the birds growing quicker and more robust, and, therefore, reducing the rearing period and improving FCR (Yakovleva and Flynn, 2004). As already mentioned above, better FCR results in improved weights for the birds such that the better the rate of feed conversion, the better would be the weights of the birds, and the lesser will be the feed consumed, leading to lower production costs. Therefore, modernisation enhances efficiency.

The number of birds managed by the employees at Maridadi was about 2.7 times more than that at Kachele sites. This also confirms the enhancement of efficiency due to modernisation as more birds are managed by fewer employees resulting in savings on labour costs. In this regard, Corkery et al. (2013) suggests that poultry farmers have been motivated to adopt modern technology as a way to meet financial targets of increased performance and production efficiency. The need for efficiency in production has become more pronounced due to increases in commodity prices and energy prices and the urge to promote efficiency. The urge to promote efficiency has become more critical as a result of poultry meat being a cost-competitive food item that causes consumers to resist the passing-on of increased production costs through increases in selling prices (Corkery et al., 2013). More important, though, is the fact that modernisation, as highlighted by Yakolveva and Flynn (2004), involves the reformation of the existing systems and the development of new models and processes of production that are better and more efficient than the old ones. For the poultry farmers to remain competitive in the face of other meat products, they have turned to modernisation (Corkery et al., 2013).

Building on the evidence outlined under 4.2.8.1 and 4.2.8.2 above, Yalcin et al. (1997) state that increased placement density assuming no reduction in the performance of the broilers should reduce production costs significantly. This is confirmed by the reduced number of employees managing a larger quantity of birds as well as a superior FCR leading to better weights for the birds. Better weights on an increased level of production using a lower number of employees enhances cost control which has become critical more than ever with the increases in stock feed prices as a result of increased commodity and energy prices.

To the extent that efficiency is not limited to increased placement and resultant volumes leading to increased revenues, the findings under 4.2.5 show a marginal benefit of utilising modernised methods. This standard was established for measuring the performance of ordinary houses and as such the evidence produced in this study shows that the modernised facilities were not as efficient as the literature review outlines.

4.4.3 Mortality of Birds

Kachele A (Figure 1 under 4.2.8.2) on a snap glance at the results achieved a lower mortality rate of 7.45% compared to Maridadi, that had 7.91% while the average for the four sites was 9.89%. However, after further analysis, that took into account the other results for the periods that were analysed, there was no significant difference between the two results. With this stated, though, the result departs from the literature review that states that safeguarding birds from adverse weather prevents stress leading to reduced mortality. The house at Maridadi has automated facilities to safeguard the birds from adverse weather conditions and as such was expected not to suffer from high mortality. Additionally, the rate was much higher than the Zamchick pre-set rate of 3% and could be a sign of inefficiency of the employees or ineffective usage of the facilities. The inability by the employees to by-pass the system as highlighted under 4.3.1.2 could have contributed to this issue given that the people that were closer to the operations could not adapt the system to what was prevailing and being observed by the operators.

However, Tabler et al. (2002) suggest that the mortality of the birds can result from a variety of causes. Further, that heat prostration and sudden death syndrome that occurs usually towards the end of the growth cycle of the bird is mainly caused by heat stress and increased stock density (Tabler et al., 2002). Additionally, Coccidiosis even with the advancements in technologies remains a significant cause of mortality in the poultry industry making it impossible to eliminate (Sundar et al., 2017). The result of this position is that mortality has a variety of causes and not only limited to the control of temperatures in the houses. Given that Maridadi was not affected by heat stress, but by increased density and also that despite technological advancement, coccidiosis still remains a significant cause of mortality, this matter could require further investigation to establish the cause of higher mortality. Another way to check would be the quality of the day old chicks as highlighted under 4.2.3 where most of the participants complained that the birds were not of good quality and that mortality resulting from poor quality still went to the account of the rearing section. If these factors of day old chicks quality and the prevalence of coccidiosis were isolated, and identified, the picture could probably have been much clearer.

Comparing the results of the sites on mortality with the standard as shown on 4.2.5, all sites failed on mortality despite Kachele A performing better than the rest though all were below the standard. As a result, the findings in this study did not show any benefits in using modern methods of poultry rearing as regards mortality of the birds.

4.4.4 Impact of Weather Patterns on Broiler Production

Results obtained under 4.2.3 Figure 2 assessed the effect of the weather given that the batches were carefully selected to represent the full year weather patterns of the country. From the

analysis done, weather patterns did not impact on the results that were obtained from the selected batches covering the four sites. However, according to Yakovleva and Flynn (2004), environmentally controlled housing had the effect of equalising the adverse weather effects to ensure the birds were protected from adverse weather conditions. This idea is also supported by Corkery et al. (2013), who state that birds, when exposed to colder conditions, tend to utilise feed to warm themselves while in warmer conditions they use the same feed to cool themselves. Additionally, FCR is poor in colder conditions, but better in warmer conditions (Corkery et al. 2013). The result of this position is that the impact of weather should have been observed at Kachele sites (with ordinary houses) and not at Maridadi (which had environmentally controlled houses). Further, that the results of this study did not support the advancements of Yakovleva and Flynn (2004) and that of Corkery et al., (2013) with regards to the impact of weather patterns on the rearing of the birds. The fact that none of this was observed is surprising.

4.4.5 Comparison of Expected Results and the Actual Results of Qualitative Data

It has been observed that modern facilities enhance production increase while maintaining or reducing labour numbers. Additionally, the analysis done on 4.2.4 showed a higher revenue per employee as evidence of production volume increase as well as labour number reduction. However, using the measurements set by Zamchick of FCR, weights and mortality as compared to the standard achievement, the results show a marginal difference. With all the improvements of modernisation, there should have been a marked difference between Maridadi and Kachele sites. Provision of temperature controlled environment should have helped safeguard the welfare of the birds leading to improved mortality percentage. But this was not the case as the site matched with Kachele A on mortality. The findings on FCR and bird weights are equally concerning firstly when compared to the set standard and secondly when the modernised site is compared to the ordinary sites at Kachele (Findings on 4.2.5).

4.4.6 Linking Modern Methods to Implementation Failures

The capacity of modernised equipment for poultry houses has been demonstrated by the benefits of increased production leading to increased revenue (4.2.4). Furthermore, the aspect of reduced labour is also demonstrated under (4.2.2.1) which shows that Maridadi employees were handling 2.7 times more birds than their colleagues at Kachele sites. However, the realisation of the other benefits of efficiency factors of FCR, live weights and mortality which were dependent on efficient application of the modern methods fail. The comparison done on 4.2.5 which compares the results of the four sites with the set standard show whether these modern techniques are being applied efficiently. Additionally, the failure and subsequent abandonment of modern equipment at Kachele B and C, highlight the impact of implementation shortcomings leading to failure of the equipment. This is further confirmed by the results of the four sites when compared with the standard (4.2.5). These two failures have been identified under 4.3.1.2 and are in line with suggestions by Serhat et al., (2016), that inadequately skilled labour often fails to detect, assimilate and manage knowledge resulting in their failure to appreciate new techniques. Furthermore, from the discussions and interaction with the participants, there is no evidence of the implementation process at the two sites having been done in a collaborative way. If collaboration was done, it could have secured their 'buying in' as suggested by Kusz (2014). This approach of the 'buying in' by the employees could

have secured their willingness to ensure the successful implementation of the new methods and further made them more desirable.

4.4.7 Linking Modern Methods to the lack of Feedback and Internal Communication Lapses

According to Serhat et al., (2016), modernisation in agriculture is a continuous process with new products and services becoming more complex as new techniques come online. In the process, new techniques will take over the old ones and as such, it is required that knowledge integration is enhanced (Serhat et al., 2016). For this to be achieved, internal communication within the organisation must be seamless. Additionally, there is a requirement to acquire resources of internal and external knowledge besides the organisational capabilities that should enhance the internalisation of knowledge and technology and ensure that this is assimilated into the organisation. This then entails that there should be a feedback process within the organisation that should allow the flow of information back and forth to ensure that knowledge is internalised and assimilated. This is so because employee skills and knowledge are an important factor in the successful implementation of modernisation. Failure of feedback and poor communication within the organisation will inhibit the internalisation of knowledge leading to failure to assimilate this knowledge in the organisation. The result of this situation is failure in the implementation of new methods.

4.4.8 Linking Modern methods to Human Resources Issues

Modernisation require planning and design in advance of its implementation. As a result, there should be careful assessment of the human resource capacity within the organisation before embarking on a modernisation program. According to Mynarczyk (2013) there is a requirement for enhancing of management capacity to ensure that there are available skills in the organisation to manage the new methods. This enhanced management capacity should be enabled to access external knowledge (Mynarczyk 2013) in the event that there is inadequate internal knowledge. This is because inadequate structures in the organisation as well as the lack of internal capacity can inhibit modernisation and as such they should be upgraded to meet the challenges that come with modern techniques. The upgrade can be achieved through training that should improve the skills of the employees or employing of skilled people. This aspect of human resource capacity building was missing at Kachele B and C as well as Maridadi as there was no evidence prior to acquisition of new methods.

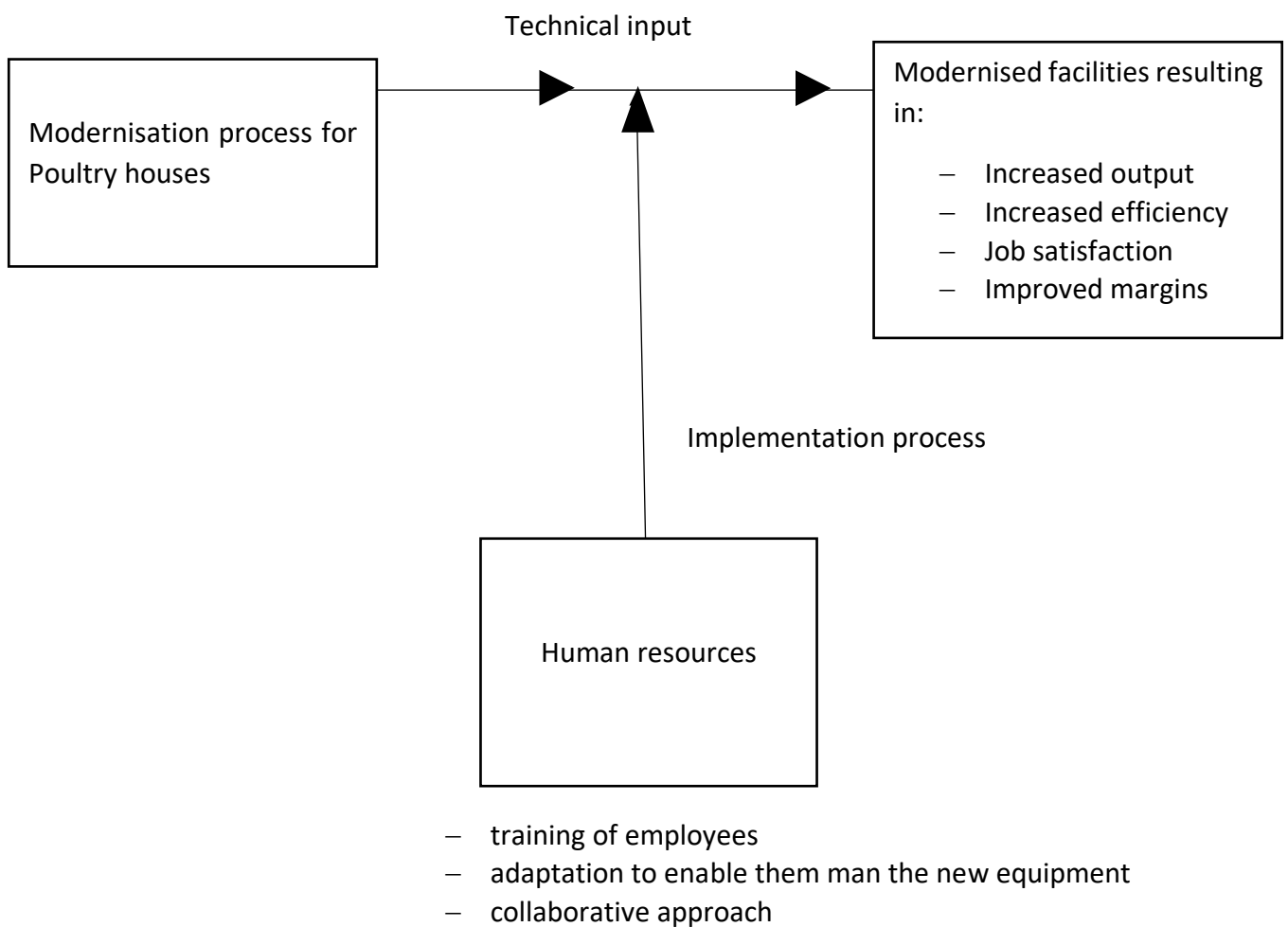
4.4.9 Linking Modernisation to the Retention of Skilled Manpower

Trained employees are an asset to the company because their skill and expertise ensure the successful operation of the company. Additionally and according to Serhat et al.,(2016), skilled employees have the ability to manage knowledge and as such appreciate modern techniques. This implies that as an asset, the skilled employee should be retained in the organisation to ensure that their expertise continues to benefit the company. The lack of human resource planning evidenced through findings under 4.3.1.4 had the effect leading to the poor management of equipment at Kachele B and C resulting in its abandonment. This action led to the loss of the equipment acquired at great cost to the company, and all the gains that were

made from the time of installation of the equipment. At the time of installation, production had increased by about 34% resulting from modernisation and this increase in capacity was lost as well. Additionally, the investment that was made in the human resource through training of employees leading to skills upgrade was also lost due to this unplanned transfers and departure of the trained employees from the company.

4.4.10 Linking Modernisation to the achievement of Desired Results

The findings of this research study together with the discussions of the findings point to an underlying operational model, that modernisation has two factors, that of the technical one and the implementation aspect which includes management planning and design. The management part involves the human resource. This finding is on the understanding that modern methods and technologies in themselves do not deliver the desired outcomes. This understanding is supported by the findings of implementation failures that were the result of poor planning and design of the human resource component in the modernisation program at Zamchick. In order to fully realise the benefits of modernisation the human resource will require to be trained through a collaborative approach and to learn and adapt to these new techniques. The figure below depicts this underlying operational model that organisations in the poultry industry should pay attention to in their modernisation program.



4.4.10.1 Implementation process for Modernised

Management should endeavour to plan for a continuous and collaborative training program that should enhance learning and knowledge creation. With this knowledge, modernisation can be sustained as the employees will become competent to operate the new equipment and this competence will result in efficiency and the achievement of Zamchick pre-set performance measurements of FCR, mortality and live weights. The achievement of these three performance measurements to lead to increased profit margins for Zamchick.

4.5 Recommendations Arising from the Findings

The matter of resolving performance problems at Zamchick rearing section is a complex matter that requires the company to coordinate the various interdependent factors involved in the rearing process so that they are synchronised to produce the intended output. This is in accordance with the view by Truong and Yamada (2002) on production. Formulating strategies resulting from this study should first require organisations to acquire knowledge and skills and these should be internalised and assimilated for them to benefit the company. Training of employees can enhance learning which should result in the upgrade of knowledge and skills.

The interactions and collaboration with the participants provided a rich source of organisational learning that was helpful in problem-solving through discussions, seeking clarity, observation, and sharing experiences that was a highlight of knowledge creation. According to Calton and Payne (2003), solutions that are arrived at this fashion are full of interdependent ideas which result in insights, and enhanced knowledge and learning. The identified problems that will be presented below and their subsequent recommendations are derived from the research-based data and grounded in interviews (with 18 participants), observation, discussions with the focus groups and company records, analysed with the reviewed literature as well the experience of the researcher. Further, consideration was given to the peculiarity of the poultry industry to advance strategies that could help with the performance improvement.

4.5.1 Training of Employees

4.5.1.1 Problem.

The problems associated with training were identified at all the four sites and all displaying different impacts but with similar results:

4.5.1.1.1 Kachele A

There was no evidence of any form of training for the employees.

4.5.1.1.2 Kachele B and C

Initial training was done at the time of installing the equipment but no follow up, re-training or subsequent training was done at the site.

4.5.1.1.3 Maridadi

Training was planned for and done at the time the site was leased. Further, additional continuous training was being done at the site even during the period of the study. However, feedback for the employees revealed shortcomings with the training program that was not addressing the challenges that the employees were facing.

4.5.1.2 Discussion

When the upgraded facilities at Kachele B and C sites were handed over to Zamchick, there were no programs for training and retention of the knowledge acquired during the initial training program that was done by installers of the equipment. The result of this was that the equipment was subsequently poorly maintained and it degenerated into disrepair and was ultimately decommissioned. This was despite the substantial capital investment that the company incurred in 2013 and 2014. At Maridadi, there was a continuous training program in place. However, feedback from the participants revealed the program's shortcomings as the employees had difficulties managing the equipment. At Kachele A, there was no evidence of training for the employees.

From the discussions with the participants at Kachele B and C, it was confirmed that there were challenges maintaining the equipment which ended up being abandoning in frustration.

4.5.1.3 Action Required

Management should consider the formalisation of a training program, and this should be documented and be made relevant with the existing equipment in use. Additionally, a deliberate policy of continuous training with regular review of the training program needs to be implemented. The continuous training program will result in regular updates of employees with new techniques and should provide for familiarisation of the workings of the equipment in use, such as the case at Maridadi. The documenting the training program should also facilitate periodic review by senior management of the Zamchick.

This recommendation could be implemented in the short and medium term depending on the availability of training facilities and approval of the training program. Management can also consider outsourcing in the event that there is a lack of training capacity internally. Knowledge that is acquired from training can help employees appreciate the workings of the equipment and can also be helpful in ensuring that the new equipment is implemented successfully. Employees that are unskilled as a result of lack of training fail to detect, assimilate or manage knowledge (Serhat et al., 2016) and this can lead to failure in the implementation process of modernisation.

4.5.2 Organisation Knowledge Retention

4.5.2.1 Problem:

All the employees that were trained at the time of equipment installation at Kachele B and C had either been transferred to other sections or left the company. This created a knowledge

gap as the new employees were not familiar with the working of the equipment that was installed at the two sections

4.5.2.2 Discussion

From the discussions with the employees at Kachele B and C and the review of their employment information, it was revealed that most of them had been on the two sites for less than three years. Given that training was done in 2013 and 2014, these employees were not on site when the training program was done. This aspect presented the issue of knowledge gaps that resulted in the employees that were left to operate the equipment being without knowledge or skill to manage it. This is what led to the poor maintenance of the equipment, challenging of operating it and subsequent abandonment.

4.5.2.3 Action Required

Two actions are required to address this issue. Firstly, there is a requirement for management to have control over the movement of employees between sites and sections to ensure that there was knowledge retention at the sites. Transfers of employees should be regulated and monitored to ensure that all the employees deployed at various sites had the required skills and knowledge to operate equipment at sites.

The second recommendation on knowledge retention is that of documenting operating procedures. The poultry rearing process should be documented to ensure that knowledge is retained in document form and can be referred to at any time.

The two recommendations can be implemented in the short term. The researcher shared these issues with management and they were well received and were being attended to with indications of the possible appointment of a consultant to undertake the two exercises.

4.5.3 Lack of Feedback and Internal communication lapses

4.5.3.1 Problem:

There was a lack of feedback on the challenges that the employees were facing as the management style in place was authoritarian in nature. This style of management prevents sharing of information and inhibits learning.

4.5.3.2 Discussion

Employees in an organisation are the ones that see through the new equipment implementation process as well as manage the operations and as such are required to be equipped with the knowledge and skills to ensure this is done properly. The employees required to be appraised on the benefits of applying the new methods and these benefits should relate to the day to day challenges that they encounter in the operations. Additionally, they can learn from each other through interaction and feedback process and this can enhance internal information flow that will ensure the internalisation and assimilation of knowledge resulting in learning.

4.5.3.3 Action Required

Management need to upgrade the function of Human Resources to ensure they are involved at planning stage of any new venture. They also need to set up management meetings that should deliberately be encouraging feedback from operations. This can be achieved by including supervisors in managements that meet on a regular basis to review the operations of the company. Upgrade of the human resource function will ensure that there is monitoring of employee working environment that should facilitate attending to their concerns.

4.5.4 Quality of Day-Old Chicks

4.5.4.1 Problem:

The quality of the day old chicks was highlighted in the findings and was viewed as a serious issue as it was considered as a critical input in the rearing of birds. The demise of these birds prematurely had significant cost implication as feed and labour resources would have been incurred to that stage. This cost was to the account of the rearing section.

4.5.4.2 Discussion

The quality of the day-old chicks can lead to high mortality if they are of poor quality and this high mortality can result in losses for the rearing section. The Hatchery supplies an excess number of birds to help mitigate this problem. It was reported that the sites sometimes received a higher number of poor-quality day-old chicks (DOC) that end up dying before they reach the maturity stage. Before they die, these chicks would have consumed feed and the labour resource and would add to the cost of production but the costs incurred would not be recovered. As a result, this is an additional irrecoverable cost to the rearing section.

4.5.4.3 Action Required

Management should also consider the recording of such mortality under the hatchery as any good efforts of the employees at Zamchick cannot help preventing this occurring. This however should be subject to an agreement that can be negotiated with the hatchery.

If this recommendation was adopted, it could result in mortality arising from poor quality of day old chicks being to the account of the hatchery and not Zamchick. This could significantly reduce production costs as feed and labour expended on the DOC could be recoverable. This aspect can also force the hatchery to improve on its efficiency levels and produce better quality day old chicks.

This recommendation can be implemented in the short term as it is a matter that can be agreed upon without any additional requirement for capital expenditure or training of the human resource.

4.5.5 Dealing with Heat Stress at Kachele Sites

4.5.5.1 Problem:

The birds were reported to suffer from heat stress in week four of the growth stage. This stress resulted in their mortality as they failed to cope with the heat. At the time of their demise, the birds would have consumed feed and labour resources and their mortality became a huge loss to the rearing section.

4.5.5.2 Discussion

Heat stress for the birds arises from three conditions; high density of birds placement, growth stage of the birds and prevailing weather conditions. This issue was highlighted during the study as a critical issue requiring resolution as it resulted in significant losses for the rearing section. Moreover, mortality is one of the three performance indicators set by Zamchick. This condition was identified to occur during the day and most especially when it was warm and when the birds were nearing maturity.

4.5.5.3 Action Required

The participants proposed measures that they had used before that they considered helpful in dealing with heat stress for the birds. Two proposals were made:

- a. It is recommended that feed be withdrawn during the day when birds get to the fourth week of their growth stage. The feed should be re-introduced in the house later in the day when temperatures cool down and less intense. Heat was more intense during the day and the withdrawal of feed during the day would help the birds cope with heat stress.
- b. Management should consider reduced placement during the warm season as a strategy to deal with heat stress. The reduced placement could mean fewer birds in the house per square meter and as such lesser heat generated by the birds.

The first recommendation when presented to management was accepted and even implemented during the study period. The second recommendation received resistance as it had cost implications and would require justification and approval by senior management before it could be implemented. As a result, the second recommendation can be considered as medium term.

4.5.5 Supply of Heat to the Birds at Kachele Sites

4.5.5.1 Problem:

During the brooding period of the birds, which is the first two weeks, heat is supplied to help the birds grow as at that stage. During the first two weeks, the birds do not have the capacity to regulate heat and require assistance. Heat has to be maintained at a constant level failing which the birds will have growth challenges in the later growth stages.

4.5.5.2 Discussion

The supply of heat in the houses at Kachele was through braziers filled with charcoal. During replenishment of the braziers after depletion of the charcoal, the houses were deprived of heat until such a time that the braziers were brought back into the houses. It was observed that during this period of replenishment, temperatures in the houses dropped going against the pre-set standard that this should be maintained on a consistent level during the brooding stage. Compromised heating supplies to the birds result in poor growth of the birds in the later stages.

4.5.5.3 Action Required

Management should consider the replenishment of braziers in phases such that at any given time, there should be some braziers left providing heat in the houses. This can help to ensure that temperature levels in the house were constant and conform to the pre-set standard of retaining a particular level of heat in the house, especially during the critical stage of brooding.

This recommendation could be implemented in the short term as it does not require any additional capital expenditure nor further training of the human resource. The recommendation can help with brooding of the birds. This recommendation is specific to Kachele sites.

4.5.6 Disposal of Poultry Waste

4.5.6.1 Problem:

The disposal of bedding waste from the poultry houses was by way of dumping the waste within the farm though few kilometres away from the poultry houses. This method of disposal could lead to the company running out of disposal space with time.

4.5.6.2 Discussion

The disposal of poultry bedding waste few kilometres away from the poultry houses was done in accordance to the company's biosecurity measures that help to prevent re-entry of diseases into the farm and also limit the spread. The challenge the company faced was that the heap of the waste was only growing bigger with no alternative solution in sight. With time, the company will run out of disposal sites and this will compromise the biosecurity measures in place. Additionally, if this matter came to the attention of the regulation authorities (such as ZEMA), it could lead to penalties or indeed sanctions being imposed on the company.

4.5.6.3 Action Required

Management should consider alternative ways of disposing of the waste from the poultry houses. With time and using the current methods of disposal, they will run out of space and this will compromise the biosecurity measures in place. Management should consider using this waste for the generation of biogas. The gas produced from the waste can be used as a fuel

to provide heat to the houses, and this can result in savings by stopping the use of charcoal for Kachele and electricity for Maridadi sites.

This recommendation can be implemented in the long term as there will be a requirement for capital expenditure for the digester and equipment for harvesting the gas, which will have to be budgeted for. In preparing the budget for this, the cost of the equipment for biogas generation and harvesting will have to be compared with the savings that will be made from using own fuel to provide the heat. The savings that will arise will be significant as the company will be generating its own fuel to provide heat for brooding of the birds.

4.5.7 Human Resource Issues

4.5.7.1 Problem:

Lack of human resource planning prior to the acquisition of modern techniques as observed at Kachele B and C, and Maridadi.

4.5.7.2 Discussion

Implementation of modern methods require planning pre-installation and acquisition to ensure that a prior assessment of the available skills and knowledge is done and relevant plans made for possible upgrade of the existing employees or indeed new employees with skills engaged. The events at Kachele B and C and Maridadi show no evidence of planning prior to the installation or acquisition of the leased property. Without the assessment of the company's capacity, no planning was done leading to training being done after installation or acquisition. This position could have resulted in the inhibiting of modernisation resulting in the failures that resulted.

4.5.7.3 Action Required

Management should consider the involvement of the human resource department in planning for acquisition of new methods to ensure that there is an assessment in terms of the structure of the company and the available human resource. This will help in the planning for training or the acquisition of skilled employees externally to help fill the skills gap in the organisation. With planning and appropriate design the upgrade of the employees can be done properly thus reducing on implementation failures as observed at Kachele B and C and Maridadi.

4.6 Chapter Conclusion

According to Stacey (2011) strategic management is concerned with the medium to long term view of the organisation's purpose and direction in which it is intended to move so that its resources, capabilities, and competence are optimally aligned. This alignment should be to its competitive advantage in the environment where it is operating from, to achieve successful performance. The recommendations outlined under 4.5 are intended to make improvements and according to Stacey (2011), some of the suggestions can be in the long term while others in the medium and short term, and as such, the company can plan accordingly.

The retention of skilled employees as well as training resulting from planning of the acquisition of modern equipment are just as important as the new equipment itself. A poorly implemented modernisation program can lead to undesirable results and failure in realising the benefits of using modern methods. The events at Kachele B and C show this. Additionally, a poorly designed plan and implementation program as the findings show at Maridadi can lead to poor results from the modernised facilities. The most surprising result is the differences between Kachele sites and Maridadi results (4.2.2.1) that show a marginal difference and in one case (mortality) almost the same if not worse. If due consideration was made of the massive capital expenditure involved in modernisation, and comparison made with ordinary houses construction expenditure, the impression that will be created is that these new techniques do not provide the benefits that they are intended to.

CHAPTER 5

Reflection on Learning in Action and Researcher's own Reflection on the Outcomes and Self-Reflection

5.1 Introduction

Action research leads to the generation of knowledge. In this regard, Bathelt et al., (2004) advise that where individuals interact and where this interaction is in pursuit of resolving an identified problem, learning and knowledge will be generated in the process. To enhance this learning, the experience that is created must be shared and retained in the organisation. To attain this retention of knowledge, guidance must be provided to ensure collaboration and collective leadership through the would-be affected employees' participation and achieve the success of the change process.

Transfield and Starkey (1998) state that management research is more about building knowledge in know-how and is, therefore, focused on creating understanding and improving practice. This knowledge can either be codified, explicit or tacit (Bathelt et al., 2004). According to Bathelt et al., (2004), of the two types, explicit/codified knowledge comprises facts, theories, and principles and can be taught in academic institutions and are transferrable and easily communicated. This type of learning was relevant in this study as it emerged in the process of interaction when individuals have a common goal to resolve a problem, as was the case in the action research study. In the operation of the action research study, participants get to learn more about the problem as they engage in finding solutions. In the process of engagement, they learn about the difficulties of not resolving the issue and the benefits of finding a solution. The knowledge generated and created in this learning results from the interaction.

5.2 Revisit of Purpose of Study

As outlined under 1.5, the purpose of the study was to explore strategies that Zamchick could use to increase the benefits including profit margins from implementing modern methods. A summary of the findings reveal that for the company to make improvements, the following require to be done;

5.2.1 Employee training program needs to be put in place and it should be documented and be made up to date with the equipment in use. The training program should be structured to be continuous and be subject to periodic review.

5.2.2 Employee transfer require to be regulated to ensure trained employees are not moved without suitable replaced in place. Additionally, operating procedures require to be documented to ensure knowledge is retention in documents.

5.2.3 To improve on the current management style of not involving lower level employees in decision making and to further improve on internal communication, supervisors should be included in management meetings that reviews company operations.

5.2.4 To improve on the current practice of lack of prior planning on new equipment acquisition and implementation. Department of Human resources should have its capacity upgraded to have the ability to assess available skills and knowledge prior to implementation and to be in a position to devise training programs for existing employees or to engage suitably skilled employees in the event of lack of available skilled employees.

5.3 With regards to the factors preventing Zamchick from realising the benefits of modern methods, this study's findings revealed the following:

5.3.1 lack of feedback and poor internal communication as the lower level employees were not involved in decision making thus depriving decision makers of valuable information that could have been negatively impacting the operations

5.3.2 failures in the implementation of new technologies arising from the lack of planning and design prior to the acquisition of the equipment as well as afterwards, leading to failure to upgrade employees' skills to manage the new equipment.

5.3.3 Failure to recognise the importance of human resource in the modernisation program leading to poorly designed training programs or none at all.

5.3.4 failure to retain skilled employees due to poor human resource practices resulting in unskilled employees managing equipment that they had no prior training nor the skill.

5.4 With regards to what strategies Zamchick can implement to be more ready for future change, as well as actions to realise the benefits of modern methods, this study identified the following:

5.4.1 by implementing the strategies identified under 5.2, these actions will result in the company realising the benefits. This is so because the solutions have been the result of engagement and collaboration with the employees which were rich in experiential knowledge, reflection and interpretation.

5.4.2 by implementing training programs, the company will upgrade the skills of the employees. Skilled employees easily learn new tasks and this will help with the change

5.4.3 The act of involving the employees in action research and proposing measures to make improvements, the employees will identify themselves with the measures and will therefore ensure to make the change more desirable

5.5 Learning in Action

Being involved in an action research study can be very challenging and at the same time exciting. It requires the skills of negotiating with the participants as well as ensuring that the purpose of the study was conducted successfully with the participants' full involvement. The researcher having been exposed to corroborative leadership (Raelin 2003) of collective, concurrent, and compassionate was equipped with the tools to use in navigating the process through. However, what was most important in the process was the initial interview that was

conducted with each individual participants that outlined the purpose and objective of the study. This was followed up by the acknowledgement that something needed to be done about the poor performance of the rearing sites and that this required their input to achieve that. The participants information sheet that clearly showed the labels of University of Liverpool played an important role in making them realise the significancy and seriousness of the study.

The first task of the researcher in the action research exercise was to gain the trust and confidence of the participants. This was critical as the participants' involvement and effective participation was dependent on them having the confidence and trust that there will be no repercussions on their side because of their involvement in the study. The researcher demonstrated to them that their identity would be protected by use of code names and as such their contribution would not be attributed to them directly. Even the journals that were later handed out to them had their code names rather than names. Additionally, the letter from the General Manager of Zamchick stating that the researcher had been authorized to visit the sites and conduct the research also helped with the confidence and trust as they were able to clearly see the difference between the researcher as an employee of the company through the holding company and the research study.

The conduct of action research was initially very frustrating, and it had to take the persistence of the researcher to get it going. Firstly, the participants having been accustomed to being given instructions were unfamiliar with a situation where they were being asked for suggestions and ideas. Additionally, it was not in their space to review the situation and provide suggested solutions to areas where it required a varied approach as opposed to reporting to their immediate supervisor and being told what to do. This situation created hesitation and difficulty in creating interaction. However, the continued persistence, and discussions over the time broke this impasse and they were able to start participating, though slowly.

As the days and interactions continued, this started to change, however at a price. The participants suddenly developed a belief that their suggestions were not subject to objections by their colleagues as such, this presented a challenge to the researcher. This situation was more prominent in areas where suggestions of one site were taken to the other site on the same subject that had been discussed before but now with a different approach. The issue of replenishing the braziers was the case in point where the other participants believed that the time it took to replenish was not long enough to lose heat in the houses, while their colleagues believed that this was so. The next challenge that arose out of this situation was their belief that once this suggestion was agreed to, it would be implemented immediately. This position was further compounded by their complaints that they had been complaining about certain work procedures, and that management was not listening to them. The researcher had the task of informing them that once agreed, these solutions and proposals would require management's approval before implementation. The participants were informed that whatever was being done needed the approval of management to ensure that everything worked through the structures and hierarchy of the company.

The researcher through observation was able to identify areas where the participants benefited because of their engagement in action research. This is now discussed in the following sections.

5.5.1 Participants

The participants learned to express themselves and articulate their views as they had to express themselves and their points of view during the action research exercise with their colleagues. They also learned to structure their work by recording the daily activities in the journal. This process of recording and articulating their views helped with self-confidence. They also learned to hold discussions with their work colleagues who had different views to theirs and still not get frustrated about not agreeing to their views. Through the weekly interactions with the researcher the participants were able to review the weekly situation and events of the previous week, and later plan for intervention as a corrective action. These actions were done collectively, and this meant that they had in the process, learned the skill of collaboration and critical analysis which could improve their attitude towards work. In the first action research cycle, they were able to review the weekly performance, apply their skills and devise a plan to address some of the challenges that they encountered in the previous week. With the help of the bird rearing stages diagram, they learned to identify the challenges for the week and apply themselves to the task. In this way, they fulfilled the objectives of the action research by applying action research to address the challenges that they were facing in their daily operations. In the second action research cycle, they learned the art of reflection by reviewing the previous week's events and using their skill to reflect and devise methods to address what they had assessed as challenges. The aspect of holding discussions with the colleagues holding divergent views meant that they had learned to relate and respect each other. The fact they planned and discussed together as a team in a bid to find solutions also meant that they had learned to think about their work in a positive way by suggesting solutions to make improvements. As outlined by Calton and Payne (2003) the solutions that are arrived at in this way are full of interdependent ideas which result in insights, and enhanced knowledge and learning.

In some cases, such as addressing heat stress of the birds, some participants applied themselves by using experience and in the process their colleagues learned from them while in other cases they applied themselves together as a team. In the process of applying themselves they used experiential learning, reflecting, interpreting, and taking action and by suggesting solutions and actioning these actions, they acquired the skill of self-management. The result of the art of self-management meant they had acquired the skill to regulate their learning. The knowledge that they acquired equipped them with the ability to develop ideas on how for example to deal with heating during brooding in the poultry houses by ensuring continuous supply of heat through phased replenishment of charcoal for the braziers. With this knowledge, they were able to plan and implement these plans though with the consent of management.

5.5.2 The Company

A company is run by its employees who must coordinate in a collaborative fashion to produce the desired output. Having a work force of employees with self-confidence benefits the company as they will have a stock of human resource that is confident and knowledgeable about their work. Given that organisations operate in a systematic relationship (Coghlan and Brannick 2014) this enhanced self-confidence will affect the individuals, teams, and interdepartmental groups as whatever happens at any one level in the organization effects the

entire organization through its systemic relations. The aspect of employees that have been involved in this type of research being able to relate with each despite their divergent views builds up teamwork and a conducive environment for change through the systematic relationship. According to Katz and Khan (1978) an organization operates an open system such that any learning that occurs is never restricted to the participants in the action research but extends to the entire organization. Furthermore, there is a two-way dynamic relationship in open system present in an organization with the external environment affecting the whole organization, including its customers and suppliers. The result of this is that the learning generated in action research benefits not only the participants but also the organization and its external environment comprising the stakeholders who can be customers or suppliers (Chisholm 1998)

The aspects of construction, planning, acting and evaluation that occurred during the action research cycles helped build relationships among the participants as there was a flow of information and ideas in the process of exploring possible solutions to the problem. As a result of the cycles repeating themselves in the subsequent weeks the aspect of critical review become enhanced, so did the interactions as the weekly feedback provided the opportunity for further reflection and replanning. These actions were built into the following week where they were repeated and again reviewed resulting in re-planning and further reflection. These actions resulted in the building of team-work relationships as they all had a common goal, which was that of making improvements. The result was the improvement of the quality of the relationships among the participants.

The improvement of the quality of the relationships did not end there. As the planning and review of the previous week's performance was taking place, the participants were involved in constructing the intervention with the key focus of making improvements. The construction of this involved the analysis and review of data from the previous weeks. The researchers and participants collaborated in devising plans to redress the situation in the case of adverse feedback; or consolidated their previous weeks' plans if the feedback was positive. In any case, their decisions were made based on the assessment of the situation and this joint evaluation of results and providing feedback improved the quality of the action research process. This is because the process was conducted in a collaborative format and was full of involvement by the participants. Further, the resultant solutions that were generated were the result of the participants involved in the work itself and as such were sustainable.

The subsequent sections will discuss the researcher's reflection on the outcomes and his own reflection on his practice and how it has been impacted by undertaking this DBA program.

5.6 Reflection on the Outcomes

This section will discuss the reflections on the outcome of this action research study, interpretations, and sense-making on the issues that arose from this study. With the intended purpose of the study in mind, how these outcomes would impact on the practice going forward and what learning was achieved in the process.

This study's first challenge was discovering that the heating system at Kachele B and C, the initially selected sites for modernized poultry houses had been decommissioned. The heating

system was one of the components of modernization. The other components were water supply and feeding systems. These three systems differentiated between non-modernized to modernized poultry houses. This aspect almost derailed the project as the critical component in the study was comparing the performance between modernized and non-modernized poultry houses. As such, the University of Liverpool's authorization that another sample in addition to the three samples at Kachele could be added to operate as a modernized facility saved the study from the imminent collapse.

The second challenge was to have employees at Maridadi site, the fourth site that was selected at a later stage, as the facility of modernised functionalities express concerns that they were limited in handling the equipment although they had a continuous training program in place.

The third challenge was to hear of the authoritarian style of management at Zamchick sites where the employees were not permitted to express their views with regards to the work process and how they were coping with their daily tasks. This aspect presented the initial challenge that the researcher encountered with regards to action research as the participants could not understand why their input was being requested and why it was collaborative when they were used to being told what to do and how to do it regardless of their views.

The researcher will therefore use this three challenges in the process of reflecting on the outcomes and in self-reflection on undertaking this study. The first and second challenges represent implementation inadequacies that resulted from poor design and planning of the implementation process. While the second challenge displayed planning and design, these fail short as the continuous training program was not subject to review and resultantly failed to meet the immediate needs of the operators of the equipment that it was intended, leading to underutilization of the facility.

The first and second challenges presented the importance of prior planning and design that should include the human resource availability assessment and that these aspects should accorded the same attention as the actual acquisition of the equipment. The challenges demonstrated that failure can result from internal capacity inadequacies and not the actual performance of the equipment. With this stated, planning and design should take into account all relevant factors in the organisation. The second challenge provide a situation where planning had been done but not in full. In both cases there was no prior planning nor the audit of available human resource skills and expertise. The attempt to plan fall short because it was not properly planned and designed.

The aspect of human resource showed its impact on the third challenge. This is because had the assessment of the human resource been done prior to the acquisition of the equipment, the issues of lack of feedback and authoritarian management style could have been picked up much earlier and probably addressed. As such, having in place planning and design capabilities in the organisation can help avoid some of these challenges arising in the future.

One of the most interesting outcomes of this study was the change in the behaviour of the individuals that participated in the study. Prior to their involvement they were cagey about their knowledge and failed to actively engage themselves in work discussions. After the conclusion of the study, they could be seen engaging and sharing their newly acquired

knowledge willingly. This is what may have prompted their colleagues on the other sites to request for my services as they were in admiration of their friends at the four sites. The change of behaviour will also benefit their colleagues who will learn something from the interaction and discussions, and this will resultantly benefit Zamchick in terms of knowledge sharing. Additionally, their request for the researcher to undertake another study of a similar nature is evidence that they had acquired the knowledge to assess themselves and solicit for help from someone they believe can assist them.

5.7 Self-Reflection

The scholar-practitioner concept is intended to link theory to practice and creating actionable knowledge in the process (Tenkasi and Hay 2004). Action research will always lead to change as was the case in this study that required the formulation of strategies to help improve the performance of the business. The researcher had to apply his leadership skills to ensure that participants fully engaged in the action research to ensure collaboration. This was achieved through discussions and assurances of good faith and emphasising on the aspect of making improvements that would ensure the security of their jobs. The researcher also used the argument that they were better off being involved in a process that will result in change than allow other people to design and set it for them. This approach, according to Raelin (2003) can lead to the resultant change to be more desirable as the participants will be part of it and that they will ensure that its successfully implemented.

During the duration of the study the researcher was mindful of the purpose of study, which was about knowledge enhancement of the challenges that were problematic to the achievement of FCR, mortality (at 3%) and live weights for the rearing sites and as such set out to seek more information in that regard. The suggested solutions that the participants put forward was an achievement. The identified issue of lack of feedback and poor internal communication was a gain to Zamchick and the researcher as he learned about the benefit of ensuring feedback from the people operating the rearing houses and the management style that inhibited information flow. The proposal to include supervisors in management meetings was a solution to this information flow lapse and improvement of feedback. The researcher gained the practice of leadership from this interaction as well as that of ensuring the full participation by assuring good faith and by understanding the organisation working culture, politics and the individual general behaviour of withholding knowledge and information.

Exposure to ESSI module during the DBA course modules, coupled with the interactions in the learning sets changed the researcher's views with regards to corporate performance. This was upon realisation that this generation has a responsibility to future generations to the extent that this generation should use the current natural resources in a way to allow sustainability so that the future generations will also use the same resources. As such, the organizational behaviour that aims to sustain the environment should be measured together with that which ensures that stakeholders needs are addressed (Norman and MacDonald 2004). This method of measuring corporate performance was new to the researcher.

The study challenged my assumptions in participating in such a program. Being in senior management position was viewed with scepticism and suspicion as I was perceived to represent management's interests. As such, ownership of the process was a challenge. My

engagement with the participants, to the extent of ignoring my suggestions for theirs, helped change this perception as they realised that the study was not about me but for them (this relates to the aspect of replenishing charcoal in the braziers in phases. I was not for the idea). After this, I noticed that they became more vocal in expressing their views freely, which produced a mixture of surprise and excitement. However what the researcher did not realise was that the participants were also scared for their jobs and were uncertain about the research exercise and how things will play out. Further that it is the fear and uncertainty that leads to the resistance to change. The researcher's persistence to engage in dialogue and to relate the reality of continued poor performance that could lead to the possible closure of the company and loss of jobs, helped to create the understanding of the actual realities of poor performance.

The challenge of the abandoned facilities at Kachele as well as the quest to have an additional sample included in the study was very frustrating as the researcher was faced with the imminent collapse of the research project. The researcher realised that the study was more about facing challenges and frustrations, and learning to negotiate and vary the approach, than sticking to the original plans of the study. The addition of the fourth site was the result of varying the approach and this is what saved the study.

While training and improvement of internal communication and well as feedback can be said to be measures that help improve the situation at Zamchick, it is also important to be mindful of the various related and interdependent factors involved in poultry rearing. The factors of water, feed, day old chicks, and drugs quality play an equally important role that can over turn all the gains made in training and communication in the organisation. This is because the influencing factors are many, and can further include the structure of the poultry housing units and effectiveness of brooding and not limited to the quality of the factors mentioned above.

5.8 Reflection on the Findings and the research papers cited in the Literature Review

The pre-set performance measurements are the final results that everyone will look at when evaluating the performance of the sites. This is now referred to as the front end. The efficiency and competence of the workers that work the equipment to achieve the front end results and the happenings in the background are now referred to as the back end. This concept of front and back end illustrates the relationship in the production set up that, what happens at the back end produces the results that are reported at the front end. Analysis of this relationship helps to build the understanding that for the front end to reflect good performance, the back end requires to be attended to through skills upgrade and training.

The research papers cited in the literature review relate in many ways to the findings of this study and the ones that come out prominently are highlighted below.

5.8.1 Modernisation vs Sustainability

The research by Kusz Dariusz (Modernisation of Agriculture vs Sustainable Agriculture 2014) explored the relationship between the need to modernise agriculture and sustainable development. Modernisation if implemented appropriately results in the improvement of the effectiveness of management and working conditions, and the level of satisfaction from the

performed work increases. This is because the employees are able to see and relate their daily challenges addressed through modernisation leading to the improvement of working conditions and production efficiency resulting in growth in productivity and profitability. Modernisation should also lead to a reduction in the negative environmental effects thus should result in the improvement in the efficient usage of natural resources.

The findings of this research study show that inappropriately implemented modernisation does not yield the desired results as was the case at Maridadi where training of the employees was in place but did not address the challenges that they were facing. The result of this was that production levels, labour utilisation and productivity were higher at Maridadi compared to Kachele sites, but mortality rates were poor. Live weights of the birds were marginally better when compared to the Kachele sites. The aspects of poor mortality rates and live weights were attributed to flaws in the implementation of modernisation and this aspect of inappropriately implemented process was highlighted by Kusz (2014) as that which can impede management effectiveness and working conditions. The result of which, according to Kusz (2014) can lead to employee job dissatisfaction and production inefficiency.

5.8.2 Features of modernised facilities and how they enhance efficiency

The papers by Yakovleva et al. 2004 (A sustainability Perspective: Innovations in the Food System) and Yakovleva and Flynn 2004 (Innovation and Sustainability in the Food system) investigated the nature and drivers for innovation in the food system and how technological development in the food system has contributed to the economic efficiency of the system through reduced production costs. The features of modernised facilities were outlined as those that had air controlled poultry houses and also had automated drinkers and feeders. These facilities accounted for the ability to manage a larger flock of birds while at the same time requiring a fewer number of employees to manage the system. The level of efficiency was enhanced by having a lower number of employees manning a larger volume of birds leading to reduced production costs. However, the authors (Yakovleva et al 2004; Yakovleva and Flynn 2004) missed out the importance of the human resource in their findings which when combined with the technical part of the equipment leads to the improved efficiency and production levels. This is because the technical side without human resources as per the findings of this research study cannot yield the desired results of modernisation.

The findings of this research study show that employees at Maridadi were able to handle 2.7 times more birds than their colleagues at Kachele and had a placement capacity of 20 birds per square meter compared to 12 birds per square meter for Kachele. Increased placement and reduced labour numbers assuming no reduction in the performance of the birds should reduce cost significantly and result in enhanced efficiency.

5.8.3 Modernisation enhances Production increase

The research paper by Ollinger et al. (2005) (Technology Change and Economies of Scale in US Poultry Processing) analysed data over a thirty year period and noticed a change in the industry from an industry of numerous small plants producing whole birds to one consisting of large plants producing a variety of poultry products. This structural change was driven by production

costs and economies of scale enhanced by technologies that increased production lines, improving yields and realising economies of scale. This article together with the one by Yakovleva and Flynn (2004); Cobb et al., (1999); Costa et al., (2008) confirmed that modernisation of the poultry industry was more about production increase and cost reduction.

The findings of this research study shows a marked difference in placement numbers for modernised as compared to non-modernised poultry of about 67.67%. This aspect is the result of controlling temperatures in the houses (Strbic et al., (2009). This aspect also translates into production increase, an aspect confirmed by this research study. The research by Ollinger et al., (2005) also confirmed that the focus of modernisation as being economies of scale but this research study findings show that this reduction in costs can only be achieved with appropriate implementation that includes the human resource that is well trained to handle the new equipment.

5.8.4 Implementation of Modernisation and the influence of the Human Resource

The research paper by Serhat et al., (2016) identified the challenges faced in this competitive and rapidly changing environment that makes innovation more costly and risky for companies if not properly adopted. The aim of the paper was to define factors that motivate or prevent the adoption of innovations by SMEs in developing countries and to suggest measures that can help and ease the adoption of innovation. The paper further identified the critical part that the human resource plays in the successful implementation of modernisation by suggesting that skilled employees have the ability to manage knowledge and as such appreciate modern techniques. This is because inadequately skilled human resource often fail to detect, assimilate and manage knowledge that creating difficulty in appreciating new techniques.

The findings of this research study did not find any programmes for upscaling the skills of the employees prior to implementing the modernisation program. Training was however done after the acquisition of the equipment at Maridadi, Kachele B and C, but nothing at Kachele A. Challenges that were encountered at Kachele B and C leading the abandonment of the equipment, while at Maridadi, the inability to work the equipment was evidence of the poorly planned training program.

The findings of this research study show that modernisation of the poultry facilities do increase placement numbers leading to increased production while at the same time allowing for the management of the increased volumes by a lower number of employees. As such two aspects are achieved, increased production and reduction in labour costs by the utilisation of fewer employees. The study also show that to achieve efficiency further to the increased production levels and reduction of labour costs requires the training of the employees so that they are competent and skilled enough to ensure that the three key performance of FCR, mortality and live weights of the birds were achieved. As a result, the human resource will require to have the skill to work the facilities to achieve the three pre-set key performance indicators.

Modernisation will be sustained if it is made to realise the objectives of increased production and reduced costs, and this realisation will be made possible once these facilities are managed efficiently. Efficiency will be achieved by how skilful the modern equipment is managed by the employees. This efficiency will be enhanced through training of the employees. As such, the

equipment by itself will not achieve efficiency but only when combined with the human resource with the skill to manage it.

5.9 Chapter Summary

When undertaking any form of research in an organisation, politics is inevitable due to human interaction. These politics become even more challenging when the research is undertaken in one's organisation (Colghlan and Brannick 2014). Bjorkman and Sundren (2005) attribute political behaviour to power, stating that individuals' capacity to influence others comes out of power. Power gets things done, and it can either be constructive or destructive and that the best management skills are those that seek and aim to ensure that constructive politics are used to marshal resources and working practices to be supportive (Buchanan and Badham 2008). On the other hand, ethics is about being true to the process and recognising the key players in the process and ensuring that these critical players participate in the research study.

Politics, like ethics, require careful selection of individuals to support the research study's political side and to ensure that individuals who will be affected by the change support the initiative. Similarly, ethics require that critical players be recognised and selected to secure the initiative's legitimacy. Individuals who are members of the organisation play a vital role in action research to help with political management and ensure the initiative's legitimacy through ethics by using critical members of the organisation. This issue was been addressed through the selection of the participants whose work processes will be impacted by the decisions made in the action research study.

CHAPTER 6

Conclusion

6.1 Introduction

This research study has been framed according to the performance measurements set by Zamchick of mortality, FCR, and live weight as regards modernization in the poultry industry comparing with non-modernized houses. First, the intention was to assess the impact of modernization on the rearing process compared to old methods, and having established this, find ways in which further improvements can be made through interaction with the employees. It has been established that modern technologies have been formulated to address existing problems faced by the poultry farmers of low yields, high feed prices, increased cost of production, and the competitiveness of the meat industry. The competitiveness of the meat industry is such that it is challenging to pass on the increased cost of production to the consumers, and as such, poultry farmers find themselves in a dilemma. They are confronted with a very challenging task; that of increased regulation from organisations such as the ZEMA, regular inspections from the animal welfare activists as well as increased pressure from the consumers to ensure acceptable food standards and that the produced food is safe to be consumed. To do this, they have to improve their production efficiency if their business is to survive, and hence they turn to modern technology. This situation has also compelled them to move from price setters to price takers. This aspect is because poultry farming is a business like any other business that should aim to provide a return on the investment and provide employment to the community and sustain itself to ensure the continued business for the foreseeable future.

The use of these three factors in making the assessment and comparison between the two rearing methods helps relate to each other in the way they impact the bird. The birds' improved welfare is attributable to the birds' reduced mortality as they are more comfortable and have access to good nutrition and freshwater, and can display their innate behaviour. The birds' enhanced welfare ensures their protection from adverse weather conditions, which improves the FCR for the birds as they use the feed to grow and not to fight off adverse weather conditions. The utilization of feed for growth and conversion into flesh results in the efficient usage of the feed. This efficiency should result in the improvement of FCR, leading to robust growth, which results in higher weights for the birds. Given that the poultry farmers are rewarded based on the birds' weights, this leads to better rewards and improved business profitability. As a result of this enhanced performance, the business will be better positioned to sustain itself and provide better returns for the owners. While the capacity of modern methods is evident, the efficient factors of FCR, mortality and live weights established by Zamchick as performance measurements failed and this has been attributed to several factors as outlined in the findings.

The study has shown that focus on the critical factors used in framing this study has created an understanding of the three factors mentioned above and how this relationship can impact the industry. The study has shown how modernisation has created the capacity for increased production and efficiency. The efficiency can be drilled down to save on labour costs and the efficiency with which the bird utilises feed. But most importantly, this study has shown that modernisation by itself is not enough; training the employees to manage the facilities is

paramount so is the upscaling of their skills as well as the organisational capacity that will enable it to deal with the challenges that modernisation will come with. Organisational capacity brings into play management style and the culture of withholding information and lack of feedback that denies the lower level employees participation in decision making. Training should be planned to be done continuously and should be treated as a critical factor during and after the planning and design stage and prior and after implementation. The training program should be tailored to suit the operators' needs and requirements and should be reviewed regularly to ensure relevance given the ever changing environment and technology.

If the management style at Zamchick had been different and more accommodating of employee's views, it is likely that the identified challenges of implementation could have been noticed and probably corrected. But the lack of feedback and the authoritarian way of managing denied management of this information leading to failure of modernisation and losses. Therefore in as much as planning and design of modernisation is important, so is the management style and the involvement of human resources in the process. This is because they will be the ones running the operations and their skill and expertise will ensure success or failure. As such human resource is just as important as modernisation itself as it plays an important role in its success or failure.

6.2 Directions for Future Research and Limitation/Delimitation of this Study

Moderation of poultry houses' temperatures using modern techniques equalises the impact of adverse weather patterns on poultry rearing. This study found that the weather did not impact the rearing process after reviewing data for over one year. This aspect may require further research on a prolonged period of review bearing in mind that Zambia is a tropical region modified by the altitude/elevation. This aspect of weather is because if studied over a longer period, the climate variations induced by global climatic conditions can be minimised and the impact verified. This should be followed up with training of the employees so that the full capacity and efficiency of modernisation is played out to its fullest extent. If this was done, it will help in fully understanding the matter as well as the impact of modernisation.

The issue of mortality should be subjected to further research on what the leading causes are. This study has shown no significant variation between the four houses regarding mortality, given that we are told through literature review that protecting the birds from adverse weather conditions prevents stress and higher mortality of the birds. Furthermore, and through literature review, this study has made recommendations for addressing the issue of heat stress, but incidences of coccidiosis remain a significant cause of mortality without much help from modern techniques. Literature review has identified a variety of causes of mortality for which further research would be required to help with strategies to address this aspect.

The issue of regulation has not been considered in this study and is a matter that can be classified as a limitation. Regulation has been through environmental legislation that has been targeted towards animal welfare, food safety, and sustainable development. These regulations have been implemented by levying fees, which have increased the cost of doing business and will increase production costs.

The aspect of welfare besides the issue of fees discussed above can be viewed with regard to the increase in the placement density of the birds. With the development of verifying minimum animal welfare standards and the focus on the welfare of the birds, this may negatively impact the benefit of increased placement of birds. This is because the welfare of birds includes placement density, which might affect the stress levels of the birds. This position's result is that placement density should be looked at with the standard of the birds' welfare in mind and might result in a reduced placement. This has already been proposed to Zamchick that they consider reducing placement density in order to comply with EU standards.

This study's delimitation is that only activities and standards at Zamchick have been used without considering all standards of companies in the same business in the country. a comparison with other companies' rearing standards and methods. This aspect deprives this study of variety and learning from other players' experiences and their practices in the sector.

The study's limitation has been that of the weather. With global warming, it gets warmer or colder in certain seasons and this may impact the comparison between modern and ordinary methods as the equalisation offered by modernised facilities gets compromised with weather patterns.

6.3 Implications of this study on the Industry in Zambia

This study will firstly create interest in the field, given that it is locally based and used the facilities that most local people would be familiar with and can relate to. The framing of this study of using the performance measurements of FCR, mortality, and live weights will generate interest, and individuals will get to know how they are related and how the focus on the improvement of one could result in the improvement of the other two. Most people involved in this business go through these practices of rearing chickens mechanically without much thought on the importance of the stages that the birds go through. In most cases, technological advancements in the sector have been shunned mainly due to a lack of knowledge and appreciation of the benefits of using them. The moment that they will be able to relate and see the relationship between appropriately adopting these techniques and the benefits that would arise from their usage is when the interest will become meaningful.

The second aspect that this study will create is knowledge about modern techniques, and this will equip the poultry farmers with the ability to know what to focus on. This knowledge will also enable the farmers to develop a sense of focusing on production efficiency and questioning the efficacy of these new techniques. With the increase in population, the demand for chicken meat will also increase. This increase will put pressure on the farmers to increase their production capabilities, enhancing their appetite for modern technology that should facilitate the increase. Similarly, the farmers' enhanced knowledge will also put the equipment suppliers on their defence to justify their products specifications and demonstrate how improvements will be achieved efficiently when applied.

However, the study's most important implication is its finding that modernisation is unlikely to lead to the expected benefits without also understanding it as a human resource process as well as a technical one. This aspect is depicted on page 83 in a diagram to show the relationship. According to Lushchak and Bepalyuk (2013), modernisation is a process of

change and at the center of any modernisation process is a person/human resource. Further that these organisations don't change by themselves, but people do, and then they change the organisation. Modernisation should therefore start with training the employees to upscale their skills and this should be planned and designed appropriately to start the training program prior to the acquisition of the equipment and should continue after wards to ensure that the skills of the employees are kept updated to the ever-changing technological advancements. It is because of this position that modernisation in organisations should not just be about facilities but also the modernisation of the minds of the people (employees) through training.

6.4 Impact of the study on the employees and the Researcher

The researcher has learned to focus on production efficiency in his poultry business. He has applied the knowledge gained from this study to focus on measures that promote production increase with minimal cost escalation. This approach has been acquired through the understanding and applying of the workings of modern methods.

Engagement in this exercise improved the confidence of the participants as they were able to think through the work processes and evaluate the impact of their efforts. Participating in this study improved the communication between the employees unlike before were there was no knowledge sharing and each employee kept to themselves, this study helped change that with the employees becoming more engaged with each other and openly shared their experiences. The awareness created in terms of getting to know how they were performing and trying to relate this to their practices and efforts has created positivity among the employees.

The researcher in a bid to share the knowledge gained from this study has plans to set up workshops with poultry farmers through Zambia National Farmers Union (ZNFU). Given that ZNFU is a national organisation, with representation nationwide, this initiative will reach all interested farmers and will help disseminate and share information.

Lately, employees have been pressuring management for more training, building on what they learned from this study and there are indications that I might be engaged to draw up a training program for the company. This realisation is the result of this study which has helped the employees to realise their weakness and limitations, and make efforts in making improvements on their skills and work processes.

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APPENDICES

Appendix 1 Company Records data from the Poultry houses per site and per season

Site Name	Mortality %age	FCR	Av. Wt Kgs	Age days	Av. Stocking	Month/Period	Season No.
Maridadi	5.17	1.70	1.78	35	20 bird /sq.mtr	Mar-18	1
Kachele-A	6.50	1.80	1.81	35	12 birds /sq.mtr	May-18	1
Kachele-B	11.72	1.82	1.60	35	12 birds /sq.mtr	Apr-18	1
Kachele-C	12.28	1.71	1.67	37	12 birds /sq.mtr	Apr-18	1
Maridadi	7.79	1.73	1.91	35	20 bird /sq.mtr	May-18	2
Kachele-A	6.33	1.83	1.86	35	12 birds /sq.mtr	Jul-18	2
Kachele-B	16.07	1.91	1.74	36	12 birds /sq.mtr	Jul-18	2
Kachele-C	10.73	1.68	1.68	35	12 birds /sq.mtr	Jun-18	2
Maridadi	10.24	1.71	1.73	35	20 bird /sq.mtr	Jul-18	3
Kachele-A	7.55	1.90	1.81	35	12 birds /sq.mtr	Sep-18	3
Kachele B	11.35	1.81	1.61	36	12 birds /sq.mtr	Oct-18	3

Kachele-C	11.81	1.78	1.74	36	12 birds /sq.mtr	Aug-18	3
Maridadi	8.42	1.70	2.03	39	20 bird /sq.mtr	Oct-18	4
Kachele-A	9.43	2.03	1.80	38	12 birds /sq.mtr	Jan-19	4
Kachele B	11.85	1.97	1.47	36	12 birds /sq.mtr	Jan-19	4
Kachele- C	10.97	1.85	2.00	38	12 birds /sq.mtr	Nov-18	4

Notes The lower the FCR, the better is the performance
 The higher the production efficiency the better

Appendix 2 Site Statistics

Site Name	Employee # per site	# of Poultry houses per site	Capacity Placement of birds per site	Average Stocking density per sq.mtr per site
Maridadi	12	3	90,000	20 birds/sq.mtr
Kachele A	22	10	60,000	12 birds/sq.mtr
Kachele B	22	10	60,000	12 birds/sq.mtr
Kachele C	22	10	60,000	12 birds/sq.mtr

The above schedule provides statistical information of the sites that were observed.

Appendix 3
Kachele C

	N	Minimum	Maximum	Mean	Std. Deviation
Mortality	4	10.73	12.28	11.4575	0.72972
FCR	4	1.68	1.85	1.755	0.07594
Average weight (kgs)	4	1.6	2	1.75	0.17321
Valid N (Listwise)	4	0	0	0	

Notes to Appendix

3

these outcomes are derived from appendix 1 being data from company records of batch results
 The above table outlines the outcome variables specific to Kachele C for a period covering one year
 N - stands for the number of observations (each observation is a batch/rearing cycle of five weeks)
 Mortality is presented in percentage terms in relation to the birds placed on site
 FCR is the ration of the feed consumed compared to the weight of the bird
 the average weight is in kilograms

Appendix 4
Kachele B

	N	Minimum	Maximum	Mean	Std. Deviation
Mortality	4	11.35	16.07	12.7475	2.2251
FCR	4	1.81	1.97	1.8775	0.07632
Average weight (kgs)	4	1.4	1.7	1.575	0.12583
Valid N (Listwise)	4	0	0	0	0

Notes to Appendix4

these outcomes are derived from appendix 1 being data from company records of batch results
 The above table outlines the outcome variables specific to Kachele B for a period covering one year
 N - stands for the number of observations (each observation is a batch/rearing cycle of five weeks)
 Mortality is presented in percentage terms in relation to the birds placed on site
 FCR is the ration of the feed consumed compared to the weight of the bird
 the average weight is in kilograms

Appendix 5
Kachele A

	N	Minimum	Maximum	Mean	Std. Deviation
Mortality	4	6.33	9.43	7.45	1.42
FCR	4	1.80	2.03	1.89	0.10
Average weight (kgs)	4	1.80	1.80	1.80	0.0000
Valid N (Listwise)	4	0.00	0.00	0.00	0.00

Notes to Appendix

5

these outcomes are derived from appendix 1 being data from company records of batch results
 The above table outlines the outcome variables specific to Kachele A for a period covering one year
 N - stands for the number of observations (each observation is a batch/rearing cycle of five weeks)
 Mortality is presented in percentage terms in relation to the birds placed on site
 FCR is the ration of the feed consumed compared to the weight of the bird
 the average weight is in kilograms

Appendix 6
Maridadi

	N	Minimum	Maximum	Mean	Std. Deviation
Mortality	4	5.170	10.240	7.905	2.098
FCR	4	1.700	1.730	1.710	0.014
Average weight (kgs)	4	1.730	2.030	1.863	0.135
Valid N (Listwise)	4	0.000	0.000	0.000	0.000

Notes to Appendix
 6

these outcomes are derived from appendix 1 being data from company records of batch results
 The above table outlines the outcome variables specific to Maridadi for a period covering one year
 N - stands for the number of observations (each observation is a batch/rearing cycle of five weeks)
 Mortality is presented in percentage terms in relation to the birds placed on site
 FCR is the ration of the feed consumed compared to the weight of the bird
 the average weight is in kilograms

Appendix 7
Summary of the
four Sites

	N	Minimum	Maximum	Mean	Std. Deviation
Mortality	16	5.17	16.07	9.8906	2.80196
FCR	16	1.68	2.03	1.8081	0.10413
Average weight (kgs)	16	1.4	2.03	1.7469	0.15814
Valid N (Listwise)	16	0	0	0	0

Notes to Appendix
7

this shows the overall picture of the four sites by polling the data together.

**Appendix 8 Anova
of the four Sites
for Mortality, FCR
and Average
Weights**

		Sum of Squares	df	Mean Square	F	Sig
Mortality in %age	Between groups	82.016	3	27.3390	9.1770	0.0020
	Within groups	35.749	12	2.9790		
	Total	117.765	15			
FCR	Between groups	0.096	3	0.0320	5.7430	0.0110
	Within groups	0.067	12	0.0060		
	Total	0.163	15			
Average weight in Kgs	Between groups	0.183	3	0.0610	3.8080	0.0400
	Within groups	0/192	12	0.0160		
	Total	0.375	15			

Notes on the Apeedix 8

this test is intended to show if there are any significant difference, and we note that for all the factors of mortality, FCR and average weights. the differences are less than 0.05 (5%) meaning that we need to look further into the individual sites to see where these significant diifferences occur.

To do this, we have to review the multiple comparisons on appendix 9

Appendix 9 Post Hoc Tests Multiple Comparisons of the four sites for FCR, Mortality and Average weights

Dependent Variable	(I) Site	(J) Site	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Mortality in Maridadi percentage	Maridadi	Kachele A	.45250	1.22047	.717	-2.2067	3.1117
		Kachele B	-4.84250*	1.22047	.002	-7.5017	-2.1833
		Kachele C	-3.55250*	1.22047	.013	-6.2117	-.8933
	Kachele A	Maridadi	-.45250	1.22047	.717	-3.1117	2.2067
		Kachele B	-5.29500*	1.22047	.001	-7.9542	-2.6358
		Kachele C	-4.00500*	1.22047	.007	-6.6642	-1.3458
	Kachele B	Maridadi	4.84250*	1.22047	.002	2.1833	7.5017
		Kachele A	5.29500*	1.22047	.001	2.6358	7.9542
		Kachele C	1.29000	1.22047	.311	-1.3692	3.9492
	Kachele C	Maridadi	3.55250*	1.22047	.013	.8933	6.2117
		Kachele A	4.00500*	1.22047	.007	1.3458	6.6642
		Kachele B	-1.29000	1.22047	.311	-3.9492	1.3692
FCR	Maridadi	Kachele A	-.18000*	.05275	.005	-.2949	-.0651
		Kachele B	-.16750*	.05275	.008	-.2824	-.0526
		Kachele C	-.04500	.05275	.410	-.1599	.0699
	Kachele A	Maridadi	.18000*	.05275	.005	.0651	.2949
		Kachele B	.01250	.05275	.817	-.1024	.1274
		Kachele C	.13500*	.05275	.025	.0201	.2499

Kachele B	Maridadi	.16750*	.05275	.008	.0526	.2824	
	Kachele A	-.01250	.05275	.817	-.1274	.1024	
	Kachele C	.12250*	.05275	.039	.0076	.2374	
Kachele C	Maridadi	.04500	.05275	.410	-.0699	.1599	
	Kachele A	-.13500*	.05275	.025	-.2499	-.0201	
	Kachele B	-.12250*	.05275	.039	-.2374	-.0076	
Average weight in Kg	Maridadi	Kachele A	.06250	.08948	.498	-.1325	.2575
		Kachele B	.28750*	.08948	.007	.0925	.4825
		Kachele C	.11250	.08948	.233	-.0825	.3075
Kachele A	Maridadi	-.06250	.08948	.498	-.2575	.1325	
	Kachele B	.22500*	.08948	.027	.0300	.4200	
	Kachele C	.05000	.08948	.587	-.1450	.2450	
Kachele B	Maridadi	-.28750*	.08948	.007	-.4825	-.0925	
	Kachele A	-.22500*	.08948	.027	-.4200	-.0300	
	Kachele C	-.17500	.08948	.074	-.3700	.0200	
Kachele C	Maridadi	-.11250	.08948	.233	-.3075	.0825	
	Kachele A	-.05000	.08948	.587	-.2450	.1450	
	Kachele B	.17500	.08948	.074	-.0200	.3700	

*. The mean difference is significant at the 0.05 level.

Appendix 10
Anova of FCR,
Mortality and
Average
weights for
the different
seasons

		Sum of Squares	df	Mean Square	F	Sig
Mortality in %age	Between groups	5.065	3	1.6880	0.1800	0.9080
	Within groups	112.7	12	9.3920		
	Total	117.765	15			
FCR	Between groups	0.037	3	0.0120	1.1950	0.3530
	Within groups	0.125	12	0.0100		
	Total	0.163	15			
Average weight in Kgs	Between groups	0.035	3	0.0120	0.4170	0.7440
	Within groups	0.34	12	0.0280		
	Total	0.375	15			

Notes on Appendix 10

a review of significant difference (under Sig) shows that on all the three factors, there are no significant differences.

This analysis was meant to show if rearing of the birds in different weather conditions had any impact of the results

the results show that there is no impact on the results arising from the varying weather conditions.

Note:

Given that there are no significant differences meaning that the seasons have no impact on FCR, mortality and the average weights, it is not necessary to look further in the multiple comparisons of the four sites.

Appendix 11 Poultry House Chart

ZAMCHICK HOUSE CHART

Farm Name		Date placed							
# placed	House #	DOA			Flock			Parent age	
Date	Age	Daily Mortality	Hand Cull	Cumm Mortality	Daily Feed Kgs	Cumm Feeb	Weekly Weights	Target Weights	Vaccination days
	1								
	2								
	3								
	4								
	5								
	6								
	7							160	
	8								
	9								
	10								
	11								
	12								
	13								
	14							400	
	15								
	16								
	17								
	18								

19

20

21

800

22

23

24

25

26

27

28

1350

29

30

31

32

33

34

35

1800

36

37

38

Appendix 12 Interview Questionnaire for Participants

PARTICIPANT ENGAGEMENT PROTOCOL

1. Welcoming remarks and introduction of the research project, explaining its purpose and why they have been selected to be participants
2. Review the consent agreement
3. Explain their rights as participants that they could withdraw participation at any time if they so wished
4. Remind the participant of confidentiality and guarantee the anonymity of their presented opinions

INTERVIEW QUESTIONS FOR PARTICIPANTS

Site

Participant Reference number

Q 1 what is the Level of education attained?

- a. Grade twelve certificate
- b. Grade Nine Certificate
- c. Tertiary education
- d. Grade Seven

Q2 where did you get your training in agriculture

- a. College
- b. On the Job Training
- c. Secondary School
- d. University

Q3 Where did you get your training in Poultry

- a. College
- b. On the Job training
- c. Secondary school
- d. University

Q4 How long have you worked at the current site

- a. 1- 2 years

- b. 2- 4 years
- c. 4- 6 years
- d. Over 6 years

Q5 How long have you worked for Zamchick

- a. 1 – 2 years
- b. 2 – 4 years
- c. 4 – 6 years
- d. Over 6 years

Q6 How do you rate your experience in poultry

- a. Still learning
- b. Have learned but require additional training
- c. you are trained and is knowledgeable
- d. you are an expert in the field

Q7 What modern techniques have you been trained on?

- a. Fully Automated Poultry houses
- b. Semi-automated poultry houses
- c. Have no formal training in modern techniques

Q8 What type of water system have you been trained on?

- a. Manual waterers
- b. Automatic drinkers
- c. Nipple system
- d. A mixture of the above

Q9 what type of feed supply system have you been trained on?

- a. Automatic feeders
- b. Manual feeders
- c. A mixture of the above

Q10 What type of heating system have you been trained on

- a. Infra-red bulbs
- b. Charcoal using brazier
- c. Gas brooders
- d. Automated heating system
- e. Steam heating
- f. Coal Heating

Q11 on each of the answers on questions 7, 8, 9 and 10, kindly advise the years of experience of using the facilities

0-1 years. 1-2 years. 2-3 years. 3 – 4years. Over 4 years

- a. Water system
- b. Feed supply system
- c. Heating system
- d. Type of housing

Q12 do you understand the practices of cleaning the poultry houses

- a. Yes I understand
- b. No I don't understand
- c. I understand but require further training
- d. I understand and can help train my colleagues

Q13 Do you understand the practice of vaccine, vitamin and anti-biotics application?

- a. Yes I understand
- b. No I don't understand
- c. I understand but require further training
- d. I understand and can help train my colleagues

Q 14 Do you understand the practice of brooding?

- a. Yes I understand
- b. No I don't understand
- c. I understand but require further training
- d. I understand and can help train my colleagues

Q15 Do you understand the practice of weighing the birds weekly?

- a. Yes I understand
- b. No I don't understand
- c. I understand but require further training
- d. I understand and can help train my colleagues

Q 16 with regards to the answers that you have provided in questions 12 to 15, kindly provide a brief explanation to your responses: Your response should outline your understanding and what the practice is intended to achieve.

- a. Question 12
.....
- b. Question 13
.....
- c. Question 14
.....
- d. Question 15
.....

Q17 what would you describe as the biggest challenge in the rearing of chickens

.....

Q18 With regards to your response to Q17 above, how have the identified challenges being addressed by the company

.....

Q19 Are you satisfied with the responses to the challenges that you have outlined under Q18, and if not, do you have alternative and additional suggestions?

.....

Q20 Do you believe that your work colleagues have the required understanding and knowledge in managing the poultry houses? If not, what are some of the areas that you believe require further training?

.....

Q21 Of the various systems of heating, water supply and feed supply, which ones can you recommend based on your work experience. Please provide reasons for your choice.

.....

Appendix 13 Key Informant Questionnaire

PARTICIPANT ENGAGEMENT PROTOCOL

1. Welcoming remarks and introduction of the research project, explaining its purpose and why they have been selected to be participants
2. Review the consent agreement
3. Explain their rights as participants that they could withdraw participation at any time if they so wished
4. Remind the participant of confidentiality and guarantee the anonymity of their presented opinions

INTERVIEW QUESTIONS FOR THE KEY INFORMANTS

1. The procedure for cleaning of poultry houses and what it was intended to achieve. Why was there the use of different cleaning chemicals at each cleaning stage and what this was intended to achieve?
2. Why is there a waiting period between the time the birds were cropped and the subsequent placement?
3. Why the bedding once removed from the houses after cropping of the chickens was disposed of at least 1km away from the poultry houses?
4. Why are particular weight ranges prescribed for each week in the rearing cycle?
5. Why were particular amounts and types of feed prescribed for the rearing cycle and what this was intended to achieve?
6. Why was FCR so important in the analysis of bird performance and what the information derived from this analysis intended to communicate?
7. Would the delivery of the above pre-set weights for the birds to the chicken abattoir be a sign of good management?
8. What benefits has the company gained from the use of the modern methods

Appendix 14 Protocol / guide for Direct Observation

Site: Observer:

Participant:

Age of the birds:

Date of observation:

- a. Note and record the procedures for application of drugs and methods used to ensure all the birds had access to the drug
- b. Note and record the procedure in place for the supply of water and feed to the birds and what mechanisms were in place to ensure that all the birds had access to the water and feed.
- c. Note and observe the procedures for the changing of bedding and the reasons for doing this
- d. Review of the work procedures observed and comparing these to the procedures outlined by the key informants. Any deviation should be interrogated for explanation and justification/authorization.
- e. Observe and record the procedures for withdrawing feed as well as for re-introducing it. Record the time of withdrawal and that of re-introduction. Ensure to obtain an explanation for doing this
- f. Review the journal for the participants and ensure that these key activities are recorded in the journals accompanied by relevant explanations for performing these tasks.
- g. At each stage of the process, ensure to engage the participants for explanations of the process and procedures giving reasons for it and that of not doing it

Appendix 15 Focus Groups Interview Guide

Focus Groups Interviews

1. What knowledge have you gained from the engagement in the research exercise that you did not have prior to this engagement?
2. What challenges have you encountered during the project with regards to the rearing of the chickens?
3. How have these challenges been resolved?
4. Are you satisfied that the resolutions provided to address the challenges mentioned in Q2?
5. Do you have alternative suggestions and are you able to provide the justification for the suggestion?
6. Do you have any comment or suggestion as to how the project has been conducted or how you could have preferred that it was conducted?

Appendix 16 Summary of Findings

16.1 Summary of Findings from Interviews

Interviews were conducted with the two key informants and the participants from each site. Four individuals were selected from each of the three sites at Kachele and at Maridadi. Given that these people worked in shifts only two from each site were interviewed at a particular time. However, the researcher planned their visits in such a way that all members of the teams were met during the week. This was set to help with the action research part of the program and also to ensure that weekly targets were discussed with all the members of the teams and feedback provided for purposes of planning for the week ahead.

16.1.1 Findings from Key Informants

The findings from the key informants are outlined in order of structure from the research questionnaire that was used to collect data from them. Two key informants were interviewed, and their responses are summarized as below:

16.1.2 What poultry houses cleaning was intended to achieve and why the same type of cleaning chemicals is not used.

Cleaning of poultry houses is intended to help reduce the number of pathogens present in those **poultry houses**. Cleaning is an important part of the biosecurity program for protecting poultry houses against infections from outside and stopping pathogens from spreading inside the houses. Using the same type of chemicals all the time causes pathogen chemical resistance.

16.1.3 Why the bedding is required and why once removed from the houses after cropping of the chickens, it is disposed of at least one kilometer away from the poultry houses

Bedding once removed from poultry houses after cropping is disposed of kilometres away from poultry houses to ensure effective biosecurity and prevent re-entry of diseases into a farm, and limit the spread. It is the cheapest and most-effective method of disease control. The bedding helps to insulate the birds from direct contact with the cold floors and provides a caution for preventing the body of the bird from getting scratches. The bedding also prevents injury to the feet of the bird and helps to absorb the moisture in the house and keeps the environment dry. The bedding further helps in the following areas:

- a. It works as a deterrent to the accumulation of disease and ammonia
- b. The bedding tends to hold the moisture and accumulated ammonia and pathogens
- c. Ammonia if allowed to accumulate works as a growth depressant to the birds and corrodes their respiratory tracts, causing respiratory complications such as coughing.

16.1.4 Why temperatures in the houses were prescribed for a particular range during the brooding stage and why this was so critical

Temperatures in the houses are prescribed for a particular range during brooding stage to ensure there is no chilling or overheating during this crucial period which can result in poor growth, poor feed conversion and increased susceptibility to disease especially that the chick does not regulate its body temperature but depends on external brooder heat supply. Chilling or overheating during brooding stage can lead to poor growth; poor feed conversion rate and poor immunity for the birds. The uncontrolled temperature in the houses at this stage of the growth of the bird can also compromise the overall performance of the bird. Prescribed temperature and the monitoring of it can be used as an accurate measure or tool to indicate performance against the pre-set standard and also in possible performance failures.

16.1.5 Why particular weight ranges are preset for each week in the rearing cycle

Particular weight ranges are pre-set for each week in the rearing cycle to allow:-

- a. For routine accurate estimates of average body weights
- b. Accurate monitoring of live flock performance.
- c. Identification of possible performance issues such as growth
- d. Defined end product specifications to be as closely met as possible.

16.1.6 Why particular amounts of feed are prescribed for the rearing cycle and what this is intended to achieve

Each stage of growth of a broiler, has specific nutritional requirements hence the prescription of particular types of feeds to meet the nutritional needs of the broiler stage of growth. High protein content feed is prescribed in the early stages of the bird while high energy content feed is suitable for birds in their finishing or older stages.

16.1.7 Why FCR is so important in the analysis of performance and what information can be derived from it

In poultry farming, feed efficiency is a major variable to determine the cost of a kilogram of poultry meat. Feed forms about 70% of the cost of producing a bird. The Feed Conversion Ratio, which varies depending on the type of production applied, is always a very helpful benchmark to determine the profitability of a farm. FCR is the measure for an entire flock of birds and not for individuals. The lower the FCR, the more profitable the broiler production will be and lesser quantities of feed will be used but the bird will have higher weight content.

16.1.8 What information can be derived from the percentage of mortality

Flock mortality has a major influence on the size of the settlement cheque after cropping and so is one of the greatest worries of any broiler grower. While differences in breeder flock status, genetic strain, hatchery conditions and management practices mean that two

consecutive flocks on a particular farm will seldom have similar mortality patterns, the examination of data from numerous flocks can help to identify specific mortality patterns. Mortality in broiler flocks represents lost income and uniformity to growers and integrators alike. The level of uniformity dictates the final result; poor flock uniformity goes hand in hand with delayed growth, rejects, and poor FCR.

16.1.9 Would above the preset weights for the birds that are delivered to the abattoir be a sign of good management?

To some extent above pre-set weights for birds delivered to the slaughterhouse cannot be a sign of good management because the processing plant requires uniform flocks with the correct average bodyweight (without too much deviation from the sample weights taken at the farm) to satisfy the demands of the modern distribution network and deviation from this constitutes bad management. Processors tend to prescribe particular weight ranges in order to satisfy their market demands (this is so with the fast-food market) and as such, adherence to such weights can constitute good management from the processor position.

16.1.10 Why is there a waiting period between the time the birds are cropped and the subsequent placement?

To ensure effective cleaning before placing a new batch, there is this waiting period. This also helps in breaking the pathogen proliferation cycle. The Company (Zamchick) has a waiting period of about four weeks between cropping and placement of a new batch of chickens.

16.1.11 What modern methods are in use at Kachele and Maridadi and are there plans for introducing more modern methods and if so which ones?

The modern method employed at Kachele is semi-controlled housing, while at Maridadi is fully automated. The facilities are not working as semi-controlled at Kachele as a result of disrepair and are operating as ordinary houses. There are no immediate plans to introduce more modern methods at Maridadi.

16.1.12 What benefits has the company gained from the use of these modern methods

The main benefits of modern poultry methods are listed below;

- a. It is very easy to care for the birds.
- b. Cleaner and healthy birds.
- c. Less feed wastage.
- d. Thousands of birds may be housed in a specific floor space of the house.
- e. The birds suffer less from internal parasites.
- f. Labour cost is very low.
- g. Does not contribute to deforestation i.e. it is environmentally friendly

16.2 Summary of Findings from Interviews of the Participants

Most of the work by the participants involved recording of daily activities on which most of the data on observation is based. They were initially trained in understanding the requirements of the research project and recording the activities in the journal. The researchers took time to compare their recordings with those from the key informants, testing for consistency and areas where they departed from the guidelines provided by the key informant. As a result, the researchers focused on the particulars of the participants in terms of age, training, and how long they had worked at the site. The intention was to look for knowledge retention from the last training conducted at the Kachele sites after the upgrade was done. Below are the comments that were recorded from the participants:

- a. Some participants commented that mortality was higher on the birds that were received with deformities for which they could do nothing about. In many cases, these constituted a higher proportion of mortality recorded. It was suggested that this type of mortality be recorded under the hatchery so that it did not affect their results.
- b. That the equipment for environmental control malfunctioned too many times and was eventually decommissioned and as such Kachele A and B reverted to ordinary houses
- c. Some participants reported that there were times when feed was delivered late. This late delivery impacted negatively on the growth of the birds. On further inquiry, it was established that this was a rare occurrence

A review of the information from the participants clearly shows that the time that they had spent at Kachele sites did not include the time when training for the upgraded house was done. Training took place in 2014 just after the upgrade. This might explain the knowledge gap and lack of understanding of the workings of modern facilities. It may also explain why they could not cope with the equipment and experienced a lot of breakdowns with it. This aspect did not affect the participants at Maridadi where training was continuously done with the workers being kept up to date on the workings of the equipment.

16.3 Summary of findings from Observation

The researchers kept a record of all the discussions with the participants and the key informants. In addition to this, a record was kept of the key observations that were made during this research exercise. The outline of the observations will follow the structure of the format of the focus of the areas that the researcher focussed on, in addition to other key areas that were noticed during this time.

The first key and most important part that was observed was that the semi-controlled facilities had been disconnected and decommissioned at Kachele A and B and, apart from the use of nipples for provision of water and automated feeders for feed, the aspect of heating and cooling the houses were manual. This is what prompted the inclusion of Maridadi which has fully automated facilities to provide data from an automated facility.

16.3.1 Application of drugs and methods used to ensure all the birds received the drugs

The application of the drugs was uniform for all the four sites with the application dates done at about the same time. The water when applied was given colourants to ensure that all the birds that took the drug with the water were marked. Additionally, water was withdrawn for a couple of hours before being introduced to the drugs. This also ensured that the birds were thirsty for the water when administering the drugs was being done.

16.3.2 Supplying heat, water and feed to the birds and mechanisms to ensure that the birds had access to these facilities

There is a set standard for providing water with the chick fount at one fount for 50 chicks while the bell drinker can serve between 90 and 100 chicks. For feed, chick trays for small chicks can serve 50 chicks and tubular feeders serve between 35 and 40 birds. With this standard in mind, the participants explained that they place the equipment in strategic places to ensure access and usually placed more than the standard to improve access.

It was observed that heat in the houses was maintained at a particular temperature during the first 14 days (brooding stage). At the three houses at Kachele heating was provided through braziers filled with charcoal while at Maridadi, the automated heaters managed through a computer program provided the heat.

16.3.3 Changing of bedding for the birds

Whenever water spilled to the bedding, the bedding was changed to ensure that no wet bedding was allowed in the houses. The explanation that for this was that damp surfaces were ideal for growth of pathogens unlike dry ones, and it was a standard rule that the bedding remained dry during the rearing period.

It was observed that on receiving the day-old chicks into the houses, the bedding had manila paper covering on top and this was removed after three days. The bedding was made up of wood chippings or wheat straws that covered the poultry housing floor.

16.3.4 Withdrawal of feed at certain times and reasoning for doing so

It was observed that after the age of four weeks, the feed was withdrawn during the day time and re-introduced later in the afternoon. The explanation that was given was that this was done during the day when temperatures were considered hot and the feed was withdrawn to help with the heat stress for the birds. In times when it was cold during the day, feed was not withdrawn. The birds suffered from heat stress during the day when temperatures were high and the rate of mortality was high if no measures were taken to help the birds with the heat. This position was only applicable to ordinary houses and not the automated ones.

16.3.5 Comparing these methods of work culture with those outlined by the key informants as good practice.

The procedures for cleaning the houses and preparation for placement of the birds were standard. The same was observed for the way water, feed and drugs were applied to the birds. The only difference that was observed was on automated feeders at maridadi and the manual

ones at Kachele sites. The automated feeders had one central place of loading for each house while at Kachele, each feeder in the houses was manually filled with feed at each time of replenishment. This conformed to the standards outlined by the key informants who supervised at a management level, of the operations of these facilities. The researcher was informed that standardization of procedures was a critical feature as it helped with understanding problems as they occur. Issues of slow growth and diseases could be best addressed if all the procedures were standardised.

16.3.6 Ensuring that key activities were recorded in the journal with relevant explanation for the performance of the tasks that were undertaken.

The researchers checked and ensured that the journal was completed daily on each visit. The notes were reviewed and explanations requested for all the activities that were performed. At first, especially during the first batch, it was difficult as the participants could not clearly explain/express themselves but over time with guidance and after gaining confidence, they volunteered the explanations and reasoning for their activities. It was observed that all participants were very particular about the established procedures.

16.3.7 Action Research engagement Arising from Observation

The researchers and participants held weekly meetings where observations during the week were discussed as a way of creating a collaborative approach to resolving some of the challenges that the participants were encountering in their work processes.

The discussion followed the process flow chart of bird rearing stages and actions that were taken during the process as presented on page 53.

a. Stage One – Brooding stage (Weeks 0 – 1 and half weeks)

All the participants identified the provision of heating to the birds as the most critical activity at this stage of the birds. Additionally, provision of bedding to ensure that the birds don't come into contact with the floor of the house was considered the second critical aspect at this stage.

During the weekly discussions, participants from the three Kachele sites expressed concern about the houses being deprived of heat at the time of replenishing the braziers with charcoal. It was suggested (by a participant from Kachele A) that the replenishment be done in phases and not all at the same time. This suggestion when taken to Kachele B and C, and was endorsed by all the participants and adopted immediately. This did not affect the participants at Maridadi as their heating system was automated. On their part, it was discussed and agreed that they should constantly monitor the temperature in the houses and test with the mobile thermostats to ensure that the recommended temperature was retained throughout in the houses.

b. Stage two – Growth Stage (1 and half weeks to 3 and half weeks)

Brooding lasts up to 14 days and as such, this stage included half a week of brooding stage. This stage's main activity was the administering of vaccines and vitamins and continued ensuring the welfare of the birds by protecting them from adverse weather conditions.

Gumboro and lasota vaccines were applied on day 10 and 14 respectively and these were repeated on day 18 and 21. At this stage, the participants paid particular attention to ensure all the birds took the vaccine that was applied through drinking water. Two techniques were deployed; firstly, water was withdrawn prior to this exercise and secondly, the water with the vaccine was given a colourant that left a mark on the beak of the bird. When water was introduced, all the birds were thirsty and in the process drunk the water with the vaccine. Further confirmation was through the coloured beak of the bird that assured the participants that the birds had taken the water with the vaccines. The birds were administered with vitamins to assist with the stress before and after taking the administering of the vaccines.

c. Stage three – Finishing Stage (3 and half weeks to week five)

The main activity that was observed at this stage was that of birds' welfare through protection against adverse weather conditions and ensuring that the environment in the house was suitable. The participants were observed turning the bedding to prevent it from getting hardened and removing any that was found to be wet and replaced with dry bedding.

The participants were also observed to be withdrawing feed during the day when the temperature was considered to be high and reintroducing the feed later in the day when temperatures dropped. All the participants acknowledged that feed withdrawal assisted the birds in coping with heat stress and that they had noticed through experience that this worked for them. This aspect was only applicable to Kachele sites.

16.3.8 Summary of findings from the Focus Groups

The researchers had initially set exit meetings with all participants at each site for purposes of covering issues that might have been left out during the visits and also to assess if, from their perspective, they had benefited from the interactions. After review, it was resolved that this be classified as focus groups. Given that two batches were observed, it followed that two meetings for each site were arranged and were attended by all the participants but for one individual that developed health challenges and could not continue with the research study.

After considering the matters that were discussed during the interview and observation process, two issues stood out during the group discussions:

16.3.9 Dealing with Heat Stress

During the observation process, the finding under this topic was that feed breaks should be undertaken during the day to help the birds deal with heat stress. However, a further proposal was made that management should consider reducing the placement numbers that should result in a reduced number of birds per square meter to help the birds deal with heat stress. This aspect affected houses at Kachele A, B and C and not Maridadi.

16.3.10 Environmentally Controlled Houses at Maridadi

The researchers were informed by the participants at Maridadi that, while acknowledging the views from their colleagues, they found themselves in a very difficult situation operating the fully automated poultry houses. The equipment was run through computer programs that were pre-set and did not allow human intervention except to re-program the progress. It was agreed that they should consider delayed reactions to the changing environment or allow a particular situation run longer than programmed.

16.4 Presentation of Findings from Company Records

Appendix 2 shows a summary of the results that were collected from the four sites over four batches covering the full year. The results have been categorised in the form of a percentage of mortality, cost of production (that is the cost of the day-old chick and that of feed), number of birds cropped, Feed Conversion Ratio (FCR), the average weight of the birds that were delivered to the abattoir, the average age of the birds at the time of cropping and production efficiency.

Average means for the different Sites using variables of Mortality, FCR and Average weights

Variable	Overall	Maridadi (N=4)	Kachele A (N=4)	Kachele B (N=4)	Kachele C (N=4)
	Average (N=16)				
Mortality	9.89	7.91	7.45	12.74	11.46
FCR	1.81	1.71	1.89	1.88	1.76
Average Weight	1.75	1.86	1.8	1.58	1.75

Note. N = number of cases/occurrences

Fig 1. Summary of the average means for all the sites. This is a collection/summary of the information of appendices 3, 4,5 and 6 and also shown in appendix 7.

16.4.1 Notes to Findings from Fig 1 above.

a. Mortality as the variable factor

Maridadi and Kachele A showed a lower number of mortality per site while the average mean for the two sites show a difference in number, a further analysis of the means was done and is analysed under Appendix 9.

b. FCR as the variable factor

The average mean for all the sites was 1.81, but Maridadi showed the lowest ratio of 1.71. The lower the FCR, the better.

c. Average Weight as the variable factor

Maridadi achieved the highest weight compared to the other sites at 1.86kgs compared to the average of 1.75kgs for all the sites.

16.4.2 Notes on Findings from information presented on Appendix 2. This shows the number of employees per site, number of Poultry houses per site, total capacity of birds per site and the average stocking density per site

- a. Maridadi site had a higher placement of 20 birds /square meter compared to 12 birds/square meter for the other three sites at Kachele A, B and C. Comparatively, Maridadi had 66% more birds placed per square meter compared to the other three sites.
- b. The three sites at Kachele have a higher number of houses but lower placement numbers of birds compared to Maridadi, which had a lower number of houses but bigger houses with a higher placement per square meter.
- c. In terms of number of birds per man, Maridadi had 7,500 birds per man (90,000/12) while the other three sites had 2,727 birds per man (60,000/22). Individuals working at Maridadi site handled a higher number of birds compared to the other three sites by more than 2.7 times.

16.4.3 Notes on Findings from Appendix 11 (Seasonal Comparison)

The batches that were picked represented the seasons of the year for the area, being summer dry, summer wet and winter. An analysis was done using ANOVA (Analysis of variances) to compare the impact of weather on rearing the birds. At 95% level of confidence, the results showed that the seasonal weather variations did not impact the variables of FCR, live weight and mortality.

16.4.4 Findings from Appendix 9 (Analysis of Variances for the four sites using variable factors of FCR, mortality and average weights.)

- a. Mortality (Maridadi vs the rest)
Significant differences were observed on Kachele B and C while there was no significant difference in Kachele A. This difference is to the effect that Maridadi performed better than Kachele B and C. This is despite the Maridadi being above the average figure of 9.98 as per fig 1 on page 78 and Kachele being below the average mean.
- b. FCR (Maridadi vs the rest)

The significant difference was observed on Kachele A and B. This showed that Maridadi in terms of FCR performed better than the two sites.

c. Average Weight (Maridadi vs the rest)

The analysis shows a significant difference observed on Kachele B as compared to Maridadi. Maridadi had higher live weights compared to the rest of the sites.

Appendix 17 List of Rearing Poultry Sites

Kalola 7 (4 houses) 4 x 12,000	48,000
Kalola 7 (2 houses) 2 x 18,000	36,000
Golf Three (6 houses) 12,000 each	72,000
Lantana (6 houses) 12,000 each	72,000
Old Poultry (9 houses) 6,000 each	54,000
Kachele A (10 houses) 6,000 each	60,000
Kachele B (10 houses) 6,000 each	60 000
Kachele C (10 houses) 6,000 each	60,000
Total Owned Premises	462,000
Leased Premises	
Maridadi (3 houses) 30,000 each	90 000

Appendix 18

Schedule showing Impact of Volume, FCR, Mortality and live weight

Impact of volume, FCR, Mortality and Average live weight

based on Fig 1 in the findings chapter

		Maridadi	Kachele A	Kachele B	Kachele C	Feed Consumption (using exchange rate of US\$ to ZMW21.00)			
						grams/bird	price/kg	value/kg (US\$)	
a	Average Weight/ birds (kgs)	1.86	1.8	1.58	1.75	Pre-Starter	200	0.36	0.072
b	Average selling price/kg (US\$)	1	1	1	1	Starter	300	0.35	0.105
c	Total birds cropped less mortality	82,881	55,530	52,356	53,124	Grower crumbles	200	0.33	0.066
d	revenue (a * b * C)	154,158.66	99,954.00	82,722.48	92,967.00	Grower pellets	1,000	0.33	0.33
			-	-	-	Finisher pellets	1,200	0.32	0.384
						total feed in grams and value in US\$	2,900		0.957
c	FCR	1.71	1.89	1.88	1.76	Maridadi (add 280grams of finisher)	3.18		1.0466
d	Feed Consumption/bird	3.18	3.40	2.97	3.08	Kachele A (add 500grams of finisher)	3.4		1.117

e	feed cost per bird (in US\$)	1.0466	1.117	0.9794	1.0146			
						Kachele B (add 70 grams of finisher)	2.97	0.9794
f	Total value of feed cost (e * c)	86,743.25	62,027.01	51,277.47	53,899.61			
						Kachele C (add 180 grams of finisher)	3.08	1.0146
g	Feed cost as a %age of total revenue	56%	62%	62%	58%			
h	Margin after deducting feed costs (f -d)	67,415.41	37,926.99	31,445.01	39,067.39			
i	Mortality percentage	7.91	7.45	12.74	11.46			
						Pre-Starter	7.64	0.36
						Starter	7.38	0.35
j	Number of employees per site	12	22	22	22	Grower crumbles	6.9	0.33
						Grower pellets	6.9	0.33
K	Revenue generated per employee (d/j)	12,846.56	4,543.36	3,760.11	4,225.77	Finisher pellets	6.76	0.32

Selling price of live birds is K21/kg
actual feed prices used as at April 2021

Appendix 19

Comparison of the Results for the four Sites to the Standard

	Standard Results	Maridadi Average	Kachele A Average	Kachele B Average	Kachele C Average
FCR (ratio)	1.78	1.71	1.89	1.88	1.76
Live Weight (kgs)	1.8	1.86	1.8	1.58	1.75
Mortality (%age)	3	7.91	7.45	12.74	11.46
Calculated total feed Consumed	3.2	3.18	3.4	2.97	3.08

Based on the following numbers

Total feed consumption 3.2kgs

Achieved Weight (Appendix 12) 1.8kgs

Mortality 3%

Notes

Using the standard for comparison purposes, the following results were achieved

Maridadi

Achieved lower feed consumption but higher weights at 1.86kgs compared with the standard achieve higher mortality rate compared to the standard as such did not perform on this factor achieved lower FCR compared to the standard. The lower the FCR, the better cause it means less feed was

Kachele A

Achieved higher feed consumption but same weights as the standard

Mortality rate was higher compared to the standard
achieved higher FCR meaning more feed was consumed. The higher the FCR the poorer is the performance

Kachele B

Achieved the lowest feed consumption of the four but had the poorest weights for the birds
Mortality rate was the highest of the four sites. And was much higher than the standard
FCR was second highest and the conversion was poor hence the lower weights

Kachele C

Achieved lower feed consumption compared to the standard and lower weights as well
Mortality was second highest and was much higher than the standard
FCR was second to Maridadi and lower than the standard. Conversion rate was good hence the lower feed