

Title: Assessment of Extension and Advisory Services on Nguni Development Project Beneficiaries in the North-West Province

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CERTIFICATION

I certify that this research work was carried out by IJATUYI, Enioluwa Jonathan in the Department of Agricultural Economics and Extension, North-West University, Mafikeng-campus, South- Africa under my supervision

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DEDICATION

I humbly dedicate this research work to God Almighty, the Creator, and Giver of knowledge, wisdom, and understanding for the opportunity to venture into this programme and project.

ACKNOWLEDGEMENT

I thank God for making this work possible despite the challenges I faced during the cause of running my M.Sc. Programme, I sought him in my trouble, he answered me and delivered me from all my distresses. He guarded and guided me through the thick and thin of this work, not only during the completion stages but right from its inception; He is truly the Alpha and Omega of my entirety.

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LIST OF ACRONYMS

AD	After Death
ADP	Agricultural Development Project
AIS	Agricultural Information System
AKIS	Agricultural Knowledge Information System
AKS	Agricultural Knowledge System
ATM	Automated Teller Machine
BATAT	Broadening Access to Agriculture Trust
BoT	Board of Trustee
CA	Contagious Abortion
CGIAR	Consultative Group on International Agriculture Research
CSIRO	Commonwealth Scientific and Industrial Research Organization
DAFF	Department of Agriculture, Forestry and Fisheries
DOA	Department of Agriculture
ERP	Extension Recovery Plan
FAO	Food, Agriculture Organization
GDI	Gross Domestic Income
GDP	Gross Domestic Product
ICT	Information Communication Technology
IDC	Industrial Development Co-operation
IIASA	International Institute for Applied System Analysis
ISRDS	Integrated Sustainable Rural Development System
KG	Kilogram
LRI	Livestock Research Institute
MRDLR	Ministry of Rural Development and Land Reform
NDA	National Department of Agriculture
NETSARD	National Education and Training Strategy for Agriculture and Rural Development
NERPO	National Emergent Red Meat Producers
NGO	Non-Governmental Organization
NOAH	National Office of Animal Health
NWU	North West University

NWP	North West Province
ODI	Overseas Development Institute
OECD	Organization of Economic Co-operation and Development
PPEA	Participatory Programmed Extension Approach
READ	Rural Environment and Agricultural Development
RMRD-SA	Red-Meat Research and Development of South Africa
SADC	South African Development Community
SARCHI	South-African Research Chair Institute
T&V	Training & Visit
TB	Tuberculosis
TC	Technical Committee
THRIP	Technological and Human Resource for Industry Programme
TOT	Transfer of Technology
USAID	United States Agency for International Development
WSU	Washington States University

ABSTRACT

The efficiency of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed and responsive to the ever-changing social, economic and political environment. This study focused on the assessment of extension and advisory services on Nguni cattle development project beneficiaries in the North-West Province of South-Africa. Random sampling technique was used and out of the total number of 187 beneficiaries in the project, a sample size of 128 beneficiaries was selected and only 76 beneficiaries participated in the study. The result showed that the average age of the respondents was found to be 55 years, male dominated, married with an average household size of 5 and 30.3% having between 11-20 years of farming experience. The beneficiaries had an average farm size of 400.5 hectares, 3-5 years of cattle rearing with majority (85.5%) recording a mortality rate of between 1- 3 cattle on their farms. The results further showed that 96.1% had access to extension and advisory services with 82.9% having improvements in vaccination techniques and cattle production areas, 93.4% kept Nguni cattle for the purpose of beef production, generating an average of R 50,000 as the total annual income. Gender, cattle rearing experience and extension visits had a positive significance at $P \leq 0.05$, and $P \leq 0.10$ respectively. Furthermore, land ownership was negatively significant at $P \leq 0.10$ affecting the performance of the project on increased productivity and income generation. The total annual income was influenced positively through the provision of vaccines and vaccination techniques at $P \leq 0.01$ and $P \leq 0.10$ respectively. Marketing strategies and opportunities were negatively significant at $P \leq 0.05$ and $P \leq 0.10$ respectively. The receptiveness of extension and advisory services by the respondents has contributed positively towards the project and generation of annual income. The study recommends that, the government should also encourage females and younger generations to participate in the programme by providing more and relevant information through extension and advisory services and more marketing opportunities should be created.

CHAPTER 1

1. Introduction

Agriculture is one of the economic sectors that contributes to the growth of the economy of any given nation or country. Such roles include the provision of food for the ever-increasing population, provision of raw materials for industries, the creation of employment opportunities, serving as a source of foreign exchange earnings among others (Adams, Nelson, and Todd, 1992). Agriculture has contributed more to reshape the socio-economic position of any given country and it is known to contribute to the Gross Domestic Income (GDI) of the African continent at large and of any country, in particular, South Africa through the products/produce, which is derived from farming and rearing of animals (Goldblatt, 2008).

For any country to produce and provide food for its citizens, the need to supplement and provide proper agricultural sector is very important. Agriculture is said to contain a provision of raw materials for industries to work with, provision of job opportunities for able-bodied men and women and foreign exchange earnings for a country at large (Agholar and Obi 2013). Agholar, Monde, Obi and Odeyemi (2012) stated that the use of agricultural sector and extension education in reducing poverty in South Africa are important given the large resources available in the sector. The provision of extension and advisory services would definitely increase agricultural production because proper communication through extension and advisory services would influence the adoption of new or improved technology.

Provision of education and training, as well as health-care infrastructures in the rural areas, would reduce rural poverty and inequality depending on the provision of the basics that are needed for development. Khan (2001); Oyeranti and Olayiwola (2005) further stated that the environment must be explored, harnessed and identified with useful opportunities for quality extension education.

The National Education and Training Strategy for Agriculture and Rural Development (NETSARD) highlighted some serious challenges through the Department of Agriculture (2005a) which must be tackled to discuss the inability of extension staff in South Africa to perform to the uttermost expected best. These include the distribution ratio of extension and advisory staff to farmers (commercial and subsistence); commercial farmers 1:21, subsistence farmers 1:857 and combined 1:878; the wide distance between farmers, the geographic areas covered by extension workers to be able to perform their duties, client literacy, i.e. level of education and knowledge, level of practical functioning of local farmers groups and associations. Agbolar *et al.* (2012) stated that the best development that happens to livestock and cattle sector in the Department of Agriculture is to provide extension and advisory services that are reliable

and timely. It was further discussed by Agholar (2012) that livestock, cattle sector have been neglected by policy makers and researchers despite its growing importance. From all the facts, there is the need to empower extension agents with the necessary capacity and skills to help communities in dealing with the effects of changes happening around them. South Africa is characterized by different farming areas and enterprises, which range from intensive crop production in winter rainfall and high summer rainfall areas to cattle ranching in the bushveld a sub-tropical woodland ecoregion of Southern Africa named after the term veld and sheep farming in the arid regions (Goldblatt, 2008). As a result, the land surface in South Africa is known to be suitable for grazing, which is the main farming technique for cattle rearing and farming. The system of cattle rearing has contributed about and between 25-30 percent of the total output per annum (Musemwa, Mushunte, Chimonyo, Fraser, Mapiye & Muchenje, 2008). According to Integrated Sustainable Rural Development System, (ISRDS, 2004; Coetzee, Montshire, and Jooste, 2004; Syngenta 2014), it is no coincidence that livestock farming has a great potential to help reduce and alleviate household food insecurity and poverty in communal areas of South Africa.

1.1 Agricultural Extension

Syngenta (2014) stated that "Agricultural extension is the function of providing need and demand-based knowledge in agronomic techniques and skills to rural communities in a systematic and participatory manner, with the objective of improving their production, income and by implication quality of life". Extension is essentially education and its aim is to bring about positive behavioural changes among farmers. Aseno-Okyere (2009) defines extension and advisory services as a means which are geared towards improving the living standards of farmers by increasing their income through the introduction of improved technologies and use of proper and effective communication information channels. Syngenta (2014) defined extension service as a "practical application of useful knowledge to the farmer and his household". Furthermore, extension is divided into three main sectors which are: the public sector, the private non-profit sector, and the private profit sector.

The public sector includes ministries and the Department of Agriculture and Agricultural Research Centers. The private non-profit sector includes local and international non-governmental organizations (NGOs), foundations, community associations, bilateral and multilateral aid projects. The private profit sector includes commercial production and marketing firms, commercial farmers or farmer group operated enterprise where farmers are both users and provider of agricultural information, trade companies and media enterprises (Syngenta Foundation of Sustainable Agriculture, 2014).

According to Oladele, Koyoma and Sakagama (2004), agricultural extension and advisory services have been changing over the past few decades. These changes are attributed to many factors that include policy and political changes and recently the introduction and participation of the non-governmental organizations (NGOs) in farmer support services. Using the survey by Eicher (2007), he highlighted 6 categories of extension models in various stages of development which he said are the basic. These include:

- i. National extension model;
- ii. Commodity extension and research model;
- iii. Training and visit (T&V) extension model;
- iv. The NGO extension model;
- v. Private extension model; and
- vi. Farmer field school (FFS) model

The introduction and implementation of Agricultural Development Programmes (ADP's), which are mainly funded by the government to increase agricultural production as well as extension and advisory services, were placed in the hands of the public extension workers to render the services to the farmers helping them become more production inclined and increase their incomes.

Weaknesses in extension and advisory services such as poor funding, lack of technological expertise and infrastructure have been recorded as some of the barriers for the proper impact of extension and advisory services on Agricultural Development Project (Ozor, Agwu, Chukwuone, Madukwe, and Garforth, 2007). Extension programmes and activities should be easy to access and are supposed to be readily available for the consumption of farmers but because change agents are not properly trained or available in the government-owned establishments, farmers turn to seek advice and services from private establishments. Extension services are more often expensive in the private establishment but are provided on time due to proper training, infrastructures and trained personnel, which are somewhat readily available. However, very few farmers and farming communities get the opportunity to access them, which can be a limiting factor in terms of skill, knowledge, and information sharing resources. Those farmers who are able to pay for the private services benefit more hence leaving out the majority of the poor cattle rearers with no access to agricultural advises, marketing opportunities, general herd management and other information sources related or relevant to livestock farming.

Anderson (2007) stated that: "Agricultural advisory (extension) services are a vital element of the array of market and non-market agents that provide critical flows of information that can

improve farmers and other people's welfare. After a period of neglect, agricultural advisory services have returned strongly to the international development agenda. Apart from their conventional function of providing knowledge for improved agricultural productivity, agricultural advisory services are expected to fulfill a variety of new functions such as: linking smallholder farmers to high-value and export markets, promoting environmentally sustainable production techniques".

1.2 Definition of Livestock

According to Ntshepe (2011) livestock is all domesticated animals, particularly sheep, goat, pig, and cattle, reared in an agricultural setting for food, fibre or breeding purposes. She further defined animal husbandry as an important activity in modern agriculture which is being practiced in several communities. Furthermore, Ntshepe (2011) stated that "knowledge and understanding of livestock and meat prices, seasonal price fluctuations and movements and areas of high and low demand are crucial in livestock marketing and are key aspects of the marketing information needs of the smallholder farming community. As a result of lack of exposure and distance from improved technology and communication systems, resource-poor livestock farmers cannot access and understand price information. This limits participation by these farmers in mainstream marketing activities.

According to Nouman, Basra, Siddiqui, Yasmeen, Gull, and Alcayde (2014) "livestock has the biggest land-use activity globally, which is expected to double by 2020 with an annual increase of 2.7 percent in meat production and 3.2 percent of milk production". Steinfeld (2004) stated that livestock farming in the developed world is very productive due to the availability of resources, especially land, that are maximized with more attention given to animal ethics, environmental impact, product traceability and consumer satisfaction. The importance of herd cannot be denied.

Traore (2010) highlighted that about one billion individuals in the world depend on livestock for their livelihood. Livestock occupies a very important position in the agricultural sector and department for most countries. This is further corroborated by Capper, (2013) that livestock provides high-quality food in conjunction with a myriad of associated economic and social benefits to communities worldwide. Livestock occupies a cogent position in helping households cope with negatives, the reason being that farmers can easily trade their animals to get cash (Imai, 2003). Cattle, particularly, are known for so many products such as being reared for meat production, milk production, hides and skins, cash income, the source of draught power (ploughing, traction, and irrigation) on farmlands and natural fertilizer (Traore, 2010).

1.3 Agricultural Development Programme

Agricultural development programmes are schemes established to increase and improve farmers' standard of living in the area of their livelihood, the improvement of their environmental status and farming skills and knowledge. Agricultural programmes contribute to farmers' empowerment which encompasses the process that increases the capabilities of smallholder farmers and farmer groups to make choices and to influence decisions towards desired actions and outcomes on the basis of those choices, hence improving production and livelihood. Cwaile, Antwi and Oladele (2012) stated that training and participating in a project is a tool for increasing the capacity of the beneficiary. It is known that not only financial capital can influence improvement of poor families' livelihood, but also food security, a place to live, education and networks are all factors that contribute a positive impact on the families' livelihood as a result of the peace of mind. Farmers' knowledge empowerment enables them to understand the causes and effects of their own agricultural problems and to articulate their technology, extension and development needs as informed demands. Knowledge empowerment allows farmers to participate in the planning, implementation and evaluation process.

According to Schwalbach, Groenewald & Marfo, (2001) empowerment enables people to influence decision processes and undertake transformative actions, which help them improve their livelihoods and standard of living. The positive visible change or impact on the poor families' livelihood comes from several sources: financial capital from sales of meat, hides and animals sales; human capital through improved nourishment from milk and meat; and social capital through establishing of networks in the project and the cooperation with local service providers.

Agricultural development programmes are envisaged to reduce poverty through rural development, enhance food security, and improve access to both local and international market. An example of the development programme is the Nguni cattle project that is meant to improve the well being of livestock holders as well as encourage those farmers who are yet to start and participate in the programme to learn about the advantages of the Nguni development cattle programme. The aim is to teach the Nguni cattle farmers on how to breed and maximize their returns from the cattle. As a result, the provincial government together with the North-West Provincial Rural, Environmental and Agricultural Department (READ) introduced the North-West Nguni Development Project. Farmers were to participate in the development programme and work with extension and advisory officers in order to get the maximum output from the programme (SA News, 2013).

The North-West Nguni cattle development project started in February 2006 as partnership between the Industrial Development Cooperation (IDC), Department of Rural, Environment and Agricultural Development (READ) and the North-West University (NWU) with the aim of re-introducing the Nguni cattle in the province by providing deserving beneficiaries with heifers and bulls on a grant-loan basis. The intention of the project was to contribute towards the alleviation of poverty and enhance job creation among all, empowerment of farmers with livestock farming skills and development of their entrepreneurship ability hence reintroducing the Nguni breed cattle into the North-West Province in large numbers. The project focused specifically on emerging farmers. The Nguni Cattle was chosen for the project as it is an indigenous breed that can survive under many divergent management systems while maintaining high level of fertility. The project has reached the 9th phase (year) and consists of 78 sites across the province that is visited on a regular basis. All 78 project sites have been awarded 23 heifers and one bull each to allow them to build a nucleus herd. The cattle are provided to beneficiaries in the form of a loan, each beneficiary project enter into a contract committing to return back to the project of the progeny, 11 heifers, and a bull after a five-year period and keep the remaining animals and any progeny resulting from efficient management of the land for production. These would then be given to another community in order to make a self-sustainable and expanding Nguni cycle (Somoro, 2009).

The development project beneficiaries are supported by a project manager, extension and veterinary personnel of the Department of Rural, Environment and Agricultural Development. The model of stakeholders and management structure adopted for the project entails the establishment of a trust that serves as the agent for the distribution of the Nguni bloodstock as contemplated in the agreement that followed it. The management structure is as shown in Figure 1.

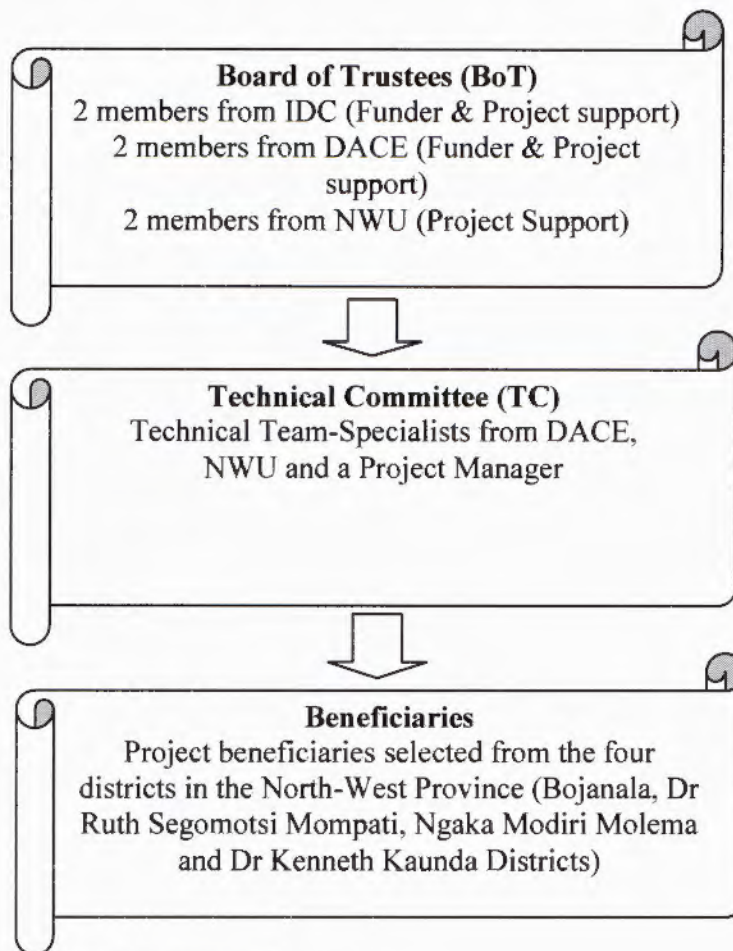


Figure 1: Project Management Structure
Source: Cwaile, Antwi and Oladele (2012)

The Board of Trustees (BoT) is responsible for the major decision making on the projects; interview of potential beneficiaries recommended by the Technical Committee (TC); Sourcing of project funds; budget management; and project monitoring and evaluation. The Technical committee (TC) uses well-designed selection criteria and recommends potential beneficiaries to the Board of Trustees. The NWU provides technical assistance, as well as research and training of the identified beneficiaries. READ provides sufficient personnel who coaches and trains the beneficiaries on appropriate livestock management practices. They conduct inspections to determine any diseases before the arrival of the cattle and aftercare services.

The beneficiaries' selection criteria are as follows:

- Land area must be able to accommodate the number of animals at recommendation stocking rates;
- Animals must be managed in a controlled area (perimeter fence, camps, water reticulation);
- Contribute maximum of 15 females of breeding age. Proof that daily supervision of livestock will be ensured;

- The owners' livestock must be certified free of Tuberculosis (TB) and Contagious Abortion (CA) prior to the arrival of the project animals; and
- Applicants are expected to undertake and participate in a selection process (completion of an application form, shortlisting, interview and an on-site visit to verify information provided).

There is also personnel that are excluded from the selection and excluded from participating in the project; this includes personnel of any of the participating institutes (READ, NWU, and the IDC). All public servants (all departments, all levels of government) are excluded from participating in the project. Communities/People currently benefiting from any other beef projects originating from READ, NWU and IDC may not apply for participation in the Nguni cattle development project.

The requirements for successful applicants are stated below:

- Identify all animals individually and apply for a registered brand mark;
- Keep comprehensive records of livestock, i.e. supplements, mating, weaning, treatments, vaccines, inoculations, and injuries, among others;
- Avail their livestock and livestock records for on-going inspection;
- Participate in prescribed training programmes. Training includes, amongst others, basic herd management, land care; pasture management, disease control, and record keeping;
- Pursue the ideals of "Organic beef production" by feeding only that which is allowed under the concept;
- Adhere strictly to the prescribed vaccination programme;
- Report any change in the status of the loan animals to the Extension Officer immediately (for example, theft, injury, death). Veterinary certificates or case numbers will be required; and
- Grant or obtain permission for infrastructural development on the land in pursuit of the objectives of the project.

Cwaile, Antwi and Oladele, (2012) further highlighted that upon successful application after the Board of Trustees (BoT's) interviews the applicant, the approved applicant signs a contract with the BOTs, livestock packs are made available, and training is then provided to the beneficiaries.

According to Bester, Matjuda, Rust and Fourle (2008) Nguni cattle were first introduced to South Africa in about 600 A.D. European colonization in the nineteenth century altered the progress of this low-maintenance breed when there was the introduction of exotic breeds into the

colony, and this altered the original gene of the Nguni cattle. A developed structure in the twentieth century gave room for the commercial sector to improve the Nguni breeds (Bester *et al.* 2008). The cattle are known to be able to survive under optimal conditions which include adaptive traits which make them have the ability to walk long distances, tolerant of extreme temperatures. It has been proven scientifically that this breed has a good resistance to diseases. It is also able to maintain its body temperatures during the winter seasons. The cattle are multi-coloured and could be white, black, brown, grey, red, there are over 80 colours either uninformed, spotted or pied (Bester *et al.*, 2008).

Nguni cattle hides have many advantages and their meat is economically valued. This has prompted big car manufacturing companies such as BMW and Mercedes-Benz to use the hide for making leather car seats. Some local furniture manufacturing companies have also started using the Nguni cattle hide, due to its valued softness and non-loss of its fur, for making leather sofas. The meat is also said to be softer and tastier than that of other European cattle breeds, making it a recommended delicacy (Kero, 2015).

1.4 Statement of the problem

Farmers have largely been on the receiving end of neglect in agriculture, especially when it comes to cattle farming and production Chavula (2016). Farmers (cattle rearers) have experienced difficulties in getting the adequate provision of essentials like infrastructures and fertile farmland to herd on. Farmers rely on farming years of experience or interactions with colleagues to get new or improved farming techniques, meaning they mostly miss out on new innovations by science on feeding techniques or vaccination guidelines Ogunkoya (2014). Afful and Lategan (2014) discussed that Training and Visitation by extension agents and advisory officers have been low due to lack of interest and lack of training centres. They further stated that training and visits are some of the best practices and approaches to extension services; however, the costs attached to them have been the major issue affecting the success of this approach. Zwane (2012) highlighted that training facilities are not provided to the standard in which extension services can be rendered or delivered at the best, hence it affects the quality of the output of services rendered by extension officers to the farmers.

Belay and Abebaw (2004), Ogunlade, Aderinoye-Abdulwahab and Mensah, (2014), Farooq, Ishaq, Shah and Karim (2010) have all indicated that extension agents do not have proper training in the field therefore, it is very difficult to pass on knowledge to the farmers on how to increase their yields during visitation. Another bottleneck is the fact that roads are not at the best conditions, thereby making access to the farmers difficult. Agricultural extension is supposed to

be a setup that facilitates and supports farmers, communities as well as rural people in increasing agricultural productivity by obtaining information, skills and technology to improve their living standards and well-being (Birner, Davis, Pender, Nkonya, Anandajayasekeram, Ekboir, Mhabu, Spielman, Horna, Benin and Kisamba-Mugerwa, 2006).

The effectiveness of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed and responsive to the ever-changing social, economic and political environment (Belay and Abebaw, 2004). Nevertheless, Birkhaeuser, Evenson, and Feder (1991) highlighted the challenges to absolutely display and mention the effect of extension and advisory services, while the result of the effect of some major extension models has been mixed, extension has shown to be a cost-effective means of increasing economic returns for the farmers and displayed significant and positive effect on knowledge, adoption and productivity.

Morton and Matthewman (1996) stated that transmitting of health information from extension agent to the cattle farmers has been a priority for centralized extension services in developing countries. Lack of proper training of extension workers has increased the inadequate timing and transfer of information to cattle farmers about the health of their cattle, thereby increasing the epidemic of disease among their herds which have ultimately resulted in low production. Furthermore, national agricultural extension services are usually designed around the need to transmit information on annual crops, while livestock departments are dominated by vets and animal health concerns, yet the potential for increasing livestock production through the provision of information via extension service is growing in many developing countries. "Despite its growing importance, livestock production extension is a field neglected both by policy-makers and by researchers. The importance of livestock to household welfare, fertility maintenance and production is still under-recognized in many developing countries. But livestock production extension faces the additional institutional problem of being marginal to both agricultural extension and animal health services" (Morton and Matthewman, 1996).

Bembridge (1979) highlighted some of the problems related to the lack of extension services have caused to cattle production. These include an increase in mortality rate, a low production which has reduced the stock numbers and rates, increase in malnutrition and lastly the low rate of disease control amongst the farmers was also mentioned. Farmers lack the knowledge of identifying the type and kind of diseases amongst their herd hereby making the importance of extension services and advisory services is paramount so as to teach them the right vaccines to administer and also the right dosage (Mutibvu, Maburutse, Mbiriri and Kashangura, 2012). A

Consultative Group on International Agriculture Research (CGIAR) meta-analysis of 292 research studies found mean rates of return of 58 percent for investments in advisory services (Alston and Pardey, 2000; Dercon, Gilligan, Hoddinott and Woldehanna, 2008).

The efficiency of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed and responsive to the ever-changing social, economic and political environment (Belay and Abebaw, 2004). The gap created between farmers and the extension officers keeps widening which has caused so much reduction in production because of lack of provision of centers to train and develop extension agents. Cattle farmers rely on their ability and farming experience to rear and produce. The lack of access to either new or improved methods and technologies from extension and advisory services have caused much set back in the return from farmers. Nguni cattle farmers are supposed to contribute to the economy of the society in which they belong through the farm produce and also provide a better well being for themselves, but this has not been so much the case which has prompted an assessment to be carried out on the effect which extension and advisory services have on the beneficiaries.

1.5 Research Questions

The study was guided by the following research questions:

- i. What are the socio-economic characteristics of the beneficiaries in the study area?
- ii. What are the extension and advisory services benefitting the beneficiaries in the study area?
- iii. What are the effects of the extension and advisory services provided on the Nguni cattle development project beneficiary's livelihood in the study area?
- iv. What is the effect of beneficiary's socio-economic characteristics on Nguni cattle development project in the study area?

1.6 Main Objective of the study

The main aim of the study was to assess the effect of extension and advisory services on Nguni development project beneficiaries in the North-West Province.

1.6.1 Specific objectives of the study

The specific objectives of the study are to:

- i. Identify the socio-economic characteristics of the beneficiaries in the study area.
- ii. Examine the extension and advisory services benefited by the respondents in the study area.
- iii. Determine the effects of the extension and advisory services provided on the Nguni cattle development project beneficiary's livelihood in the study area
- iv. Assess the effect of beneficiary's socio-economic characteristics on Nguni cattle development project in the study area

1.7 Hypotheses

The following hypotheses shall be tested:

H_0 : There is no significant relationship between the socio-economic characteristics (age, gender, marital status, household size, etc) of the beneficiary's and the extension and advisory services provided

H_1 : There is no significant relationship between beneficiary's socio-economic characteristics and the total annual income generated from Nguni cattle development project

1.8 Significance of the study

The importance of cattle and livestock farming in South Africa is highlighted as being a source of employment and job creation, poverty relief, and socio-economic development, value adding, agri-business and food security. Furthermore, it is partially a rural-based practice contributing positively to food security and sustainability. In addition, livestock performs a number of roles which are social, economic and cultural functions in the rural communities, livestock produce such as meat, dairy are contributors to a balanced diet whereas livestock fibre products are very important in the fashion, leather, housing and decorative industries. The success of the livestock sector in terms of the GDP is as a result of commercialization to enhance turnover. Livestock provides over half of the value of global agricultural output and one-third in developing countries to rural livelihoods. Livestock development project is often regarded as a project aimed at increasing and improving livestock production so that beneficiaries may realize increased and improved economic returns or improved diet quality. Livestock development for small-scale farmers is considered as a potential mechanism for income generation for many rural

households, thereby alleviating poverty and improving the standard of the living amongst rural poor Moran (2009).

According to Ja Teline (2010), agriculture plays a crucial role in the life and development of any country's economy. Furthermore, agriculture also includes forestry, fruit cultivation, cattle rearing, dairy, and poultry besides farming. The importance of agriculture to a country's economy is highlighted as a source of livelihood; contribution to national income; the supply of food; the international trade market; contribution to foreign exchange market; vast employment opportunity; and source of savings, source of government income as well as basic economic development. South Africa has a dual economy, with both well-developed commercial farming and more subsistence-based production in the deep rural areas (Rootman and Magda du Toit, 2014). Directorate Statistics and Economic Analysis (2013) highlighted that animal production in 2011 rose by 4 percent, mainly because an increase in the production of poultry meat, as well as increase in the number of sheep, goats, pigs and cattle slaughtered during the mentioned period. The contribution of livestock is up to 49 percent of agricultural output. South Africa generally produces 85 percent of its meat requirements while the remaining 15 percent is imported from Namibia, Botswana, Swaziland, Australia, New Zealand and Europe as reported in Pocket Guide to Agriculture (2011/2012). The livestock department is the largest and main contributor in the agricultural sector. Baleta and Pegram (2014) state that "the South African dairy industry is important to the job market because it is actively involved in making sure job creation is established and job security guaranteed which makes the industry work with over four thousand dairy producers employing sixty thousand farm workers and providing forty thousand people with indirect jobs within the value chain such as in processing of milk".

Agriculture as a contributing percentage of Gross Domestic Product (GDP) has decreased over past four decades, but currently, it is contributing about 2 percent to the economy of South Africa, this implies that the economy is maturing, moving towards the secondary and tertiary sectors and farming remains vitally important to the economy with 638, 000 people formally employed although it is estimated that around 8.5 million people are directly or indirectly dependent on agriculture for their employment and income (South-Africa.info, 2012). Cervantes-Godoy and Dewbre (2010) "stated that the payoff from investments in agricultural research, development, extension, and education comes in the form of a sustained increase in agricultural productivity". The study contributed to the knowledge that the Nguni cattle farmers already had through the extension and advisory services that were rendered. It was expected that

the data would be contributory to the improvement and development of the Nguni cattle Development Project in the North-West Province.

Clearly, on the broader level, the need for more studies to provide empirical evidence for informed policy intervention in agriculture and in livestock farming is imperative. It also showed the attitude of Nguni cattle project participants towards the project. Despite all these attempts and studies, agricultural extension plays a key and an integral part in improving the lives of the farmers participating in the Nguni Development cattle project, and at the same time re-introduce and improve the Nguni cattle breed, which in the colonial period has been replaced by exotic breeds. This study will therefore be a valuable tool to assess the extension and advisory services rendered to the beneficiaries of Nguni cattle development programme in the North-West Province.

The findings of the study will sought to add to the empowerment of farmers through understanding of their training needs and to increase the capabilities of smallholder farmers and farmer groups to make right choices, influence collective decisions towards desired outcomes in training and participate in the project thereby increasing their financial capacity, influence improvement of the poor livelihood. Farmers' knowledge and empowerment enable them understand the causes of their own agricultural problems and to articulate their technology, extension and development needs as informed demands. Knowledge empowerment allows farmers to actively participate in the planning, implementation and evaluation services boasting production in the process.

1.9 Outline of the study

Chapter one deals with background information on livestock farming. It provided the significance of the study together with the research questions, objectives of the study. Chapter two presents literature review that identified issues related to the factors or constraints affecting livestock farming at both global and local levels. The overall concept of the reviewed literature was to guide to the data analysis, discussion, conclusion and the recommendation. Chapter three deals with the study area that also included a detailed discussion and explanation of the method(s) used for data collection and analysis. Chapter four presents the results and discussion. Chapter five concludes the study, gives the summary, conclusion, and recommendations based on the findings and result of the study.

1.10 Chapter Summary

This chapter introduced the study and explained agriculture in depth as an important aspect of any given economy. Agriculture is one of the economic sectors that contribute to the growth of the economy of any given nation or country as well as playing tremendous roles in the nation's

economic development. Such roles include the provision of food for the ever-increasing population, provision of raw materials for industries, the creation of employment opportunities, serving as a source of foreign exchange earnings among others (Adams, Nelson, and Todd, 1992). For any country to produce and provide food for its citizens, the need to supplement and provide proper agricultural sector is very important. Agriculture is said to contain a provision of raw materials for industries to work with, provision of job opportunities for able-bodied men and women and foreign exchange earnings for a country at large (Agholar and Obi 2013). Agholar, Monde, Obi and Odeyemi (2012) stated that the use of agricultural sector and extension education in reducing poverty in South Africa are important given the large resources available in the sector. The provision of extension and advisory services would definitely increase agricultural production. Provision of education and training, as well as health-care infrastructures in the rural areas, would reduce rural poverty and inequality depending on the provision of the basics that are needed for development.

According to Oladele, Koyoma and Sakagama (2004), agricultural extension and advisory services have been changing over the past few decades. These changes are attributed to many factors that include policy and political changes and recently the introduction and participation of the non-governmental organizations (NGOs) in farmer support services. Weaknesses in extension and advisory services such as poor funding, lack of technological expertise and infrastructure have been recorded as some of the barriers for the proper impact of extension and advisory services on Agricultural Development Project (Ozor, Agwu, Chukwuone, Madukwe, and Garforth, 2007). Extension programmes and activities should be easy to access and are supposed to be readily available for the consumption of farmers but because change agents are not properly trained or available in the government-owned establishments, farmers turn to seek advice and services from private establishments. Using the survey by Eicher (2007), highlighted 6 categories of extension models in various stages of development which he said are the basic. These include:

- i. National extension model;
- ii. Commodity extension and research model;
- iii. Training and visit (T&V) extension model;
- iv. The NGO extension model;
- v. Private extension model; and
- vi. Farmer field school (FFS) model

The problem statement of the study points to the fact that the efficiency of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed and responsive to the ever-changing social, economic and political environment (Belay and Abebaw, 2004). Nevertheless, Birkhaeuser, Evenson, and Feder (1991) highlighted that it is a challenge to absolutely display and mention the effect of extension and advisory services, while the result of the effect of some major extension models has been mixed, extension has shown to be a cost-effective means of increasing economic returns for the farmers and displayed significant and positive effect on knowledge, adoption and productivity. Hence, the need to assess the effect of extension and advisory services on the beneficiaries of the Nguni cattle development programme since the implementation of the project.

The study objectives were broadly to assess extension and advisory services on Nguni development project beneficiaries in the North-West Province. The other part of the objectives focuses on the identification of the demographic characteristics of the beneficiaries, Examining the extension and advisory services benefits by the respondents as well as determining the effects of the extension and advisory services in the province.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature review and is divided into different major perspectives. The theoretical framework entails and discusses how Agricultural Extension is used to enhance the life and skill of Farmers. This is vital in providing the best service for beneficiaries and in return gets the best out of production by the farmers.

2.2 Theoretical background on agricultural extension approaches

According to Akpalu (2013), Bergevoet and van Woerkum (2006) discussed the different approaches used in agricultural extension service delivery which has been classified under four paradigms, namely transfer of technology, problem-solving, education and human development.

2.2.1 Transfer of Technology approach

The Transfer of Technology (TOT) has been described as proactively changing behavior in the form of the adoption of new technology that is externally developed, already available and tested or management practice through the provision of information, opportunity and persuasion (Coutts, 1994). This is a one-way model from science to practice (Bergevoet and van Woerkum, 2006), in which the user is the passive receiver (Coutts, 1994). Hence, knowledge is perceived as a product that flows from science to the user (Madukwe, 2006). Bergevoet and van Woerkum (2006) discussed that the TOT model has been criticized because technology is not adapted to or suitable for the specific situation that an individual farmer is confronted with. As indicated earlier, it also tends to reinforce social inequalities because it benefits producers who are better endowed than others in material, intellectual and social resources (Röling and De Jong, 1998). Finally, it ignores the knowledge, skills and farmer adaptive abilities. Despite all these criticisms, TOT is still a commonly used extension paradigm (Coutts, 1994).

2.2.2 Problem-solving approach

Problem-solving is an important part of extension work (Bergevoet and van Woerkum 2006; Madukwe, 2006). Assisting individuals in finding solutions to technological or management problems is one of the functions of extension advisory or consultancy. In farmers' practice, problem-solving is an often used format for the transfer of knowledge, with the use of their expertise which is given to farmers by individual advisers (Hogeveen, Dijkhuizen and Sol, 1992), or a group of advisers. These two different groups have different roles to play in this context, in which case the consultants have specific specialist knowledge, whereas the farmers

need to be competent in deciding on the type of expertise they require, to provide a basis for the consultant's advice (Bergevoet and Van Woerkum, 2006; Hogeveen, Dijkhuizen and Sol, 1992).

2.2.3 Learning and adult education approach

Learning in study groups is a means of proactive informal education that seeks to help individuals to better understand their situation (Coutts, 1994; Madukwe, 2006). To be able to gain insight into the learning process that takes place, adult learning theories may help. Consequently, learning cycles and styles have been used to describe the study group learning process. However, while being used as a conceptual framework in adult learning, the technique of learning cycles and styles has not really been used in agriculture. The learning cycles include concrete experience; observation and reflection; the formation of abstract concepts and generalizations and, hypothesis for future testing, which leads to new experiences, thus closing the cycle. The learning process has been observed as a continuously recurring process which is governed by one's needs and goals. The approach is indicative of the fact that individuals develop their own learning cycles. Four learning styles, namely, divergent learning, assimilation, convergent and accommodative learning have been identified as associated with the different stages of the learning cycle (Kolb, 1984).

2.2.4 Human development approach

In human development, extension is a means to the facilitation and stimulation of individuals or groups to take the initiative in the definition of problems and in the seeking of solutions to individual and societal concerns including opportunities (Coutts, 1994; Madukwe, 2006). This extension paradigm consists of participatory approaches that are based on participation, adult and action learning principles. The participatory approach is adopted because of the increasing complexity of agricultural and environmental problems, the uncertainty associated with recommendations, and a need for local learning communities. These approaches have merits including ensuring the recognition of local ways of knowing, and draws on accumulated knowledge and experience on the farm; supports local innovation and adaptation; involves stakeholders in research that has a financial and/or social impact on the farming community; acknowledges the value of sharing information and ideas among farmers; encourages producer ownership both of problems and solutions; makes use of the group processes for learning. However, these approaches have been criticized since farmers may not recognize problems because they may be new to them (for example, environmental problems), in which case non-participatory approaches may be added; there may be the prevalence of a tyranny of situations that may cause possible rejection of ideas; further the dissemination of knowledge developed in groups may be limited to the group itself.

Furthermore, the framework on extension and advisory services discusses how agricultural extension programme is used to enhance farmer's knowledge and skills, as well as promote and expand improved technologies which affect farm productivity among livestock holders. It is a general fact that agricultural extension and advisory services play an important role in agricultural development and contribute to improving the welfare of farmers and other people living in rural areas. In spite of this, there are many factors that condition the relationship between extension inputs and outcomes, and these factors act in complex ways (Elias, Nohmi, Yasunobu and Ishida, 2013).

According to Anderson and Feder (2003), improvement in productivity is only possible when there is a gap between actual and envisaged potential productivity. They further suggested two types of 'gaps' that contribute to the productivity differential, "the technology gap and the management gap". Feder, Murgai, and Quizon, (2004) stated that the reduction of the productivity differential by increasing the speed of technology transfer and by increasing farmers' knowledge and assisting them in improving farm management practices can be achieved through extension. The importance of extension and advisory services as a strategic function was highlighted as integral to successful land reform. The inception phase of the policy comprises comparative research based on situational analyses, global extension models and practices (Rayi, 2014). The policy's widespread consultation was particularly emphasized. The key problem areas identified were a poor connection and linkage between research, extension and producers. There was a low extension practitioner to producer ratio. The current numbers failed to meet the standard of 450 farmers to one practitioner as the situation was that one practitioner would service between 800 to 1000 farmers. Disintegrated and thus uncoordinated efforts were experienced from different extension support agencies. Rayi (2014) further stated that there was a lack of a national policy regulatory framework that would provide formal guidelines, working standards and governing code of ethics for extension. Thus, practices were disparate, lacking uniformity and consistency. Limitations were faced with the extension education system and narrow service focus. As the policy was a response to the identified problem areas, its purpose served to deliver and maintain a pluralistic, harmonized and coordinated extension and advisory services that operate on a common set of principles and values. As there were various role players in the value chain, the policy was to ensure that the extension service responded to the needs, aspirations, opportunities and other circumstances of the many actors in the respective value chains. The policy strove to recognize the overall

livelihood context within which extension and advisory services operated and committed to the support of producers on a wider livelihood system and sustainable development initiatives.

The food department of a nation otherwise the agricultural sector acts as a gap to development for rural communities. Due to its contribution which is usually alleviating poverty; hence, a greater urge for extension and advisory service operated by the government in collaboration with the important key-acts is to be established and implemented. Ten years down, agricultural services in South-Africa have passed through a phase of basic change from a dual service to a single consolidated delivery system, particularly putting more focus on the needs of both the disadvantaged small-scale farmers and the large-scale farmers. In the agricultural sector, this process led to the development of a paper on agriculture by Nduli (1995) that enveloped the strategic transformation imperatives through Broadening Access to Agriculture Thrust.

The objectives of Broadening Access to Agriculture Thrust (BATAT) that Nduli (1995) stated was to create structures for broadening access to agriculture for previously unmerited individuals in terms of what they need for their finances, humanity development, technological advancement, delivery systems and marketing. It is seen to this day that BATAT still carries on to be the agricultural sector's guiding aspect which is the basis for a vision that says "equitable access and participation in a globally competitive sector that contributes to community development, income generation, employment creation, food security and a better life for all in a sustainable manner". The need for a total re-adjustment and fine-tuning of agricultural extension services was made imperative through the realization by broadening access to agriculture with the emphasis that the delivery system is the key to the transformation of the small-scale not so opportune or advantaged sector of agriculture and appropriate communication of new ideas must be passed on time and regularly to farmers. The current form of extension services as raised a serious concern because of its efficiency and relevancy which has also prompted the government to want to broaden its policy about extension services to review and reform it urgently in terms of its effectiveness, structure, relevancy, content, and focus.

The total nine provinces in the country have been given the motive to strengthen their extension services respectively but challenges and pressures on their ability to provide successful extension and advisory services to farming communities are currently being experienced which significantly affected the goal to be achieved. The Department of Agriculture, Fishery and Forestry since ventured on a hunt for a proper befitting model of extension for South African conditions through an accredited and empowered study, with financial assistance from the Dutch Government. Unfortunately, the study carried out was unable to recommend a specific extension model but found out important principles that are basics to form the framework for extension approaches. The study committed key participants in extension services from each nine provinces and various inputs reflecting constraints to, and success in the provision of services was weighed. A different avenue to extension was evaluated.

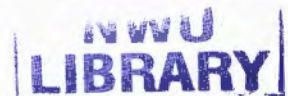
It was advocated by the Department of Agriculture (2005) that a Participatory Programme Extension Approach (PPEA) for which five programmes are suggested be commenced. They include: "(i) Extension planning and projects, (ii) Extension linkage and coordination, (iii) Knowledge and support, (iv) Education and training, and (v) Monitoring and evaluation". These recommendations are enveloped into the measures and regulation. The development of measures and regulation has become something of prime concern for the Department of Agriculture since a handful amount of challenges with regard to the distribution of extension and advisory services need to be addressed urgently to enhance and stabilize the required speed of rural development. The lack of a national guideline for extension and advisory services creates unnecessary confusion with regard to the roles and responsibilities of different stakeholders in service delivery. Thus, it is a matter of urgency to create minimum measures and regulations for efficient extension and advisory service delivery within the provinces of South Africa. The result envisaged and intended is to create measures and regulations to guide and protect the sector in the provision and rendering of services, particularly extension and advisory services based on the policies and goals of the government, as well as the needs of the stakeholders with due consideration of the present government structures in the departments. The lack of recognition in this context of a handful quantity of services delivered by a range of subject specialists that includes veterinary, health technicians, agribusiness advisors, consultants, non-governmental organizations, all of which provide important and critical services to farmers provides a reason for inclusion in the approach.

It is, however, important to differentiate between extension and advisory services. There is no single definition to explain what extension is; but the definition that is commonly used refers extension to a systematic process of working with farmers or communities to help them acquire relevant useful knowledge with skills to increase farm productivity, (Department of Agriculture, 2005). Swanson (2008) discussed that the aim of setting measures and regulations is to contribute to the success of the vision of a prosperous sector by empowering clients to possess the potent skills and technical know-how for productive farming through extension and advisory systems. The measures and regulations will also help to attain the department's mission through:

- The improved access to agricultural support services which will create an enabling environment for improved agricultural productivity;
- Empowering farmers with skills and knowledge to help them sustain their resource management;
- Promotion of access to the new and improved technologies and awareness thereof; and
- Enhancement of communication channels with farmers and farmer organizations, mentors and advisors.

The main aim of setting measures and regulations as compiled by the Department of Agriculture (2005) is to transform the extension and advisory services in South Africa. The specific aims are to: improve the efficiency of publicly funded agricultural extension/advisory services, encourage a participatory approach to agricultural extension and advisory services. To accomplish the stated specific objectives above, extension and advisory services should go through the following specifics:

- Encourage access to extension and advisory services that lead to substantial income generation;
- Present, promote accessibility to information needed for improved planning and decision making;
- Promote and encourage technology where possible and provide such when needed;
- Present and promote access to advise on sustainable agricultural production;



- Present and promote skills development in agriculture; and
- Strengthen institutional partnerships, for the effective delivery of extension services.

Rivera and Kalim (2003) stated that "public sector commitment and dedication is essential to promote agricultural extension and communication for rural development and food security". They further stated three main recommendations that are put forward to governments: (i) to develop a well conceived policy agenda for agricultural extension and communication for rural development; (ii) to adopt a diversified and pluralistic national strategy to promote agricultural extension and communication for rural development; and (iii) to build a platform for communication and collaboration with the relevant institutions that comprise the diversity of multi-sectoral agricultural extension service providers that exist in most countries. The purpose of these recommendations is to advance the livelihoods and standard of living, i.e. food security and income generation, of poor people in rural areas. Rivera and Kalim (2003) further stated that "with emphasis on models and approaches to agricultural extension, both top-down and bottom-up systems are effective and efficient, depending on the expected and anticipated result". After all, private company advisory systems utilize top-down technology transfer methods.

2.3 Extension as a function and development concept

Although as a developmental concept extension is in wide use especially within the agricultural and rural development sectors, extension service has been and meant different things to different people. Other authors such as Moris (1991), defines extension "as the mechanism for information and technology delivery to farmers". This conceptualization of the extension service has been the basis for the Transfer of Technology (TOT) and extension model (Terblanché, 2008). Zwane (2012) explained that extension has three different dimensions which he presented as firstly, extension in terms of agricultural performance which means it is only viewed in terms of improving production and profitability among farmers. Secondly, he equated extension to rural community development in which extension is viewed as working to advance rural communities through improvement of their agricultural development tasks. Finally, he equates extension to comprehensive non-formal community education which is viewed as a provider of non-formal agriculturally related education in a community. He further highlighted that one of the common definition used to explain extension can simply be that extension is a service or system which assists farmers through education in improving farming methods and techniques as well as production. Ultimately it will better their standard of living uplifting the social,

educational and the economic level of rural life. A more comprehensive definition of extension service is given by the World Bank as a 'process that helps farmers become aware of improved technologies and adopt them in order to improve their efficiency, income, and welfare' (Purcell and Anderson, 1997, 55).

According to Gebremedhin, Hoekstra and Tegegne (2006), they defined extension broadly as a process to include facilitation of linkages of farmers with other institutional support services such as input supply, credit and agricultural produce marketing. Sygenta (2016) stated extension as "a function of providing need- and demand-based knowledge in agronomic techniques and skills to rural communities in a systematic, participatory manner, with the objective of improving their production, income, and by implication quality of life". Extension can, therefore, be essentially an education and its aim is to bring about positive behavioural changes among farmers. Therefore, extension service is defined in this study as a service of information, knowledge and skill development to enhance adoption of new and improved agricultural technologies and facilitation of linkages with other institutional support services (input) supply, output marketing, and credit that farmers can benefit from.

At the same time, extension could be viewed as a political instrument or an organizational instrument utilized to facilitate development. Rivera and Qamar (2003); Chikaire, Nnadi, Nwakwasi and Ejiogu-Okereke (2011) mentioned that extension purposes may differ, from technology transfer by companies organized around specific, usually mono-cropping farm systems to problem-solving educational approaches to participatory programmes aimed at alleviating poverty and advancing community involvement in the process of development. In its introduction, extension is multi-disciplinary. Rivera and Qamar (2003); Chikaire *et al.* (2011) further discussed that extension combines educational methodologies, communication and group techniques in promoting agricultural and rural development. It includes technology transfer, facilitation, and advisory services as well as information services and adult education.

Rivera and Qamar (2003) discussed further that extension is dependent for success on other agricultural development processes such as marketing and credit services, not to mention economic policy and physical infrastructure. In short, it is a function that is dependent for success on other factors, including other services and institutions. Rivera, Kalim, and Crowder, (2001) indicated that agricultural extension operates within a broader knowledge system that includes research and agricultural education. This larger system is referred to by Food Agriculture Organisation (FAO, 2000) and the World Bank as AKIS/RD 19 (Agricultural Knowledge) and (Information Systems for Rural Development). The OECD (Organization of Economic Co-operation Development) countries refer to it simply as the Agricultural

Knowledge System (AKS) whilst others describe the three pillars of this system Research, Extension, and Agricultural higher education – as the agricultural knowledge triangle and suggest that since the three pillars involve complementary investments they should be planned and sequenced as a system rather than as separate entities (Eicher, 2001).

Furthermore, Eicher (2001) stated that linking the triangle's institutions with their common clientele, namely the farmers, and with each other, also requires systematic planning. Rivera and Kalim, (2003) highlighted that extension is a non-formal educational function that applies to any institution that disseminates information and advice with the intention of promoting knowledge, attitudes, skills and aspirations, although the term "extension" tends to be associated with agriculture and rural development. As a result, it is known that no matter what approach (for example, cooperative extension, advisory services, special programme for food security, technical assistance or technology transfer) may be, the function remains that of extension: the transfer and exchange of practical information, extension is a political and organizational instrument utilized to facilitate development.

It was Further noted by Rivera and Kalim (2003) that most Departments of Agriculture have an extension unit that deals mainly with crops and mixed agricultural systems, as well as separate technical divisions (livestock, forestry, fisheries, and so on) some of which also provide extension services, during the 1970s and 80s, efforts were made to unify ministerial agricultural extension operations but with limited success. Anderson and Feder (2003) discussed that despite the difficulty of isolating its impact on agricultural productivity and growth from that of other factors, many studies have demonstrated the high economic returns of investments in agricultural information and agricultural extension dissemination. Investment in agricultural research and extension is thus a crucial input for agricultural growth.

Gallagher, (2002), states that "agricultural extension services in developing countries are currently grossly under-funded to undertake the activities required for achieving food security while protecting the productive resource base in order to keep up with population and economic growth". Report by the Department of Agriculture (2008), shows that agricultural extension and advisory services are wonderful occupations that regularly change in response to changing environment, clientele needs or requirements. Extension and advisory services, therefore, requires personnel of trained, dedicated staff skilled in production, with inter-relation techniques. It is the farmers that make the production happen not technological intervention then productivity can be said to happen right after. Collett and Gale (2009) highlighted that the provision of efficient training through development programmes are a long-term interest in the

extension and advisory service. The training needs of every extension agent must be examined and in-service training established accordingly.

Figure 2 illustrates that, optimally, Agricultural Information Systems (AIS) for rural development should connect people and organizations to promote learning to generate, share and use agriculture-related technology, knowledge, and information to the best advantage. According to the AKIS/RD *Strategic vision and guiding principles* (FAO/World Bank, 2000), the system integrates farmers, agricultural educators, researchers and extensionists, enabling them to harness knowledge and information from various sources to improve farming and livelihoods. It was further discussed according to Department of Agriculture, Forestry, and Fisheries, 2008/9-2010/11, that when extension as a function in agricultural development is systematically and effectively provided; the extension is known to enhance social and economic development. According to the World Bank report (2003a, 2003c), technological change and the knowledge system that underpins it is a critical factor in development and growth. Birkhaeuser, Evenson and Feder (1988); as cited by Anderson and Feder, (2003) all stated that in "spite of the difficulty of isolating its impact on agricultural productivity and growth from that of other factors, studies have demonstrated the high economic returns of investments in agricultural research and dissemination, with returns typically above 40 percent".

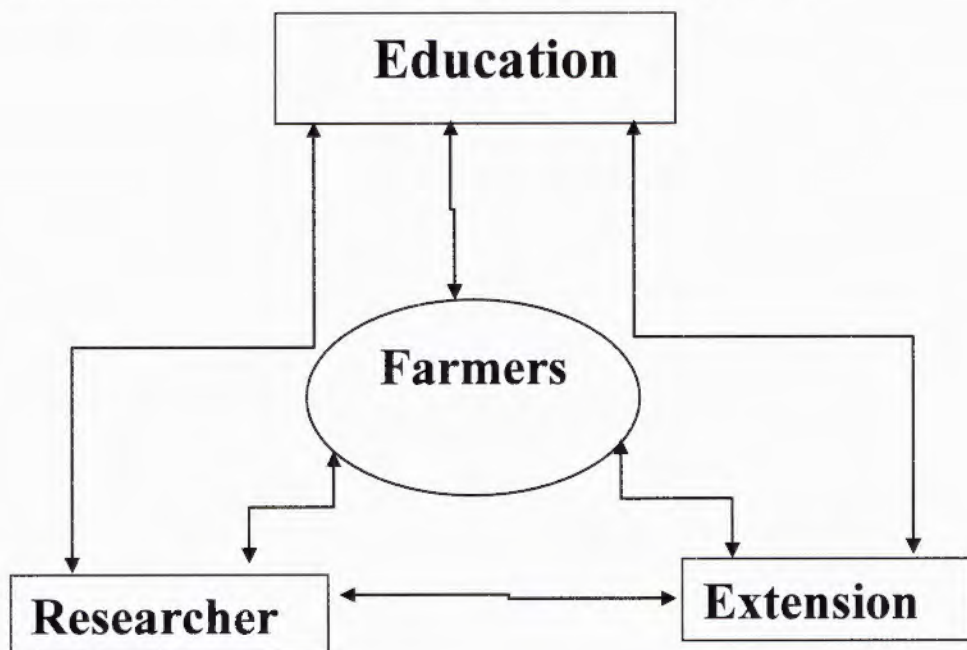


Figure 2: Agricultural extension as part of Agricultural knowledge system/Agricultural knowledge information system (AKS/AKIS)

Source: Department of Agriculture, Forestry and Fisheries (2008/9-2010/11)

Recognizing the central role that extension services can play in the agricultural development and agrarian transformation efforts in South Africa, the South African governments' Department of Agriculture, Forestry and Fisheries (DAFF) launched the Extension Recovery Plan (ERP). Thus, Rivera and Qamar (2003) stated the role of government again became recognized as critical for the reconstruction of agricultural extension, especially for fostering the public good. Furthermore, it became acknowledged that only the public sector can effectively and efficiently carry out certain functions and indeed, only national governments can assume the responsibilities that affect the state as a whole. Rivera and Zijp, (2002) highlighted that only governments, could ensure that extension services work for the public good, even if those services are provided by contracting with private sector providers. An acknowledgement was also made which was also stated by Rivera and Qamar (2003) that "only national governments can promote increased institutional pluralism in extension service provision and oversee the quality enhancement and assurance necessary for rural development".

Serageldin (1996) succinctly put it, it became recognized that "strong, effective, and efficient governments are essential to development, for they alone can create the enabling environment required for the private sector and civil society to flourish". However, in spite of this renewed commitment to public funding and support for extension services, a number of challenges still exist. Gebremedhin, Hoekstra and Tegegne (2006) argued that "globally, a number of generic problems still confronts extension service including problems related to coverage; complexities involved in the service; effect of wider agricultural development policy environment for success; the critical role of other institutional support services such as input supply, credit and agricultural marketing; lack of political support and commitment; inadequate public funding; and insufficient appropriate and relevant technologies".

2.4 Livestock and the Environment

A recent report published by the Food and Agriculture Organization of the United Nations (2006) indicates that livestock generates and contributes to the environment about (18%) greenhouse gas emission (CO₂) equivalent more than the transport system. Remedies are urgently needed in order to rectify the impact which the livestock contributes to the pollution of the environment (Land and water degradation). FAO (2006) highlighted that with increased prosperity in the livestock sector, this has led to people consuming more meat and dairy products every year which has projected the production of global meat from 229 million tons in 1999/2001 to 465 million tons in 2050, while milk output is set to climb from 580 million tons to 1043 million tons. The impact of the livestock sector to the economy is growing faster than any other agricultural sub-sector. Livestock farming provides a source of livelihoods for about 1.3

billion people and contributes about 40 percent to global agricultural output. Livestock is also a source of renewable energy for draft and essential source of organic fertilizer for many poor farmers in developing countries for their crops. Livestock generally has made use of about 30 percent of the land's entire land surface, mostly permanent pasture but also including 33 percent of the global arable land use to producing feed for livestock. FAO (2006) also stated that livestock farming has led to much deforestation especially in Latin America where, for example, some 70 percent of former forests in the Amazon have been turned into grazing.

According to FAO (1994) different studies have for a long time shown that livestock business is among the most demanding sectors of the earth's increasing scarce water resources, contributing among other things to water pollution. Animal wastes, antibiotics, and hormones, chemicals from tanneries, fertilizer and the pesticides used to spray feed crops mostly contributes to water pollution when they go grazing and drinking. Livestock provides the power to cultivate at least 320 million hectares of land. This would otherwise have to be cultivated by hand tools resulting in harsh drudgery, especially for women. Livestock provides the plant nutrients for large areas of cropland through manures valued in millions of dollars per year (Jansen and De wit, 1996). Sethuraman and Naidu (2008) indicated that livestock is an important asset for investment and insurance for hundreds of millions of rural poor in situations where banks are often too remote and the banking systems too unreliable for safeguarding any savings a smallholder might accumulate.

Walsh (2013) striking statistics which underscores how much production varies from region to region according to the researchers from the Livestock Research Institute in Kenya (LRI), the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia and the International Institute for Applied Systems Analysis (IIASA) in Austria on the assessment of livestock industries around the world showed that:

- i. Each year the livestock sector globally produces 586 million tons of milk, 91 million tons of pork, 59 million tons of cattle and buffalo meat and 11 million tons of meat from sheep and goats.
- ii. The majority of the 95 million tons of beef produced in the world in 2000 came from Latin America, Europe, and North America. Sadly only 3 million tons of beef was produced in all the whole Sub-Saharan Africa which is nearly three times as many people in the entire United States.
- iii. 1.3 billion tons of grains are consumed by farm animals each year, and all the livestock in Sub-Saharan Africa eat just 50 million tons of grain a year otherwise substituting on grasses and crop residue.

- iv. Poor feeding quality in regions of the Sub-Saharan Africa means that a cow may consume as much as 10 times more grasses to produce a kilogram of protein than a cow raised in richer regions.
- v. Poor feed quality in arid countries and high mortality rates in herds of often undernourished and sick animals means that a cow consumes about 500 kg to 2000 kg of dry matter/grass to produce a kg of protein and while a cow in North America or Europe will consume just about 75 kg to 300 kg of dry matter/grass to produce a kg of protein.
- vi. 75% of the global greenhouse gas comes from emissions from cattle

The environmental impact of meat production varies on a wide variety of agricultural practices employed around the world. Some of the effects highlighted in the environment have been associated with meat production through fossil fuel usage, water, and land consumption. Meat is obtained through a variety of methods that includes: organic farming, free-range farming, intensive livestock production, and subsistence agriculture, hunting and fishing (Sunday Standard Reporter, 2015). Despite all the environmental impact of the livestock, it has been shown that the importance of the livestock to the economy is a major global player. It employs 1.3 billion people and creates livelihoods for one billion of the world's poor, it accounts for 40% of Agricultural GDP, livestock provides one-third of humanity's protein intake, growing populations and incomes as increased the demand for livestock products (Steinfeld, Gerber, Wassenaar, Castel, Rosales and de-Haan, 2006). Ogunkoya (2014) stated that in South Africa the issue of climate change according to studies has proven to be a major issue because food unsecured areas are at a risk of several crops that are important to food security and livestock feed by 2030 which would have effects on smallholder livestock farmers.

2.5 Smallholder livestock farming

Smallholder farmers can be defined as those farmers owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost on family labour. Smallholder farmers play an important role in livelihoods creation amongst the rural poor. Some of the many characteristics of smallholder farmers are simple, outdated technologies, low returns and women playing a vital role in production (Department of Agriculture, Forestry, and Fisheries, 2012). There is, therefore, a need to significantly increase the productivity of smallholder farmers to ensure food security because smallholder production is important to sustain household food security in which the productivity in this sector is still relatively low.

Poor yields may be a part of the reasons why smallholder farmers are losing the interest in agricultural production.

Ntshepe (2011) further stated that a "smallholder livestock farmer in South Africa is in a difficult position not only grappling with a changing global environment but at the local front without access to domestic markets". Also, "the lack of marketing information limits adequate access to livestock markets by smallholder farmers due to the very limited knowledge of buyer requirements originating". Statistics released by the North-West Department of Agriculture (2003) shows that an estimated 1.816 million herd does exist in the North-West Province which is approximately 12 percent of the herd in the country. Also, approximately 30 percent of this herd is owned by the smallholder farmers with a take-off rate estimated to be between 5-8 percent and which is extremely low.

Since every developing country has its own share and percentages of the smallholder family farmers, it is important that livestock development benefits poor rural families. According to Pathak (2014) smallholder farmers especially the women farmers stated that livestock means a lot of things to them, livestock help women earn a regular income, i.e. livestock can act like personal ATM (Automated Teller Machine), on which women can draw upon when they need money. Livestock is richly endowed with lots of nutrients that nourish their families with rich protein food and with manure to fertilize vegetable plots. In summary, some remedies like access to resources for the animals, such as pastures and water which are jointly owned by the community has called on the importance of developing community resources and enable access to all.

Table 1: The benefits and products obtained from livestock adapted from Munyai, (2012)

BENEFITS	PRODUCTS
Food	Milk, meat, eggs, fish, honey, processed products
Clothing	Wool, hides, skin, leather
Work	Draught power cultivation, transport of goods and people, threshing, milking, pumping water
Monetary	Capital wealth, Investment, and savings, income from hiring work animals, sale of products and animals
Social	Lobola (bride-price), ceremonial, Companionship, recreational, status
Manure	Fertilizer (soil amelioration), fuel, flooring
Other benefits	Feathers, bone meal, soap production

2.6 Constraints faced by smallholder farmers

According to the Department of Agriculture, Forestry, and Fisheries (2012) some of the constraints faced by the smallholder farmers relate to the lack of land, poor physical and institutional infrastructures. Most farmers are located in rural areas where lack of infrastructures limits their expansion in production. Lack of proper road, the market for agricultural resources (input and output) is often missing and unreliable for smallholder farmers. High transaction cost is also a major issue contributing to the problems smallholder farmers are facing, Lack of reliable markets has also been found to be one of the main constraints faced by smallholder farmers i.e. many of these farmers receives low offers or prices for their products by selling them in their local markets. Lack of human capital has also been found to be another major constraint. An increase in the growth of the smallholder farmers cannot be achieved without access to support services which include co-operative societies or farmer groups, extension service rendition, the creation of long-term food security, job opportunities and income (Department of Agriculture, Forestry, and Fisheries, 2012).

2.7 Veld management in cattle production

Dekker (2012) defined veld management as the planned utilization and conservation of the natural vegetation for the mutual benefit of plant and animals. Van Pletzen (2009) stated that historically, beef cattle farming in South Africa developed on the veld. He further added that veld was the only food source for beef cattle. Veld management either deteriorates or improves the veld. Van Pletzen (2009) added that veld in a good condition with a basal coverage of 8.3% was compared to reasonable veld with 6.4% basal coverage and poor veld of 2.9% basal coverage. The dominant species on good veld are *T. triandra* (Rooigrass) and *D. eriantha* (Finger grass), on a reasonable veld there are *E. chloromelas* (Curly leaf), *E. Lehmanniana* (Lehmann's love grass) and *S. fimbriatus* (Bushveld drop-seed) and for a poor veld we have *A. congesta* (Tassel three-own) and *T. koeleriodes* (Common carrot-seed grass).

The nutritional value of pastures thus differs as drastically as their environments and it is obvious that there is no recipe to correct the nutritional deficiencies and imbalances in all types of pasture. Natural grazing lands constitute the main feed resources for domestic livestock in South Africa, especially beef cattle. Farmers need to understand the veld in conjunction with their livestock for optimum beef production and retaining the stability of the veld. They also need to understand the growth of plants as well as the factors that affect plant growth that is, climate (temperature, light, and water), soil type, soil fertility, the effect the animals have on grazing and also the influence of fire. In South Africa, the season of growth is expressed as sweet, mixed and sour-veld. Sweet-veld is veld which remains palatable and nutritious when matured (Van Pletzen, 2009).

Sour-veld provides palatable material only in the growing season. Mixed-veld is intermediate between these two extremes and varies from sweet-mixed (9-11 months grazing per year) to sour-mixed (6-8 months per year). A good veld should be productive and palatable in order to sustain maximum animal production and ensure economic benefits in the short terms, and it should be stable and prevent soil erosion to sustain long-term sustainable production.

Dekker (2012) further highlighted some proper guidelines for a grazing management program. These include:

- i. Knowing the various species of grasses and their value as grazing plants
- ii. Accepting that not all grasses are valuable grazing species meaning the source of nutrition should be palatable perennial grasses
- iii. Planning your farm and create camps according to the veld types
- iv. Good animal production depends on only when animals have access to adequate supply of nutritious palatable grasses

- v. Maintaining the correct stocking rate by adjusting animal numbers to the current veld and climatic conditions
- vi. grazing just about 60% of the grasses and leaving the rest for photosynthesis and the recuperation of the plant
- vii. resting veld occasionally during the growing season for the formation of resources, seed production and the establishment of seedlings
- viii. Keeping records of the numbers of animals and the number of days that a camp is utilized in order to be able to calculate the carrying capacity
- ix. An abundance of perennial species and accumulation of organic material on the ground is a strong indication that the veld management program is on the right track.

2.8 Nguni cattle

The Nguni breed is a breed uniquely adapted to the South-African environment; it faced a lot of discrimination in the past by government trying to cross-breed and make a dilution of the exotic stock (Bester, Matjuda, Rust and Fourie, 2001). A realization arose when its adaptive traits led to its evaluation and development as a beef breed in both intensive and extensive farming systems, hence the birth of a programme that will uphold this goal. This required infrastructure and support systems to re-introduce the low maintenance Nguni breed in different and selected communities. Furthermore, Bester *et al.* (2001) mentioned that projects like these to re-introduce exotic breeds to communities have failed in the past and these projects included: support systems, programmes for the improvement of management, a development programme and a marketing system to facilitate the sale of animals at market-related prices. The Nguni breed was able to enter the growing commercial sector, and extensive recording facilitated breed improvement in the twentieth century as a result of a unique structure developed in South Africa as a country, thus, the breed was improved in the commercial sector and also it was being eroded in the rural areas, hence, and fortunately, the survival trait of the breed allowed it still be found in limited numbers in rural communities (Bester *et al.*, 2001).

2.9 The Nguni breed description

According to Bester *et al.* (2001), "it is small to medium in size depending on the prevailing nutritional conditions; the depth is good and is accompanied by a moderate width. Mature cows have fairly short legs with good feet. The dewlap is medium-sized and thin. The cervicothoracic hump is hardly noticeable in the mature cow but is fairly well developed in the full-grown bull. The barrel of the Nguni cattle is of good length and strength, the rump is inclined to droop

towards the tail and the rear quarter is light. The head is of good size with a flattish poll. It has a broad dished forehead, widest between the eyes. The face is wide and straight to slightly convex in profile. The muzzle is broad and the ears have a refined look, being small with a sharp apex. The horns are usually round are noticeably lyre-shaped in mature cows. Coats are soft, fine and glossy with the udder and teats small to moderate".

In summary, the Nguni cattle has shown that it developed a process of natural selection in a highly challenging environment and that it has the genetic potential to perform better under optimal production environments. It is also a medium-frame animal with a measure of tick tolerance and disease resistance.

2.10 Nguni cattle development project

The goal of the project is the re-introduction of the indigenous breed to the rural farming areas of the province through the upgrading of non-descript cattle to Nguni status. The objectives of the project are to empower and ensure upliftment of the emerging livestock farmers to become more commercial Nguni cattle producers. It is furthermore aimed at transferring skills and capacities necessary for the establishment of black commercial livestock farmers and lastly importantly to create jobs for the rural poor. The project envisages training beneficiaries in financial management, computer literacy, infrastructure maintenance, value adding and processing. Nguni cattle development project is participatory between three organizations which, include: the North-West Department of Agriculture and Rural Development, the Industrial Development Corporation (IDC) and the North-West University (Mafikeng campus), which aims to re-introduce the indigenous Nguni cattle to the mainstream of the livestock Industry (SA News, 2013). The commercial farmers play a major role in economic growth, job creation, food security and the transformation of the industry.

A grant of about R 45 million for the implementation of the Nguni cattle project which involves the establishment of nucleus registered Nguni herds in communal villages over a period of five years was originally approved by the IDC. The project has brought together traditional farmers in the breeding and conservation of indigenous livestock (IDC, 2007). The success of this project depends largely on the provision of extension services, training of livestock managers and project management. This is very important in order to ensure that pure-breed Nguni retains its genetic value. Nguni cattle development was launched together in the North-West and Limpopo provinces in February 2006. Certain assumptions were made among which are that the animals produced will be of market quality and that there is sufficient resources on ground to maintain production that will lead to improved meat supplies on the market. However, some problems

encountered included the lack of qualified extension staffs to monitor the project, minimal infrastructures within communal lands, lack of record keeping and finally rights to possession or the right of right to use i.e. land tenure systems.

The introduction of the Nguni cattle especially the bull to the rural areas of South Africa has been an effort by the Department of Agriculture and the University Of Fort Hare in collaboration with some non-governmental organization (Mapiye, Chimonyo, Muchenje, Dzama, Marufu and Raats, 2007). The bull introduction to communities is well expected to facilitate and develop livestock production, community institutions, and opportunities in rural areas (Bester, Matjuda, Rust and Fourie, 2003). In order to improve the introduction of the cattle to rural areas, there is still a need to develop sustainable models for boosting their productivity, improve the productivity of communal areas, and assess the performance of the existing produce (Bester *et al.*, 2003). Nguni cattle development has the potential to create economic growth in rural areas, it generates job opportunities in adding value to the food processing industry, bringing agricultural products to the consumers and finally improving the standard of living of the farmers (Sikwela and Mushunje, 2013).

It is important in reducing poverty in the country as a result of the blessings of nature and the resources that are numerous and enormous that agricultural sector and extension services and advisory services must be improved and developed. Agholar (2012) showed that a major way to the development of agriculture in the livestock sector is the provision of extension services which would lead to an increase and improvement in production. Extension service seeks to alleviate poverty, improve the standard of living, and improve food security. Extension service has a main potential to reduce rural poverty and it depends on the strong development of education and training as well as health care development in most rural areas (Organization for Economic Co-operation and Development [OECD] 2006 as cited by Agholar (2012). The impact of extension and advisory service has been relatively low because the linkage between extension service and farmers over the years has been relatively weak. For the extension to have an impact it must enhance its gap with research, farmers and among extension provider i.e. the public and the private service renders (Agholar, 2012). Muchenje (2015) stated that Nguni cattle development project has also seen offshoots and collaborations emerging, specifically the South African Research Chair initiative (SARChI) in meat science, which is shared with Stellenbosch University and the Technological and Human Resources for Industry Programme (THRIP) in animal science and meat science in partnership with the Red Meat Research and Development of South Africa (RMRD-SA).

2.11 Development project

The success of a development project depends largely on the provision of extension services, training of livestock managers and project management (IDC, 2007). The main objective of the development project is to create both local and international market for organically produced Nguni beef, hides and skin, dairy and so on. Rural development, in summary, can be described and divided into different categories namely:

- i. Reducing the environmental impact of agricultural production.
- ii. Introducing programmes to improve soil and environmental fertility.
- iii. Introducing programmes to improve pest control and water management.
- iv. Introducing programmes to reduce poverty through rural development.
- v. Enhancing food security.
- vi. Providing a conducive environment for agricultural production and economic returns
- vii. Introducing programmes to sustain food security.

It is also known that not just agricultural development alone but the rural development of any country will help to reduce poverty. Reduction of poverty in South Africa, North-West Province as a case study is the implementation of the Nguni cattle development project. The success of this is said to be the strategies and plans created and new policy development which places reduction of poverty, food security and sustaining the food security amongst all the spheres of the government that is, (the national, provincial and the local governments). In order to have significant returns, the need to establish and create an enabling environment for both government and private sector involvement in agricultural development programmes is very important. Rural development will briefly be described.

2.12 Rural development

According to Anríquez and Stamoulis (2007), rural development has evolved through time as a result of changes in the perceived mechanisms and / or goals of development. According to Ministry of Rural Development and Land Reform, (2009) rural development is defined as a process whereby rural dwellers are empowered and enabled to take their own destinies and futures in their hands, thereby dealing with poverty through the management of natural resources. To obtain best results in rural development, a participatory process is best advised to be established through which rural people learn over time, through their own experiences and initiatives, how to adapt their knowledge to their changing world. Rural development can be achieved through self-help initiatives as well as through coordinated and integrated broad-based

transformation; through strategic investment in economic and social infrastructure that benefits entire rural communities and not only those involved in agriculture (MRDLR, 2009). Some of the development that are expected in rural development includes:

- i. Good roads, rails, and ports;
- ii. Provision of dipping tanks for cattle against diseases;
- iii. Provision of milking parlors for dairy cattle;
- iv. Provision of storage houses;
- v. Rural electrification;
- vi. Provision of communication networks; and
- vii. Irrigation schemes.



Rural development is also characterized by its emphasis on locally produced economic development strategies, Rural Development Research (Rowley, 1996). Rural development aims to find the ways to improve the lives of rural dwellers with the participation of the rural people themselves so as to meet the need of the area.

2.13 Evaluation of agricultural projects

Agricultural projects are schemes that are created in order to better the lives of both a local settlement or in the case of establishment of urban settlements. Agricultural Development Programmes are basically supposed to help alleviate poverty and better the socio-economic characteristics of a community. Agricultural Development Programmes are created either by the government or the private sectors or the Non-governmental organizations (NGOs). An example of the agriculture-related development programme is the Nguni cattle development programme which runs in partnership by the North-West Province together with some NGOs and the beneficiaries. According to Winters, Salazar and Maffiol (2010), agricultural projects are generally designed to improve production or the returns to agriculture and therefore, impact evaluations or agricultural projects focus on production-based indicators, such as yields, productivity, agricultural investment, technology adoption, food and home production.

The challenge is even greater when attempting to evaluate the impact of a project on different types of households, such as small holders and large holders, who quite often have very distinct production systems. Furthermore, Winters *et al.* (2010) continue by mentioning that impact evaluations often focus on examining a series of indicators in order to obtain a picture of the overall average effects of the intervention as well as the mechanism by which these effects were obtained. Presumably, agricultural projects have an impact not just on production inputs and outputs, but on how they are used and combined. Agricultural extension projects

such as the Nguni cattle development project is best or often evaluated by self-selection and usually interaction with self-formed groups of farmers.

Agricultural extension projects that often offer credits to farmers may encourage farmers to take up the offers but also not all farmers do take it up. The assessment of extension and advisory services are also best evaluated by comparing those farmers that chose to partake in the services rendered and those farmers that chose not to partake in the advisory service. Basically, farmers that choose to accept and practice the services rendered are those that partake in extension projects meaning they are the innovative and open-minded ready to put into action new technologies and ideas that are being introduced by the extension agents and the advisory service units. These farmers will definitely have higher and better yields in their outputs. "The problem is that it is hard to know how much of the yield difference is due to the project and how much the differences in farmer type, this makes any estimate of project impact biased since the estimate cannot solely be attributed to the project" (Winters *et al.*, 2010). The need to continue to evaluate development projects is very important. According to NDA (2009), "livestock sector holds the largest sector in South Africa with a population of 13.8 million cattle".

2.14 Access to extension services

Agricultural extension and rural education have been emphasized by development experts as crucial to achieving agricultural development, poverty reduction and food security (Ragasa, Berhane, Tadesse and Taffesse 2012). Ragasa *et al.*, (2012) further stated that there is a systematic and statistical gender difference in terms of access to different channels and types of extension services using both female only and male only datasets. The need for gender analysis is described as a basic role in agriculture and in the household at large, hence Jiggins, Samanta and Olawoye (2013) state that gender has proven to be an essential variable for analyzing the roles, responsibilities, constraints, opportunities, incentives, costs and benefits in agriculture.

Furthermore, the need to improve women's access to agricultural research and extension services must begin with an analysis of men's and women's participation in the agricultural production process along two related dimensions. Nambiro, Omiti and Mugunieri (2006) found that distance from towns and access to means of communications significantly influenced access to extension services, especially in rural areas. Nambiro *et al.* (2006) further stated that the closer the client is to the source of extension, the more likely he/she is to seek its services.

Many other factors have also been identified as factors that influence access to extension services. These include:

- i. income and literacy level;
- ii. the wealth status of the farmer;
- iii. non-access to media that is, access to a radio, television and so on;
- iv. the age;
- v. the gender;
- vi. the distance of settlement making extension agents spends more time in locating farms;
and
- vii. Fuel resources.

All these are some of the factors that affect access to extension. The willingness to pay for services that were maybe previously free of charge is another factor that affects the access to extension services. New innovations have further been initiated into the extension and advisory services delivery system in order to aid and produce the needed results and these include farmer groups focusing on rural resource centres, networking and marketing systems, volunteer advisory services programmes and ICT-based approaches (Mbo'o-Tchouawm *et al.*, 2014). It is very important to make use of all means of extension and advisory services in order to have a proper and good return from the farming period or farming season.

2.15 Support to agriculture through extension and advisory services

Rivera, Quamar and Van crowder (2001) highlighted that support has been proven in the agricultural sector as the medium in which innovations, new technologies, farming techniques are best introduced and preached to the communities living in the rural areas majorly because of the lack of access to information through the internet and another medium of information transfer. Extension and advisory services encourage mouth to mouth passage of information, physical demonstrations of innovations and improved methods. Extension helps in the passage of innovations from the scientist to the farmers, thereby helping farmers in taking a decision, also setting and clarifying their own goals. Agricultural extension or advisory services is an important force in the agricultural development over the centuries. Agricultural extension service basically serves as the link between the farmers and the researchers. The extension also serves as a means of training and guidance in decision-making among farmers.

Rivera *et al.*, (2001) stated that "agricultural extension also is concerned with providing information on other crucial issues such as food storage development, processing, farm management and marketing". Ultimately, if the extension department is properly given the

needed attention, then there would be the development of agriculture and livestock sector. If extension workers are well empowered, the expectation would be that each and every extension agent who benefited from this empowerment will be an expert in at least one field of technical agriculture so as to be successful in delivering outstanding services to the farmers with all its duties which are all capsulated in communication.

Communication involves sending messages with the help of the media or without the media to one or more receivers. It can, therefore, be defined as a process that initiates dialogue with farmers, communities, and beneficiaries to fully involve them in the whole farming process and planning. Hence, Mwangi (1998) stated that a good extension officer should be able to communicate, teaching farmers, convincing and influencing farmers into adopting a new innovation or an existing improved technology.

2.16 Agricultural extension challenges

For every given sector aimed at development in any country, there are challenges that come along with it. Extension is known as a bridge and gap between farmers and the researchers during transfer of information. According to Mbo'o-Tchouawm and Colverson (2014) many factors have contributed to the challenges of extension and advisory services to be rendered. These include:

- i. insufficient funds for supporting public extension;
- ii. poor resourcing;
- iii. disorganized structures resulting in poor infrastructure for attracting businesses;
- iv. limited involvement of rural farmers and
- v. Population in extension process to the lack of appropriate strategies for effective research and adequate extension methods.

Some of the challenges faced by agricultural extension include:

- i. the non-availability of accessible road that is, lack of good road network;
- ii. the distance covered by the extension agents;
- iii. non-availability of proper training centres;
- iv. the ratio of the extension workers to the number of farmers;
- v. the educational level and commitment to the programme by the extension agents;
- vi. the salary package;
- vii. non-availability of the basic amenities; and
- viii. Extension programme funding.

2.17 Extension programme

Israel, Harder and Brodeur (2011) defined an extension programme as "a comprehensive set of activities that are intended to bring about a sequence of outcomes among targeted clients". Despite different successes across the country, extension always makes conscious efforts to ensure that there is communication of information to help people form opinions and make good decisions (Taye, 2013). Extension is aimed at improving the lives of the target audience and improves the socio-economic characteristics together with the standard of living. There are stages extension programmes go through before they are adopted and accepted. These include:

- i. awareness stage i.e. when the innovation or technology is made known to the farmer
- ii. knowledge stage i.e. when the introduced technology is understood by the farmer
- iii. adoption stage i.e. when the farmer decides to accept the introduced innovation and
- iv. Practicing stage which is when the farmer finally puts to use the adopted technology

Investment in extension services is an important tool for improving agricultural productivity and increasing farmer's income (Anderson, 2007). The productivity and success of the extension programme largely depend on various natural factors such as season, agro-ecology, climate, diseases and so on which vary over time and space (Taye, 2013). Furthermore, this author stated that the impact of agricultural extension programmes could be over or underestimated if these effects are not controlled.

2.18 Training and Visit approach (T&V)

Ejembi, Omoregbee, and Ejembi, (2006), indicated that training and visit (T&V) extension has been criticized for being top-down, top-heavy, inefficient and effective. Furthermore, Ejembi *et al.* (2006) stated that the training and visit approach was basically introduced to all World Bank projects i.e. the Agricultural Development Programmes (ADPs) to decipher the problems of poor organization, dilution of efforts, inappropriateness and untimeliness of messages inherent in the conventional extension system. Mohammed, Olaleye, Umar, Ndanitsa and Jibrin (2015) stated that training and visit approach is more effective with the right technology, effective and timely delivery of messages, regular extension-farmer contact and regular training and pre-requisites for an effective agricultural development programme. Ejembi, Omoregbee, and Ejembi (2006) opined that although information diffuses much faster among farmers through interpersonal communication channels, their ability to get timely information to solve specific production problems depends on direct access to extension agents. The training and visit (T&V) model of extension organization was promoted by the World Bank

from 1975 to 1995 as a national public extension system (Anderson, 2007). Training and Visit approach encourages farmers to discuss and practice what the problem and challenge they encounter on their farms with the extension agents during visitation and also demonstration of new or improved techniques are made easier, hence it improves communication among farmers in the same farming cooperative and better production and in the course improve the aim of the Development Project.

2.19 Programmes in improving cattle management

2.19.1 Cattle rearing programme

It is a known fact that people rear cattle for different reasons, purposes and intentions. Some raise large herds to sell, others in case of dairy i.e. rearing the flock just for the purpose of selling their milk. Families today are contributing to the country's economy by raising herds for personal use, and either you decide to raise a small stock, or a large number of stock to sell, there are always steps to go about in starting up the cattle rearing. These are:

- i. making a business plan;
- ii. locate the area where you want to raise cattle for the next 10 to 30 or more years;
- iii. find a land that is up for sale after a decision on where to rear cattle has been made;
- iv. find out more about the land location you are interested in;
- v. research then purchase the type of facilities, equipment, and machinery necessary for the type of cattle you have chosen to raise;
- vi. determine the type of cattle you want to raise according to your budget and goals;
- vii. research the various breeds that you can or wish to raise;
- viii. start off with a handful cows;
- ix. determine the amount of pasture that will be required for the breed of cattle that you have selected; and
- x. Start keeping good records of finances, breeding/calving, health/vaccinations, purchases/sales and assets in your operation.

According to Wikihow (2015), some more tips on how to rear cattle to have more efficient reward from the decision are to:

- i. talk with the local vet about herd health programmes and incentives for your herd, this process needs to be carried out after the animals have been purchased;
- ii. buy more hay than what you will need;

- iii. there is no best breed to own, buy the breed you are most attracted to or you believe will give you the most in terms of profit;
- iv. buy what you need, not what you want;
- v. test your feed nutritional value i.e. know the times when your cows will be at their peak nutritional needs and when they will be at their lowest;
- vi. start off with only a few cows or heifers then build your herd from there;
- vii. try to keep your operation as low-cost as possible;
- viii. keep good records from breeding and calving to health and financial records;
- ix. avoid getting too many bulls;
- x. don't keep calves from your first calf heifers;
- xi. ask questions and have the local animal veterinarian on speed dial in case of any health concerns; and
- xii. visit local yard sales for used equipment.

Furthermore, Wikihow (2015) stated some important warnings to yield to when rearing cattle. They include:

- i. always keep your eye out for trouble when working with cows and bulls;
- ii. don't get into something you think or know you can't handle;
- iii. raising cattle can be a tough, rough, tiring job at times;
- iv. raising cattle is not a 9-5 weekday only job;
- v. avoid sick, and all-around unhealthy animals on your first purchases;
- vi. never get complacent around a bull, no matter how docile he may seem to be; and
- vii. do not spend all your money in the first two years on the newest farm equipment or the most expensive handling facilities otherwise, you may go broke sooner than you think.

2.20 Cattle vaccination programme

Vaccines are a major part and tool in cattle and herd health progress for the protection of animal health. A proper timing and selection of vaccines are very important considerations. However, it is known that vaccines do not alleviate or prevent all diseases, so it is important to have a veterinarian who understands the local and current conditions always on speed dial and stand-by. Using vaccines as part of a herd health programme is very important and taking the advice from the veterinarian for any health programme or vaccination schedule that might be in planning yet to be implemented. Animals, like humans suffer from a different range of diseases. Arguably one of the best means of preventing diseases is to provide immunity to the animals and this is usually achieved by vaccination (Noah, 2002).

Noah (2002) highlighted that vaccines stimulate the body to produce its own defence against infection that is, when an animal comes in contact with a disease, its body is ready to fight it and the animal will not fall ill and suffer and showed how vaccines work and is controlled. Vaccines administered through different methods such as through water, baits, air spray, eye inoculation, intranasal, orally or using the most classical injection. Furthermore, Noah (2002) stated that in early days, vaccination was risky but now through much development work by manufacturers, risks from vaccines have been reduced or decreased while the vaccines efficiency has been increased. The use of vaccines has brought significant levels of control against a disease that farm animals previously suffered. Research is still on-going to ensure new vaccines are made to cater for the welfare of all animals. When vaccines are available, they are effective in answering many animal problems. Cattle can be vaccinated either before calving, after calving, before weaning, after weaning or as specified by your veterinarian. Surridge (2010) stated that vaccinations can be split into 5 groups like clostridia, infertility, and abortion, feedlot, neonatal scours and pinkeye. Washington State University (2013) states that there are generally two types of vaccines, these include:

- i. The killed (inactivated) vaccines which are viruses and bacteria that are inactivated preventing them from causing harm to the animal but yet still stimulate the animal immune system
- ii. Life (active) vaccines which are viruses and bacteria that are modified not to cause diseases in the vaccinated animal but still produce immune responses to fight off disease causing organism.

WSU (2013) shows us the advantages and disadvantages of both killed and live vaccines in Tables 2 and 3 respectively.

Table 2: Advantages and disadvantages of killed vaccines adapted from Rick Sibbel, (2014)

Advantages	Disadvantages
Safe in pregnant animals	Often requires more than one dose
Will not revert back to virulent form	May does not have a strong response
Will not shed the virus	May does not stimulate all phases of the immune response (West, Petrie, Haines, Konoby, Clark, Martin and Ellis, 1999)
Will not cause immune suppression	Hypersensitivity (allergic type) reactions

Table 3: Advantages and disadvantages of modified live vaccines adapted from Rick Sibbel, (2014)

Advantages	Disadvantages
Longer lasting responses (Ellis, Belden, Haren, and Cavender, 1992)	Potential for vaccine included disease
Stronger responses (Ellis <i>et al.</i> , 1992)	Vaccinal virus can be shed by animal
Injection or mucosal administration (intranasal)	Short shelf life once reconstituted
	It is very fragile and has possible risk to pregnant cattle

2.21 Marketing access and income generation on cattle farming

Heinemann (2002) as cited by Mngomezulu (2010) stated that rural people in Africa, especially the poor often say that one reason they cannot improve their living standards is that they face difficulties in accessing markets where they can obtain agricultural inputs and consumer goods and sell the produce that they grow. According to IFAD (2003), the issue of market access can be considered according to three dimensions. First, physical access to markets (distance, costs), secondly, structure of the markets (asymmetry of relations between farmers, market intermediaries, and consumers) and finally, the lack of skills, information, understanding of the market, prices, and bargaining among others.

It is obviously seen that the lack of marketing facilities for cattle farmers imposes a serious constraint on the market of livestock (Mahabile, Iyne, and Panin, 2002). Earlier, there was the discussion that most of the farmers reside in rural or remote areas that are located away from the major markets; this explains the poor livestock suppliers to formal market outlets by small-scale farmers, United States Agency for International Development (USAID, 2003). According to Frisch (1999), even in the communities that happen to have the marketing facilities, "the farmers or communities are either in a poor state or they are non-functional because they just do not have the funds to maintain them. Bailey, Barrett, Little and Chabari (1999) stated that the physical infrastructural facilities that are the most important in cattle production is related to transporting and holding facilities. Apart from the distance, the National Emergent Red Meat Producer "NERPO" (2004) discussed that the poor state of road networks in the country's communal areas impose serious constraints, and it influences small-scale farmers are not being able to bring buyers to their communities which lead to high cost of transportation. On the contrary, Fidzani

(1993) stated that poor infrastructure does not influence livestock marketing since in most cases buyers provide their own loading and transportation services.

2.22 Chapter Summary

The literature reviewed in the chapter explained that extension and advisory service comprises of different set of technological tools used to create, disseminate new or improved technologies to further increase productivity. It was reviewed that agriculture has and will be the backbone of the African economy contributing to the livelihoods of rural communities and most farming communities rely on the public agricultural extension services for technical farming advice and information. Therefore, extension and advisory services plays a vital role in ensuring the success of all the aspect of Agriculture stimulating growth between farmers and the extension and advisory Agent's.

The literature further revealed that Agricultural Extension and advisory services in the field of agricultural development has seen many changes in the past decades. The first trend is the change in philosophy and rationale behind extension services towards more participatory approaches and Participatory Technology Development (PTD), and the development towards 'extension-plus' which means that extension and advisory services plays an expanded role because extension has long been primarily associated with 'transferring technologies to farmers.

Literature further discussed that for the success of agriculture, the government should ensure that extension and advisory services are readily available, accessible and affordable by all farmers either rich or poor. The conclusion was that extension services in Africa have failed to address the needs of small-scale farmers and arguments that agricultural extension services that provide agricultural information do not work effectively in Africa. These shortfalls may be due to changes in the extension process that have resulted in the shift to the facilitation and brokerage of information, communication and advocacy services. Several aspects of improving cattle production was discussed which includes: improving the relationship between the farmer and researcher through extension, the challenges of livestock and the effect on the environment, improving the livelihood of the smallholder farmers, veld management and the access to extension and advisory services by the farmers.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter is aimed at orientating the reader on the agro-ecological factors including the location, topography, climatic conditions, economic activities including mining and agriculture and infrastructural developments of the study area, it also outlines the research design including type and choice of the study area, the data collection strategy which includes, information sources, sampling procedure, data collection tools, reliability of results as well as data analysis

3.2 Study area

The Northwest Province (NWP) is the country's fourth-smallest province in the Republic of South Africa and is in the central north of South Africa and completely landlocked. Nationally the province is bordering the following provinces (i.e. Northern Cape, Free State, Gauteng and Limpopo Province) and internationally within the South African Development Community (SADC) countries, is bordering the Republic of Botswana in the west. With a total area of 106 512 square kilometers, taking up 8.7% of South Africa's land area and accounting for a mid-2010 population of 3.2-million (7.1%) it is mostly rural in nature. It is also known as the Platinum Province for the wealth of the metal it has underground. The Province is divided into four districts namely Ngaka Modiri Molema, Bojanala Platinum, Dr Kenneth Kaunda and Dr Ruth Segomotso Mompati districts with Mafikeng (previously Mafeking) as the capital, and best known for the famous siege during the Anglo-Boer War, which ended in a decisive victory for the British and made a hero of Robert Baden-Powell (Statistics South Africa, 2010). The dominance and locality of agricultural activities were the predominant reasons for the selection of the study area. Figure 3 below shows the map of the North-West Province.

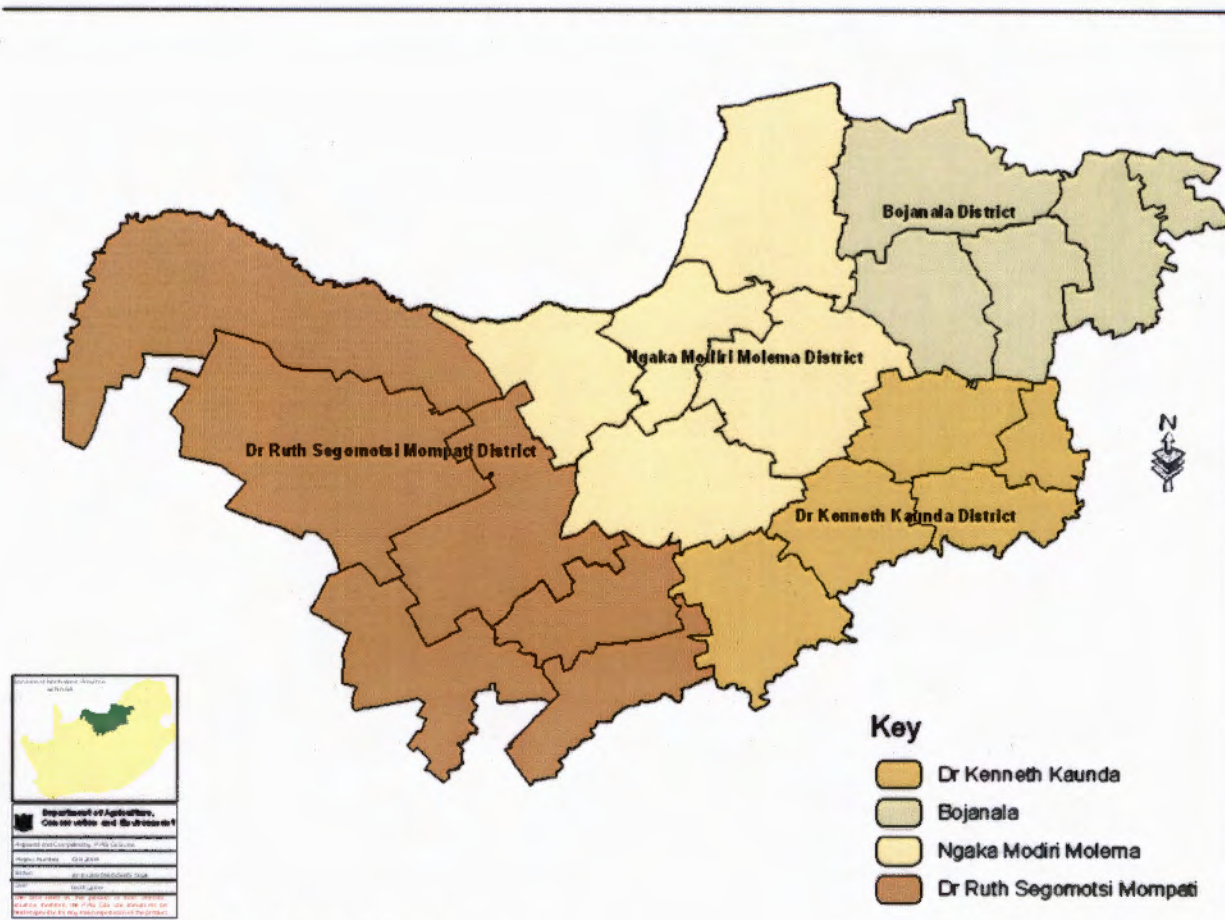


Figure 3: Map of the North-West Province

Source: READ (2015) Information Services (GIS UNIT)

3.2.1 Climate of the North-West Province

Using the report of SA-venues (1999-2015), forming the southern part of the Kalahari Desert, the North-West Province offers almost year-round sunshine, making suntan lotion and a hat a prerequisite when visiting the North-West Province. Furthermore, the capital Mafikeng enjoys weather that can be said is the same round the entire province, with towns in the Western areas only slightly hotter and those further South a bit cooler. The summer months from August to March bring brief but refreshing afternoon thundershowers. The town has an above average rainfall of 300 to 700 mm annually. Summer temperatures range between 22 and 34 °C and winter brings with it dry, sunny days and chilly nights. The average winter from May to July temperature is 16 °C but can range from an average of 2 to 20 °C in a single day. The North-West Province is all about the authentic African bush experience, if properly prepared for, is truly special. Hence, so many indulge in the many water recreational facilities available throughout the region.

3.2.2 Agro-ecology

3.2.2.1 Topography

The province is located on latitude 25.8° south of the Equator and longitude 25.5° east of the Greenwich. Most of the land is flat and undulating with few high elevations. Some parts of the Ngaka Modiri Molema and Dr Ruth Segomotsi Mompati districts are on a lower elevation of between 1000 and 1200m.

3.2.2.2 Temperature

Temperatures in the Province increase in northerly and westerly direction. For the most part of the province, the mean winter (July) temperature is 10°C . In summer (January) mean temperature is generally between 22.5°C and 25°C except in the western areas where it exceeds 25°C . Generally the greatest part of the Province experiences 90 days during which temperatures range from up to 31°C in summer and 3°C in winter.



3.2.2.3 Rainfall

All parts of the province fall within the summer rainfall area, with rainfall occurring between October and April. Rainfall decreases in a westerly direction, from 600-700mm/An to 300mm in the west. Between 70-90% of the rainfall occurs during October and April. During these months the monthly rainfall exceeds 20mm. The climax of the rainy season ranges from January in the Bojanala Platinum district where 120mm has been recorded for Pilanesberg in the Mankwe region, in the Ngaka Modiri Molema district is in February where 75-80mm has been recorded, whereas in the western it is March with 55-65mm been recorded. The province's rainfall is unpredictable and unreliable.

According to READ (2015), for the greater part, rain falls during violent conventional storms, accompanied by thunder lightning, and hailstorms. This kind of rain is common in the Bojanala Platinum district. These rains fall in the afternoon or early evening and are experienced for about 80 days in the east and for only 40 days in the west, causing damage to crops and property.

3.2.2.4 Vegetation

According to (READ, 2015) Information Services- GIS Unit, the following veld types are found in the Province. Figure 3.3 shows the different veld types in the North-West Province.

- a) Most of the Bojanala Platinum district and some parts of the central and southern districts have mixed Bushveld vegetation. The Sandvaal boom (*Terminalia sericea*) and wild senga (*Burkea Africana*) which are tall trees, and elephant grass (*Eragrostis pallens*) are common features of this vegetation type.
- b) Some parts of the southern, central and Bojanala Platinum districts have Sourish Mixed Bushveld vegetation. This vegetation consists of a more open acacia savanna with tall dense grassveld, including edible trees and shrubs, which provide browse and grazing. However, a variety of grasses in this vegetation provide limited grazing value.
- c) The Dr. Segomotso Mompoti district is dominated by Kalahari Thornveld and Shrub Bushveld. The vegetation is of acacia savanna type in which the common trees are camel thorn (*Acacia giraffe*) and karee thorn (*Hycium oxyladium*). Common grasses occurring include blue seed grass (*Eragrostis lehamanniana*) and buffalo grass (*Anthopora pubescence*). These veld types are however also found in the western areas of Ngaka Modiri Molema district (Molopo and Ditsobotla) and in northern parts (Lehurutshe).

supplementary products. Not only are asbestos, tin, chrome, lead, marble, granite, and slate produced in the area but the two largest platinum mines in the world are also found in Bojalana".

3.2.3.2 Tourism

Salga (2010) discussed and described that water for irrigation purpose is provided by the Hartebeespoort Dam, "a popular tourist attraction and a recreational area for enthusiastic local communities as well as visitors. The Magaliesberg, Pilanesberg and Borakalalo nature reserves provide wonderful opportunities for game viewing and for experiencing the wealth of nature in South Africa, while the popular destinations of Sun City and the Lost City, offer local and foreign tourists excitement of a different type".

3.2.3.3 Agricultural activities

"North-West is well known for cattle farming, while the areas around Rustenburg and Brits are fertile, mixed-crop farming land. Maize and sunflowers and peanuts are the most important crops, and the province is the major producer of white maize in the country also" (North-West, 2015). North-West Province is South Africa's largest beef producing district, with Hereford cattle being the most popular. It is sometimes called "the Texas of South Africa". Figure 3.6 shows the predominant agricultural activities in the North-West Province.

3.4 Research method

The research method used in the study was the quantitative method. Awino, (2009) defines the quantitative method as an inquiry into social or human problem based on testing a theory composed of variables measured with statistical numbers and analyzed with statistical procedures. This method further employed the use of frequencies, means, and regression analysis.

3.5 Population of the study

The population for this study is the beneficiaries of Nguni Development cattle project in the North-West Province. According to Borg and Gall, (1989), population is defined as means of all the members of a real or hypothetical set of people or objects to which we wish to generalize the results of our research. The Department of Rural, Environment and Agricultural Development (READ) provincial report (2015) indicates that the total number of the beneficiaries is 187 in all four districts of the North-West Province.

3.5.1 Sampling technique and sample size

Random sampling technique was used because of the stratification of the Nguni cattle development project; beneficiaries from each project site had an equal chance of being selected. The respondents are all beneficiaries from all the districts of North-West Province who are participating in the Nguni cattle development project. The North-West Province is the country's largest beef producer with Hereford cattle being the most popular breed. Out of the total number of 187 beneficiaries in the project, a sample size of 128 beneficiaries was selected and only 76 beneficiaries participated in the study. Krecjie and Morgan (1970) sample size calculator was used to calculate the sample size. Frame error was controlled by excluding administrative and support staff of the Nguni Cattle Development project, while selection error was eliminated by ensuring that all frontline extension (field) officers were contacted for the study.

3.6 Data Collection

3.6.1 Data collection instrument

Data from this study were generated through the primary sources based on the objective of the study. A structured and self developed questionnaire was used as the instrument. This questionnaire was divided into six sections from A to F. The questionnaire consisted of open- and closed-ended types, Likert forms. The open-ended question provided the respondents with an opportunity to express their opinions and attitudes on the research problem. Closed-ended

questions were used to collect demographic information of the respondents such as location, age, gender, marital status, educational levels. Some of the open-ended questions were followed by close-ended questions in order to reveal a respondent's reasoning and thinking about the pertinent issues.

Section A: elicited information on the demographic and socio-economic characteristics of the beneficiaries

Section B: elicited information on cattle rearing among the respondents

Section C: focused on access to extension service by respondents

Section D: elicited information on vaccination programme

Section E: asked information on core activities of Nguni development from respondents

Section F: required information on market access and income generation among respondents

3.7 Validity and Reliability

The face validity of the questionnaire was done by a panel of experts in Agricultural Extension, Development studies and Agricultural Research. The panel consisted of a Lecturer in Agricultural Extension, Community and Senior Management Officers in the Rural, Environment and Agricultural Development as well as other researchers. To ensure the reliability of the questionnaire, a split half technique was used to determine the reliability coefficient with $R=0.81$. The questionnaire was tailored to the needs of the subjects to whom it was intended (Bless and Higson-Smith, 2000).

3.8 Measurement and discussion of variables

The dependent variable "Y" (total annual income) was measured in Rands. The independent variables "X" (provision of drugs, provision of vaccines, marketing strategies, marketing opportunities, cattle production, milk production, production of hides and skin, and general training on cattle rearing) were all measured with the frequency of use which include: Always, Most of the time, Often, Rarely and Not at all, feeding technique, dipping process, vaccination technique, milking technique, hides and skin procedures and marketing of farm produce were all measured with the frequency of use which include: Weekly, Fortnightly, Monthly, Yearly and Not at all). Furthermore, age was measured in years, gender was measured in a dummy form (Male and Female), marital status was measured with single, married, separated, divorced and widowed. Educational level was measured with matric, diploma, degree and others. Household size was measured in persons, farming experience was measured in years, land-ownership was

measured in a dummy form (Yes and No). Farm size was measured in hectares, rearing of cattle was measured in years and extension visits was measured in a dummy form (Yes and No).

To determine the assessment of the extension and advisory services on the Nguni cattle development beneficiary's livelihood in the study area, Tobit regression analysis was used because it is the best functional form that explains the causal relationship between the income proxy (Farmers livelihood). Income proxy was chosen because it is one of the key pillars of livelihood. The five pillars of livelihood includes: Natural capital which are land, water, and biological resources, financial capital, social capital, Physical capital which includes infrastructure, resources created through economic production and human capital defining the quantity and quality of labour available. However, financial capital was used as the proxy for livelihood in this study.

3.9 Ethical considerations

The study took into account the ethical consideration which was addressed through, Voluntary participation: the respondent's right to privacy was exercised by obtaining direct consent from them. Informed consent: respondents were made aware of the positive and negative aspect of aspects of participation. Anonymity was also ensured to avoid biased responses from the respondents. Permission was sought from the READ and the University Ethics Committee. Participants were also insured that they may at any time they like withdraw from participating in the study. The service of a translator was used to translate questions into the local language for the convenience of the respondents.

3.10 Data analysis

Data were analyzed by using STATA 12. Descriptive statistics such as percentages, frequency tables, and mean were used in describing the socio-economic characteristics of the beneficiaries as well as regression analysis.

Tobit regression analysis and Ordinary Least Square (OLS) regression were used to test the relationship between the independent variables (age, sex, gender, household size, farming experience in years, farm size) and the dependent variable (Total annual income). Maree (2007) opined that OLS is a "mathematical model that is used to describe the relationship between a dependent variable and several independent variables". Rutherford (2001) stated that Ordinary Least Square regression is one of the major techniques used to analyse data, and forms the basis of many other techniques. Hutcheson and Sofroniou (1999) also discussed that "Ordinary Least Square regression is particularly powerful as it is relatively easy to check model assumptions

such as linearity, variance and the effect of outliers", hence the choice of use of OLS. Tobit regression analysis was used because it is the best functional form that explains the causal relationship between the income proxy (Farmer's livelihood). The tobit equation is shown as:

$$Y_i^* = x_i\beta + \varepsilon_i$$

where Y_i is the dependent variable (total income) and X_s are as defined for the equation as the independent variables used for the analysis which includes:

X_1 =Provision of drug, X_2 =Provision of vaccine, X_3 =Marketing strategies, X_4 =Marketing opportunities, X_5 =Cattle production, X_6 =Milk production, X_7 =Hides and skin, X_8 =General training in cattle rearing, X_9 =Feeding techniques, X_{10} =Dipping process, X_{11} =Vaccination techniques, X_{12} =Milking technique, X_{13} =Hides and skin production, X_{14} =Marketing of farm produce.

And the implicit function for the OLS is as follows:

$$Y_t = \beta_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \dots e_0$$

where: Y_t = Total annual income, β_1 = Parameter estimate, X_1 =Age, X_2 = Gender, X_3 = Marital status, X_4 = Educational level, X_5 = Household size, X_6 = Land-Ownership, X_7 = Farm size in Hectare, X_8 = Rearing experience, X_9 = Farming experience, X_{10} = Extension visit, e = Error term

3.11 Chapter Summary

This chapter provided a detailed description of the study area. The study area was clearly defined as the North-West Province which is the 4th smallest province in South Africa, being predominantly rural with a total land area of 106 512 square kilometers, taking up 8.7% of South Africa's land area and with a mid-2010 population of 3.2-million people (7.1%). It is known as the Platinum Province for the wealth of the metal it has underground. The climate of the North-West Province is characterized by well defined seasons with hot summers and cool and sunny winters. The major economic sectors in the North-West Province are mining sector which remains a key economic sector accounting for approximately one third of GDP followed by the second most important sector agriculture, contributing 13% of the GDP and 18% of employment. The average annual rainfall in the Province varies between 700 mm in the east to less than 300 mm in the west. The vegetation type changes accordingly from temperate grasslands in the east to arid bush and shrub veld in the west. These east-west variations in rainfall and vegetation types govern the type of agricultural activity. The primary agricultural practices in the North West Province consist of mixed crop and livestock farming in the east

(with different degrees of intensity), with a progression to almost exclusively livestock farming towards the west.

Furthermore, the chapter outlined the detailed research methodology for the study area. Based on the distribution of the beneficiaries of the Nguni Cattle development Project, Stratified Random sampling was used in the study to select 128 of the total 187 beneficiaries, in which only 76 beneficiaries were willing and ready to participate in the study. Krecjie and Morgan (1970) calculator was used to calculate the sample size. In other to analyze the primary objective of the study on the impact of extension and advisory services benefited by the Nguni cattle development beneficiaries in the North-West province, indicators were developed taken into account there relevance to the study. Furthermore, primary data for the study was collected using a structure questionnaire consisting of six sections. Both open and closed ended questions were used to solicit information from the respondents.

Tobit regression analysis was used in this study to determine the effect of the extension and advisory services benefited on the Nguni development project beneficiaries in the study area. STATA 12 was used to analyze the descriptive statistics such as standard deviation, mean and frequency distribution which were used to describe the personal characteristics of respondents; tables, percentages were used to summarize the data and enhance the readability of the results; Semi log using OLS was used to show the effect of respondent's socio-economic characteristics on Nguni development project beneficiaries of the study.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the findings of the study were presented. The chapter was divided into two sections. The first section focused on the results and discussion of the descriptive statistics of the respondents while the second section presented the regression analysis. The aim of this study was to assess extension and advisory services on Nguni development project beneficiaries in the North-West Province.

4.2 Results and discussion of the descriptive statistics of the respondents

The following section outlined the different variables that were analyzed and discussed. These variables are age, gender, marital status, household size, educational level, farming experience in years of respondents, land ownership, farm size in hectare, rearing experience, farming experience.

4.2.1 Age

The findings of the study showed that the age of respondents ranged between 20 to 90 years with an average age of 55 years. The results further showed that most of the age of beneficiaries in the study area was between 51-60 years (28.9%) and 31-40 years (23.7%). Only 17.1% fell between the 20-30 years while 13.2% were between 41-50 years. Finally, 1.3% of the respondent's age was between 81-90 years. This means that agriculture is still practiced by older people; this trend still applies to the Nguni development cattle project. However, the results also shows that farmers were still very much active to be involved in cattle farming thus they can put in the best of their strength and energy to increase their productivity and invariably welfare as presented in table 4. According to Smith and Zopf (1970) as cited by Bembridge (1982) an individual's age is one of the most important factors pertaining to his personality, because his needs, behaviour and thinking are closely related to the number of years he has lived.

Table 4: Age distribution of respondents

<i>Age (years)</i>	<i>Frequency</i>	<i>%</i>
20-30	13	17.1
31-40	18	23.7
41-50	10	13.2
51-60	22	28.9
61-70	9	11.8
71-80	3	3.9
81-90	1	1.3
Total	76	100

4.2.2 Gender distribution of respondents

The findings presented in table 5 shows that 75% of the respondents were males while 25% were females. This result shows that there are more males than female participant involved in Nguni cattle farming in the study area. This finding is corroborated by the study of Okoedo-Okojie (2015) that agriculture is dominated by men.

Table 5: Gender distribution of respondents

<i>Gender</i>	<i>Frequency</i>	<i>%</i>
Male	57	75
Female	19	25
Total	76	100

4.2.3 Marital status distribution of respondents

The result in table 6 showed that the highest percentage of 46.1 of the respondents indicated that they were married with 43.4% being single. Furthermore, 1.3% separated and divorced and 7.9% being widowed. This is further supported by the study by Omotayo (2011) that showed that most of the farmers (producers) are married, which can positively affect the productivity and welfare of the business as the case maybe, since other family members the wife and children can assist thereby serving as a source of labour.

Table 6: Marital status distribution of respondents

<i>Marital status</i>	<i>Frequency</i>	<i>%</i>
<i>Single</i>	33	43.4
<i>Married</i>	35	46.1
<i>Separated</i>	1	1.3
<i>Divorced</i>	1	1.3
<i>Widowed</i>	6	7.9
<i>Total</i>	76	100

4.2.4 Educational level distribution of respondents

Most of the respondents (43.4%) fell under the old standard of education. This finding in table is supported by Ogunkoya (2014) which revealed that majority of the respondents in her study had the standard form of education. The study further revealed as indicated in table 7, that 32.9% of the respondents had matric certificates, 13.2% are diploma holders, 9.2% are degree holders and with 1.3% of the respondents having no form of education at all. This finding supports the Land Bank of South Africa (2000) which states that farmers who have passed standard five are regarded as literate enough to make decisions about production and the requirement of agriculture. The finding here is in disagreement with the view of Cutrufelli (1983) that education has negative effects on agriculture because it offers an alternative type of living away from agriculture. It is generally acknowledged that agriculture education and training are of vital importance in promoting sustainable agricultural production, rural development and ensures household food security. According to Bembridge (1988) education is regarded as a basic human need, essential for meeting other basic needs and acceleration of overall development through training skilled workers and, enabling farmers to make fruitful use of existing resources and accurate assessment of new ones.

Table 7: Educational level distribution of respondents

<i>Educational level</i>	<i>Frequency</i>	<i>%</i>
<i>Matric</i>	25	32.9
<i>Diploma</i>	10	13.2
<i>Degree</i>	7	9.2
<i>Others/standard</i>	33	43.4
<i>None</i>	1	1.3
<i>Total</i>	76	100

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4.2.5 Household size distribution of respondents

Table 8: Household distribution of respondents

<i>Household size</i>	<i>Frequency</i>	<i>%</i>
1-3	13	17.1
4-6	42	55.2
7-9	13	17.1
10-12	8	10.5
<i>Total</i>	<i>76</i>	<i>100</i>

Household sizes refer to the number of people living together in a household including non-family members. The study showed in table 8 that 55.2% of the respondents had a household size ranging between 4-6, followed by 1-3 and 7-9 household members with 17.1% respectively. It was further shown that respondents with between 10-12 household size had a frequency of 8 and a percentage of 10.5 which was seen as the lowest household size. The mean household size of the total respondent was found to be 5. Household size can be reckoned to be a great contributor to productivity. Ajani and Ashagidigh (2008) stated that a household's contribution to productivity could be said to be based on a personal view of interest as an increase in household size increases expenditure and this decreases farmer's annual income.

4.2.6 Years of farming experience of respondents

Table 9 showed that 46.1 was the significant percentage of the respondents with farming experience of between 1-10 years followed by 30.3% farmers with 11-20 years of farming experience. 10.5% of the respondents had between 21-30 years and 31-40 years respectively. The least as revealed by the results 2.6% had between 41-50 years of farming experience. This result is supported by Ogunkoya (2014) that about 47.2% had a farming experience of between 7-12 years.

Table 9: Years of farming experience distribution of respondents

<i>Farming experience in years</i>	<i>Frequency</i>	<i>%</i>
1-10	35	46.1
11-20	23	30.3
21-30	8	10.5
31-40	8	10.5
41-50	2	2.6
<i>Total</i>	<i>76</i>	<i>100</i>

4.2.7 Land ownership and farming land distribution of respondents

The study revealed as indicated in table 10, that 22.4% of the respondents did have ownership of the land in which they farm on, and majority (77.6%) of the respondents did not own the farm land they practice with. This indicates that land ownership for this Nguni cattle development project maybe a hampering factor to the increased productivity. Furthermore, it shows that respondents with no land ownership either farmed on family land (18.5%) or communal land (14.5%), and majority (61.8%) farmed on lease land and 5.3% looked for other means. According to FAO (2000) factors such as land, credit, extension education and appropriate technology still serve as major constraints for farmers in the developing countries.

Table 10: Land ownership and farming land distribution of respondents

<i>Land ownership</i>	<i>Frequency</i>	<i>%</i>	<i>Farming land</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>17</i>	<i>22.4</i>	<i>Family land</i>	<i>14</i>	<i>18.4</i>
<i>No</i>	<i>59</i>	<i>77.6</i>	<i>Communal land</i>	<i>11</i>	<i>14.5</i>
			<i>Lease land</i>	<i>47</i>	<i>61.8</i>
			<i>Others</i>	<i>4</i>	<i>5.3</i>

4.2.8 Farm size distribution of respondents (Ha)

According to table 11, the majority (52.6%) of respondents had 301-500 hectares of farming land to rear their cattle while 11.8% had access to 1301-1500 hectares. 10.5% and 9.2% of the respondents had between 100-300 and 501-700 hectares and 701-900 hectares respectively. Furthermore, 3.9% of the respondents reared their cattle on between 9.2% of the respondents reared their cattle on between 901-1100 hectares and while 1.3% reared cattle on a farm size of between 1101-1300 hectares of land. The mean farm size was 400.5 hectares.

Table 11: Distribution of respondents according to farm size in Hectares

<i>Farm size (Hectares)</i>	<i>Frequency</i>	<i>%</i>
100-300	8	10.5
301-500	40	52.6
501-700	8	10.5
701-900	7	9.2
901-1100	3	3.9
1101-1300	1	1.3
1301-1500	9	11.8
Total	76	100

4.3 Number of years in cattle rearing by respondents

The results presented in table 12, showed that most respondents 52.6% had between 3-5 years of rearing experience, whereas 26.3% of them have between 6-8 years of rearing experience with 18.4% and 2.6% had 1-2 years and between 9-11 years respectively. This is an indication that extension and advisory services offered by READ will have increase the frequency of advices rendered to respondents. However, the results indicated that the Nguni cattle development beneficiaries were still very much early with cattle rearing experience and are still very new and active in terms of looking after the Nguni cattle.

Table 12: Rearing experience distribution of respondents

<i>Rearing Experience (years)</i>	<i>Frequency</i>	<i>%</i>
1-2	14	18.4
3-5	40	52.6
6-8	20	26.3
9-11	2	2.6
Total	76	100

4.4 Mortality experience and mortality rate distribution of Nguni cattle among respondents

Table 13 showed that 85.5% of the respondents had experienced mortality amongst their herd of cattle and 14.5% of them never experienced it. Furthermore, most respondents with 48.7% have lost between 1-3 cattle and 36.8% between 3-6 cattle while 14.5% have lost about 6 or more cattle. The result shows that there has been less loss of cattle in the project, as Nguni cattle are strongly adapted to harsh conditions and can survive in harsh conditions leading to diseases and

even death. This is further supported by Ogunkoya (2014) that no prevalent loss of animals in her study.

Table 13: Mortality experience and mortality rate in numbers distribution among respondents

<i>Mortality</i>	<i>Frequency</i>	<i>%</i>	<i>Mortality Rate (N)</i>	<i>Frequency</i>	<i>%</i>
			1-3	37	48.7
Yes	65	85.5			
			3-6	28	36.8
No	11	14.5			
			>6	11	14.5
Total	76	100		76	100

4.5 Feeding rate of Nguni cattle by respondents

The result as presented in table 14 indicated that 50.0% of the respondents fed the animals once a day, 43.3% of them fed the animals twice daily while 6.6% of them fed the animals three times in a day. Further 52.6% of them feed them with supplements and grass together while 47.4% of the respondents feed them or allow them to graze only on grass. This could be attributed to the fact that Nguni cattle can survive under harsh conditions and can easily adapt in semi-arid areas such as in the North-West Province.

Table 14: Distribution of respondents according to feeding rate of Nguni cattle

<i>Feed-rate</i>	<i>Frequency</i>	<i>%</i>
Once daily	38	50
Twice daily	33	43.4
Thrice daily	5	6.6
Total	76	100
Feed		
Grass	36	47.4
Other	40	52.6
Total	76	100

4.6 Extension and advisory services

4.6.1 Frequency of access to extension service by respondents

The findings in table 15 indicated that majority of respondents (96.1%) had access to extension services while 3.9% had no access in the study area. Also, 77.6% indicated that they were visited by extension workers once a month, whilst 14.5% of the respondents indicated that extension officers visited their farms once in two weeks (fortnightly), 3.9% of respondents indicated they had extension visits every day and weekly respectively. It is worth noting that 96.1% of the respondents had access to public extension services and 2.6% of the respondents used other means of extension services whilst 1.3% used a private extension services. This implies that most of the respondents had access to extension services. The findings of the study are supported by Spens, (1986) that access to agricultural extension has been the instrument for the improvement of agriculture and the quality of life in rural areas all over the world. There is a link or synergy between research, teaching and extension chain. Ragasa, Berhane, Tadesse and Taffesse (2012), indicated that agricultural extension is mostly being emphasized by development experts as "crucial in achieving agricultural development, poverty reduction, and food security".

Table 15: Frequency of access to extension service by respondents

<i>Access to Ext</i>	<i>Frequency</i>	<i>%</i>	<i>Extension Visit</i>	<i>Frequency</i>	<i>%</i>	<i>Extension Provider</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>73</i>	<i>96.1</i>	<i>Everyday</i>	<i>3</i>	<i>3.9</i>	<i>Government</i>	<i>73</i>	<i>96.1</i>
<i>No</i>	<i>3</i>	<i>3.9</i>	<i>Weekly</i>	<i>3</i>	<i>3.9</i>	<i>Private</i>	<i>1</i>	<i>1.3</i>
			<i>Fortnightly</i>	<i>11</i>	<i>14.5</i>	<i>Others</i>	<i>2</i>	<i>2.6</i>
			<i>Once a month</i>	<i>59</i>	<i>77.6</i>			
<i>Total</i>	<i>76</i>	<i>100</i>		<i>76</i>	<i>100</i>		<i>76</i>	<i>100</i>

4.6.2 Provision of drugs and vaccines

The result shows that 34.2% of the respondents in the study area had access to the provision of drugs and vaccines by extension service most often, and 21.1% of respondents revealed that they rarely had access to drugs or vaccines, whilst 19.7% never received the provision of drugs for their animals. This could be attributed to the fact that majority of the respondents were relying on public extension services as indicated in table 16. Further 9.2% and 15.8% of respondents respectively revealed that they had provision of drugs or vaccines regularly and this could be

supported by the findings that a small percentage of respondents had access to private extension service and other means.

Table 16 further revealed that significant percent of the respondents with 36.8% had provision of vaccines more often, 21.1% rarely had provision of vaccines while 18.4% never had access to vaccines. Additional 15.8% received vaccines most of the time it is needed with 7.9% receiving vaccines always. Vaccines are a major part of cattle protection. Noah (2002) stated that one of the best means of preventing diseases is to provide immunity to the animals and this is usually achieved by vaccination. This indicates that more respondents needed to receive vaccines to immunize their cattle's for sustaining increased productivity in their herds.

Table 16: Distribution of respondents according to provision of drugs and vaccines

<i>Provision of drugs</i>	<i>Frequency</i>	<i>%</i>	<i>Provision of vaccines</i>	<i>Frequency</i>	<i>%</i>
<i>Always</i>	7	9.2	<i>Always</i>	6	7.2
<i>Most of the time</i>	12	15.82	<i>Most of the time</i>	12	15.8
<i>Often</i>	26	34.2	<i>Often</i>	28	36.8
<i>Rarely</i>	16	21.1	<i>Rarely</i>	16	21.1
<i>Not at all</i>	15	19.7	<i>Not at all</i>	14	18.4
<i>Total</i>	76	100	<i>Total</i>	76	100

4.7 Provision of marketing strategies, opportunities and marketing of farm produce to respondents by extension service

Table 17 showed that the results of distribution of marketing strategies, opportunities and marketing of farm produce, that 39.5% of the respondents had access to provision of marketing strategies more often whilst 26.3% of the respondents had access rarely, 25.0% did not receive assistance of provision of marketing strategies and 7.9% had it most of the time and 1.3% of the respondent received this service always when needed. This is in accordance with Naser and Scholtz (2015) who mentioned that marketing strategies are often made available to suit indigenous breeds which Nguni cattle are one and as well as crossbreds. This could also be attributed to access of respondents to extension services in the study area. The results further showed that 35.5% of the respondents reported that they had access to marketing opportunities very often whilst 28.9% did not have access to any marketing opportunity. These findings could imply that the extension service needs to create more awareness programmes on marketing opportunities of Nguni cattle. 22.4% rarely had access to marketing opportunities, and on the

contrary 11.8% revealed that they received the opportunities most of the time and 1.3% has the opportunities always when needed. This also could imply that these respondents that have access to private extension service have more marketing opportunities presented to them. This finding is also corroborated by Ntshephe (2011) that respondents in her study area also had relatively often access to marketing opportunities.

From table 17, 59.2% of the respondents do have an opportunity of marketing their farm produce yearly, 30.3% do not have the opportunities and 10.5% of the respondents sold their farm produce monthly. The results revealed that the respondents were not able to market their farm produce either on weekly or forth-night basis. This could imply that the extension service has to assist the respondents in unlocking other market potential and avenues to the neighboring villages and slaughter houses.

Table 17: Distribution of respondents according to provision of marketing strategies, opportunities and marketing of farm produce

<i>Marketing strategies</i>	<i>Frequency</i>	<i>%</i>	<i>Marketing Opportunities</i>	<i>Frequency</i>	<i>%</i>	<i>Marketing farm produce</i>	<i>Frequency</i>	<i>%</i>
<i>Always</i>	<i>1</i>	<i>1.3</i>	<i>Always</i>	<i>1</i>	<i>1.3</i>	<i>Weekly</i>	<i>0</i>	<i>0</i>
<i>Most of the time</i>	<i>6</i>	<i>7.9</i>	<i>Most of the time</i>	<i>9</i>	<i>11.8</i>	<i>Fortnightly</i>	<i>0</i>	<i>0</i>
<i>Often</i>	<i>30</i>	<i>39.5</i>	<i>Often</i>	<i>27</i>	<i>35.5</i>	<i>Monthly</i>	<i>8</i>	<i>10.5</i>
<i>Rarely</i>	<i>20</i>	<i>26.3</i>	<i>Rarely</i>	<i>17</i>	<i>22.4</i>	<i>Yearly</i>	<i>45</i>	<i>59.2</i>
<i>Not at all</i>	<i>19</i>	<i>25.0</i>	<i>Not at all</i>	<i>22</i>	<i>28.9</i>	<i>Not at all</i>	<i>23</i>	<i>30.3</i>
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

4.8 Extension advice received on cattle and milk production

The results in table 18 show the distribution of respondents according to cattle and milk production in the study area. 25.0% of the respondents in the study often received assistance with cattle production from extension services whilst 23.7% rarely received the assistance. 22.4% revealed that the assistance from extension service is received most of the time, with 21.1% not receiving the service at all whilst 7.8% received the assistance always when needed. This could imply that the public extension service needs to provide the service to the beneficiaries of the Nguni cattle project so that they could be able to penetrate the formal market. The findings further indicate that 67.1% of the respondents never received extension service assistance with regards to milk production, whilst 21.1% rarely received the assistance.

On the contrary 7.9% of the respondents often received the assistance with 2.6% and 1.3% receiving the assistance most of the time and always when needed respectively.

Table 18: Respondent's distribution according to cattle and milk production

<i>Cattle</i>	<i>Frequency</i>	<i>%</i>	<i>Milk</i>	<i>Frequency</i>	<i>%</i>
<i>production</i>			<i>production</i>		
<i>Always</i>	6	7.8	<i>Always</i>	1	1.3
<i>Most of the</i>	17	22.4	<i>Most of the</i>	2	2.6
<i>time</i>			<i>time</i>		
<i>Often</i>	19	25.0	<i>Often</i>	6	7.9
<i>Rarely</i>	18	23.7	<i>Rarely</i>	16	21.1
<i>Not at all</i>	16	21.1	<i>Not at all</i>	51	67.1
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

4.9 Extension advice on production of hides and skin

Majority of the respondents (60.5%) revealed that they did not receive extension advice on production of hides and skin with 14.5% rarely receiving extension advice as well as shown in table 19. While 10.5% of the respondents indicated that often times they receive and 3.9% indicating that they receive most of the time. DAFF (2013) report showed that the Nguni cattle hides and skins are marketable and are a profitable business but the result represented in the table below shows that respondents were not exploiting this avenue enough. It could imply that the extent to which extension advice is received by respondents is not encouraging them to explore such an opportunity. Wayua and Kagunya (2012) also show that "there is a great potential for hides and skins to contribute to livelihood diversification in rural pastoral areas in Kenya".

Table 19: Distribution of respondent according to production of hides and skin

<i>Hides and Skin</i>	<i>Frequency</i>	<i>%</i>
<i>Always</i>	8	10.5
<i>Most of the time</i>	3	3.9
<i>Often</i>	8	10.5
<i>Rarely</i>	11	14.5
<i>Not at all</i>	46	60.5
<i>Total</i>	76	100

4.10 Farmer training programme

The findings in table 20 showed that 84.2% of the respondents had attended an Nguni farmer training programme while 15.8% said they have not. This result is in line with the objectives of the Nguni development project that all approved beneficiaries of the project should attend and undergo farmer training program. It can be implied that extension services in the study area do afford the beneficiaries of the program training programme.

Table 20: Distribution of respondents into farmer training programme

<i>Training programme</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	64	84.2
<i>No</i>	12	15.8
<i>Total</i>	76	100

4.11 Assistance received in general management cattle

Table 21 showed that 31.6% of the respondents always have assistance in general cattle management training, with also 23.7% often receiving similar training, 19.7% of the respondent received general cattle management training from extension service regularly whereas 17.1% and 7.9% of the respondents did not receive or rarely have received assistance in training. This implies that majority of the respondents in the study area do receive training in general cattle management which is a crucial component in promoting and improving cattle productivity amongst beneficiaries.

Table 21: Respondents distribution according to general cattle management training

General Training	Frequency	%
<i>Always</i>	24	31.6
<i>Most of the time</i>	15	19.7
<i>Often</i>	18	23.7
<i>Rarely</i>	6	7.9
<i>Not at all</i>	13	17.1
Total	76	100

4.12 Specific training on cattle management received

Table 22 revealed the specific training on cattle management that respondents received. Majority of the respondents 72.4% were trained weekly in cattle feeding technique, whilst 93.4% did not receive training in milking. 67.1% received training monthly in vaccinating and 55.3% in dipping respectively. The high percentage of specific training received implies that extension service in the study area concentrate on those key aspects of cattle management related to Nguni cattle. It could also imply that the training program for Nguni development beneficiaries was carried out when there were many participants in the project. This could imply that that the majority of the respondents 93.4% that did not receive training in milking and could experience a general health risk that could arise as this is further supported by Aphis (2008) that if gloves are not worn during milking, mastitis-causing pathogens can be transferred from hands to the teats of non-infected cows. Furthermore, fore- stripping that is removing a small amount of milk from the udder prior to milking helps identify new intra-mammary infections and improves milk quality, thus showing us the advantages of milking your animal.

Table 22: Distribution of respondents according to specific training cattle management training received

<i>Training</i>	<i>Feeding</i>		<i>Vaccination</i>		<i>Dipping</i>		<i>Milking</i>	
	<i>Frequency</i>	<i>%</i>	<i>Frequency</i>	<i>%</i>	<i>Frequency</i>	<i>%</i>	<i>Frequency</i>	<i>%</i>
<i>Weekly</i>	55	77.4	1	1.3	3	3.9	1	1.3
<i>Fortnightly</i>	0	0	2	2.6	6	7.9	0	0
<i>Monthly</i>	9	11.8	51	67.1	42	55.3	2	2.6
<i>Yearly</i>	3	3.9	16	21.1	11	14.5	2	2.6
<i>Not at all</i>	9	11.8	6	7.9	14	18.4	71	93.4
<i>Total</i>	76	100	76	100	76	100	76	100

4.13 Constraints and degree of assistance by extension services

4.13.1 Degree of assistance of extension service with availability of cattle feed

Majority 52.6% of the respondents as shown in table 23 indicated did not receive assistance through extension services on the provision of cattle feeds for their animals. 32.9% revealed that they received a fairly degree of assistance whilst 11.8% revealing that they experienced a poor service assistance by the extension services while 2.6% indicated that the degree of assistance has been relatively very well. The results could be attributed to the lack of extension service not being able to provide relevant advises to respondents.

4.13.2 High transaction cost

Table 23 further showed that 57.9% of the respondents did not receive assistance with high transaction costs, 32.9% indicating that the assistance has been poorly rendered. A further 66% revealed that the assistance has been fair and 2.6% revealed a very well degree of assistance by extension services and this could be attributed by the fact that this low percentage is receiving assistance from the private extension service.

4.13.3 Veld fire

The result in table 23 further showed that 38.2% of the respondents do poorly receive assistance with regards to veld fire management practices with 32.9% not receiving any assistance. Also, 18.4% of respondents indicated that the assistance they received was fair and 10.5% revealed that the service has provided a very good assistance. Forsyth, Kruger and Le Maitre (2010) report shows that to improve the services of extension to guide and help fight against veld-fire/wild-fire, the implementation of the national veld and forest fire act must be approved hence improving the services provided to the farmers.

4.13.4 Stock theft and predator invasion

Table 23 showed that 50.0% of the respondents had not received assistance from extension and advisory services in preventing stock theft while 28.9% indicated that the assistance received was fair and 10.5% had received good assistance. The results further revealed that majority of the respondents 71.1% were not receiving assistance regarding predator invasion and 14.5% receiving a fair assistance and advice. 10.5% of the respondents had a relatively good and very well experience in receiving the assistance while 3.9% revealed that the assistance has been poor.

4.13.5 Access to information

The findings of the results in table 23 further showed that 51.3% of the respondents received assistance fairly regarding access to information from extension service, 30.3% indicated that that the degree of assistance has been very well while 9.2% that the assistance has been poor, whereas 9.2% showed that they did not receive assistance at all. Ndoro, Mudhara, and Chimonyo (2014) stated that respondents who had access to extension services had a good return in products from their farms with 65.0% from the total respondents as they received the assistance that they needed to increase the productivity.

4.13.6 Disease infestation

The results presented in table 23 shows that majority 64.5% of the respondents revealed that they received fair assistance in disease infestation among their cattle from the extension service. 14.5% indicated the assistance has been very well rendered on the contrary 14.5% of the respondents indicated that they did not receive assistance at all while 6.6% were poorly served.

4.13.7 Market availability

Table 23 showed that 11.8% of the respondents revealed that they had a relatively good and fair assistance from the extension service respectively. This could be attributed to the fact that some of the respondents in the study area do get serviced by private extension service; significantly 44.7% of the respondents did not receive any assistance in these regards, whereas 31.6% indicated that the assistance rendered by extension service was poor.

4.13.8 Pasture availability

From the results presented in table 23, 40.8% of the respondent claimed extension services has been fairly helpful for their animals, 31.6% show that they have not received assistance, 14.5% and 13.2% indicated that they received very well assistance very well and poor assistance respectively. This is corroborated by Flack (2013; 2015) that proper pasture is important to holistic farm that when the animals graze, they deposit manures on pastures which will nourish the growth of the pasture and will help reduce pasture run off.

4.13.9 Poor livestock conditions

Majority of the respondents in the study area (55.3%) as presented in table 23 revealed that extension and advisory services had been fair in helping across their farming with the poor livestock conditions, 30.3% did not receive assistance and 9.2% indicated poor degree of assistance while 5.3% indicated a very well degree of assistance.

4.13.10 Lack of infrastructure

Results presented in table 23 showed that 35.5% did not receive any assistance regarding the lack of infrastructure for their farms whilst 25.0% indicated the assistance they received was fair, 22.4% indicating poor assistance and 17.1% revealing that the assistance was very well. It could be attributed to the fact that some respondents have access to private extension services and other sources of information which assist on alternative information and advises. Infrastructure plays a very important role in cattle rearing.

4.13.11 Low income

The result shows in table 23 that 3.9% of the respondents were assisted, while 18.4% were fairly and received a poor degree of assistance. Majority 59.2% indicated that they did not receive assistance from extension services to increase their low income. This could be attributed to the lack of access to readily available markets in the study area.

4.13.12 Access and areas of improvement through extension service

Table 23 showed that 36.8% and 31.6% of the respondents had access to extension service with the result of improvement being very well and fairly respectively. The results are further supported by the finding that 82.9% have seen improvements in their farms especially with Nguni cattle whereas 17.1% indicated that they did not see any improvements in their farm. Furthermore, 18.4% of the respondents revealed that they experienced poor access to extension service which a further 13.2% indicating that they never had access to extension service. This is contrary to the results as shown in table 16 which shows that 36.8% of the respondents indicated that they experienced more improvement in their cattle being immune to disease and infestation due to the proper vaccination techniques they have been taught by extension service. Other respondents 30.3% show that they had more improvement with cattle production, 18.4% indicated other areas in general, 6.6% in marketing practices while 3.9%, 2.6% and 1.3% in the feeding techniques, milking, hides and skin production respectively.

4.13.13 Access to veterinary service

The results in table 23 showed that 35.5% of the respondents received assistance with veterinary services whereas 31.6% indicated that they received a fair assistance. On the contrary, 23.7% indicated that they received poor degree of assistance while 9.2% indicated that they did not receive the assistance at all. The results are further supported by Pretty (2012) that vaccination and veterinary services are very important in order to achieve maximum benefit in production.

Table 23 Distribution of respondents according to constraints and degree of assistance by extension service

<i>Assistance</i>	<i>Frequency</i>				<i>%</i>			
<i>Cattle feed availability</i>	2	25	9	40	2.6	32.9	11.8	52.6
<i>High transaction costs</i>	2	5	25	44	2.6	6.6	32.9	57.9
	8	14	29	25	10.5	18.4	38.2	32.9
<i>Veld Fire</i>								
<i>Stock Theft and predator invasion</i>	8	22	8	38	10.5	28.9	10.5	50.0
	8	11	3	54	10.5	14.5	3.9	71.1
<i>Access to information</i>	23	39	7	7	30.3	51.3	9.2	9.2
<i>Disease Infestation</i>	11	49	5	11	14.5	64.5	6.6	14.5
<i>Market availability</i>	9	9	24	34	11.8	11.8	31.6	44.7
<i>Pasture availability</i>	11	31	10	24	14.5	40.8	13.2	31.6
<i>Poor livestock conditions</i>	4	42	7	23	5.3	55.3	9.2	30.3
<i>Lack of infrastructure</i>	13	19	17	27	17.1	25.0	22.4	35.5
<i>Low income</i>	3	14	14	45	3.9	18.4	18.4	59.2
<i>Frequency of access to extension service</i>	28	24	14	10	36.8	31.6	18.4	13.2
<i>Access to veterinary services</i>	27	24	18	7	35.5	31.6	23.7	9.2
Total	76				100			

4.13.14 Area of improvement through access to extension and advisory services

Table 24 showed that 82.9% of the respondent revealed that they seen improvements in their farms through the access they had to extension services while 17.1 did not see any improvements as they did not have access. The result furthermore shows that 36.8% of respondents experienced more improvement in vaccination techniques as a result of access to extension services. This

implies that their cattle were being immune to disease and infestation due to the proper vaccination techniques they have been taught. Other respondents 30.3% show that they had more improvement with cattle production, 18.4% indicated other areas in general. 6.6% in marketing practices while 3.9%, 2.6% and 1.3% in the feeding techniques, milking, hides and skin production respectively.

Table 24: Distribution of respondents by area of improvement through access to extension and advisory services

<i>Access to improvement through extension services</i>	<i>Frequency</i>	<i>%</i>	<i>Area of improvement</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>63</i>	<i>82.9</i>	<i>Milking</i>	<i>2</i>	<i>2.6</i>
<i>No</i>	<i>13</i>	<i>17.1</i>	<i>Cattle Production</i>	<i>23</i>	<i>30.3</i>
			<i>Marketing</i>	<i>5</i>	<i>6.6</i>
			<i>Hides and Skin</i>	<i>1</i>	<i>1.3</i>
			<i>Feeding techniques</i>	<i>3</i>	<i>3.9</i>
			<i>Vaccination techniques</i>	<i>28</i>	<i>36.8</i>
			<i>Others</i>	<i>14</i>	<i>18.4</i>
<i>Total</i>	<i>76</i>	<i>100</i>		<i>76</i>	<i>100</i>

4.14 Vaccination programme

4.14.1 Vaccination and vaccination period

The results in table 25 showed that 98.7% of the respondents indicated that they do vaccinate their animals with only 1.3% was not vaccinating their animals. It further indicates that 71.1% of the respondents indicated that they do vaccinate their animals before calving, 9.2% said vaccinating after calving and after weaning respectively, whilst 6.6% of the respondents indicated that they do vaccinate at the prescription and guidance of the veterinarian and with just 3.9% vaccinating just before weaning.

Table 25: Distribution of respondent according to vaccination and vaccination period

<i>Vaccination</i>	<i>Frequency</i>	<i>%</i>	<i>Vaccination period</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>75</i>	<i>98.7</i>	<i>Before calving</i>	<i>54</i>	<i>71.1</i>
<i>No</i>	<i>1</i>	<i>1.3</i>	<i>After calving</i>	<i>7</i>	<i>9.2</i>
			<i>Before weaning</i>	<i>3</i>	<i>3.9</i>
			<i>After weaning</i>	<i>7</i>	<i>9.2</i>
			<i>Other</i>	<i>5</i>	<i>6.6</i>
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

4.14.2 Vaccine's availability and amount paid

The result in table 26 showed that 86.8% of the respondent always had vaccines available at their disposal while only 13.2% did not have vaccines at their disposal. Furthermore, 44.7% revealed that they pay an amount between R1001 - R3000 for the vaccines they use with 15.8% indicating that they spent an amount less than R1000. 19.7 % of the respondents further revealed that they also spent an amount between R3000 and R5000. 6.5% and 5.2% spend between R7001 - R9000 and R9001 - R11 000 while 3.9% indicated they spent amount between R5001 - R7000 and more than 11 000 respectively. This implies that the majority of the respondents do vaccinate their cattle as supported by the 86.8% presented by the results.

Table 26: Distribution of respondent according to vaccine's availability and amount paid

<i>Vaccine availability</i>	<i>Frequency</i>	<i>%</i>	<i>Amount paid for vaccines(R)</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>68</i>	<i>86.8</i>	<i><1000</i>	<i>12</i>	<i>15.8</i>
<i>No</i>	<i>10</i>	<i>13.2</i>	<i>1001-3000</i>	<i>34</i>	<i>44.7</i>
			<i>3001-5000</i>	<i>15</i>	<i>19.7</i>
			<i>5001- 7000</i>	<i>3</i>	<i>3.9</i>
			<i>7001-9000</i>	<i>5</i>	<i>6.5</i>
			<i>9001- 11 000</i>	<i>4</i>	<i>5.2</i>
			<i>>11 000</i>	<i>3</i>	<i>3.9</i>
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

4.15 Core activities of Nguni development

4.15.1 Reasons for rearing Nguni cattle

Majority of the respondents (93.4%) reared Nguni cattle for beef production and 3.9% for production of hides and skin while 2.6% reared them for other reasons and none rearing them for dairy production as shown in table 27. This result is further supported by Koro (2015) that Nguni beef is very economical and the meat is also said to be softer and tastier than that of other European cattle breeds, making it a little-known delicacy, hence the percentage of respondent keeping this breed for beef production.

Table 27: Distribution of respondent according to reasons of Nguni cattle rearing

<i>Nguni cattle</i>	<i>Frequency</i>	<i>%</i>
<i>Diary</i>	<i>0</i>	<i>0</i>
<i>Beef</i>	<i>71</i>	<i>93.4</i>
<i>Hides and skin</i>	<i>3</i>	<i>3.9</i>
<i>Others</i>	<i>2</i>	<i>2.6</i>
<i>Total</i>	<i>76</i>	<i>100</i>

4.15.2 Financial assistance received by respondents

From the results as presented in table 28 showed that most respondents 81.6% revealed that they did not receive financial assistance when they started farming with Nguni while 18.4% indicated that they received some financial assistance. The results are in line with the objective of Nguni development cattle that beneficiaries participate in order to address the issue of food security, increased and promotion of Nguni cattle and beef production as well as generating income.

Table 28: Distribution of respondents into financial assistance

<i>Financial assistance</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>14</i>	<i>18.4</i>
<i>No</i>	<i>62</i>	<i>81.6</i>
<i>Total</i>	<i>76</i>	<i>100</i>

4.16 Market access and income generation

4.16.1 Market access

The findings as presented in table 29 indicated that majority of respondents (92.1%) revealed they have access to market while only 7.9% did not have access to market. Furthermore, 82.9% showed that they do access markets such as auctions around to market and sell their animals and

products, with 6.6% and 5.3% indicating that they access markets through funerals and weddings respectively. The results show that there is market potential in the study area that extension service has to explore and expand for the benefit of the beneficiaries. Furthermore, most respondents 78.9% generated income of over R1500 from selling their cattle whereas 14.5% generated between R1000 and R1500. Only 6.6% of the respondent's generated less than R1000 on sales as presented in table 29. The results are supported by Koro (2015) that sales of Nguni cattle as beef or leather is a high income generating enterprise.

Table 29: Distribution of respondents according to market access and income generation

<i>Market accessibility</i>	<i>Frequency</i>	<i>%</i>	<i>Types of markets</i>	<i>Frequency</i>	<i>%</i>	<i>Income ®</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>70</i>	<i>92.1</i>	<i>Funerals</i>	<i>4</i>	<i>5.3</i>	<i>R</i>	<i>5</i>	<i>6.6</i>
<i>No</i>	<i>6</i>	<i>7.9</i>	<i>Weddings</i>	<i>4</i>	<i>5.3</i>	<i><1000.00</i>	<i>11</i>	<i>14.5</i>
			<i>Auctions</i>	<i>63</i>	<i>82.9</i>	<i>1000.00-1500.00</i>	<i>60</i>	<i>78.9</i>
			<i>Farm lots</i>	<i>5</i>	<i>6.6</i>	<i>>1500.00</i>		
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

(At 1 US\$= 12.03 Rand)

4.16.2 Membership of cooperatives

From the results presented in table 30, 59.2% of the respondents have membership to a cooperative whilst 40.8% indicated that they do not have affiliation with any cooperative. Furthermore, the results shows that 61.8% of respondents received advisory services from their peer in the cooperative, 30.3% with other needs, 6.6% with loans and 1.3% with free cattle. Nembhard (2014) stated that being a member of a cooperative as a farmer does have benefits and its impacts. Cooperatives help to solve general economic problems, business uncertainty, excessive costs, and market failures hence fill gaps that other private enterprise and businesses ignore such as the provision of affordable healthy and organic foods, provision of utility, provision of affordable credits and affordable markets.

Table 30: Distribution of respondent to membership of cooperative society

<i>Cooperatives</i>	<i>Frequency</i>	<i>%</i>	<i>Cooperative assistance</i>	<i>Frequency</i>	<i>%</i>
<i>Yes</i>	<i>45</i>	<i>59.2</i>	<i>Loan</i>	<i>5</i>	<i>6.6</i>
<i>No</i>	<i>31</i>	<i>40.8</i>	<i>Advices</i>	<i>47</i>	<i>61.8</i>
			<i>Free cattle</i>	<i>1</i>	<i>1.3</i>
			<i>Free livestock feed</i>	<i>0</i>	<i>0</i>
			<i>Others</i>	<i>23</i>	<i>30.3</i>
<i>Total</i>	<i>76</i>	<i>100</i>	<i>Total</i>	<i>76</i>	<i>100</i>

4.17 Receptivity of extension advices by respondent

From the results as presented in table 31, majority of the respondents 53.9% revealed that they were excellent in the receptivity of advisory services rendered to them by extension service. 26.3% indicated that the receptivity is very good, 14.5% fairly good with extension and advisory services while 5.3% indicated that they are poor regarding receptivity of extension and advisory services around them. The outcome of being receptive to extension and advisory services cannot be over-emphasized. Swanson (2008) stated that when a farmer is receptive to extension services, this will improve rural livelihoods, including food security at the household level and increasingly manage natural resources.

Table 31: Distribution of respondent's receptivity of extension advices

<i>Receptivity</i>	<i>Frequency</i>	<i>%</i>
<i>Excellent</i>	<i>41</i>	<i>53.9</i>
<i>Very good</i>	<i>20</i>	<i>26.3</i>
<i>Good</i>	<i>11</i>	<i>14.5</i>
<i>Poor</i>	<i>4</i>	<i>5.3</i>
<i>Total</i>	<i>76</i>	<i>100</i>

4.18 Total annual income of respondents

Most of the respondents 44.9% generated between R40, 001-R80, 000 as revealed in table 32. It was further discovered that 34.2%, 14.4%, 3.9% and 2.6% of the beneficiaries all generated between R1- R40, 000, R80, 001-R120, 000, R160, 001-R200, 000 and R120, 001- R160, 000 respectively. As income is one of the pillars of measuring the livelihood of an individual, this implies that beneficiaries did not lack profits from being a member of this project, and this has

directly contributed to their day to day living and improving the well-being of most beneficiaries.

Table 32: Distribution of total annual income of respondents

<i>Total annual income (Rand)</i>	<i>Frequency</i>	<i>%</i>
<i>1-40,000</i>	<i>26</i>	<i>34.2</i>
<i>40,001-80,000</i>	<i>34</i>	<i>44.9</i>
<i>80,001-120,000</i>	<i>11</i>	<i>14.4</i>
<i>120,001-160,000</i>	<i>2</i>	<i>2.6</i>
<i>160,001-200,000</i>	<i>3</i>	<i>3.9</i>
<i>Total</i>	<i>76</i>	<i>100</i>

4.19 Effects of the extension and advisory services on the Nguni cattle development beneficiaries

Provision of drugs had a negatively significant impact at $P \leq 0.05$, this means that a unit change in the provision of drugs leads to a decrease of 5% towards the total annual income of the respondents. The provision of vaccine had a positive significance at $P \leq 0.01$ impact on the dependant variable. This positive relationship implies that an increase in the unit of vaccine leads to 3% unit increase towards the total annual income of respondents. Noah (2002) further confirms that it is very and highly imperative to always vaccinate because it is a major part of cattle production.

Marketing strategies and the marketing opportunities of the beneficiaries of the project were negatively significant at $P \leq 0.05$ and $P \leq 0.10$ respectively which in the result did not conform with the appropriate expectations of the research in which proper training in marketing strategies and access to market was supposed to improve the livelihood of the respondents in the study area through the income generated from farm produce and cattle sales. This could be as a result of a peculiar reason of the study area which is either related to access to market or the quality of the extension and advisory service rendered and received. Cattle production at $P \leq 0.10$ also had a negative significance to the livelihood of the beneficiaries while milk production at $P \leq 0.01$ level of significance also had a negative effect on the beneficiaries. The feeding technique used by the respondents for their cattle was negatively significant at $P \leq 0.10$ towards their livelihood, which is contrary to Chiba (2014), who showed that proper feeding technique for cattle always have a positive significance for the animals which will in return contribute to the farmer's income after sale.

Dipping process was seen to also have a negative significance to the livelihood of the beneficiaries at $P \leq 0.05$. Junquera (2015) highlighted that dipping as a process or procedure remains the most efficient and economic method for periodically treating a very large number of

animals against ticks, flies, mites, lice and other external parasites. This is still the case in many cattle farms in several tropical and subtropical parts of the world, where thousands of cattle have to be dipped monthly or even weekly.

Vaccination technique had a positive significance at $P \leq 0.10$ to the livelihood of the beneficiaries in the study area. This result is further supported by Gunn, Jensen, Williams, Parsons, Hudson and England (2013) that proper procedures and guidelines if followed would always have a great effect on the production and income generations in cattle. The milking technique also was positively significant at $P \leq 0.01$ while hides and skin procedures was significant at $P \leq 0.05$ positively. All of the variables are contributing to the livelihood of the beneficiaries hence improve their well being through their income generation. Table 33 shows the regression analysis.

Fourteen (14) independent variables were used in the regression analysis, Out of these independent variables ten (10) were significant. They include: Provision of drug (0.015), Provision of vaccine (0.002), Marketing strategies (0.031), Marketing opportunities (0.070), Cattle production (0.841), Milk production (0.005), Feeding techniques (0.081), Dipping process (0.037), Vaccination techniques (0.074), and Milking technique (0.000). However, independent variables such as the production of hides and skin, general cattle training and marketing of farm produce were not significant. These could be as a result that extension and advisory service are not well trauned in nguni cattle and also on exploring possible market access in which beneficiaries can sell their farm produce. An increase in the services rendered might increase the beneficiary's income on access to market which will influence the standard of living.

Table 33: Effects of the extension and advisory services on the Nguni cattle development beneficiaries

Number of obs = 74, LR χ^2 (14) = 33.69, Prob > χ^2 = 0.0023, Log likelihood = -49.059237
Pseudo R^2 = 0.2556

Loginc	Coef.	Std.Err.	T	p> t	[95% Conf.	Interval]
DRUG	0.7356918	0.2943924	-2.50	0.015	1.324564	0.1468193
VACCINE	1.043064	0.3144135	3.32	0.002	0.4141432	1.671984
MKTSTRAT	0.5621644	0.2547198	-2.21	0.031	1.07168	0.0526491
MKTOPP	0.1882706	0.1023815	-1.84	0.07	0.3925162	0.0159749
CTLEPRO	0.0130365	0.064827	0.20	0.841	0.1427098	0.1166368
MLKPRO	0.2391416	0.0829483	-2.88	0.005	-0.405063	0.0732203
HIDESSKIN	0.0891704	0.0609652	1.46	0.149	0.0327781	0.211119
GENTRAIN	-0.091309	0.0591986	1.54	0.128	0.0271059	0.2097239
FEEDTECH	0.1071719	0.060343	-1.78	0.081	0.2278759	0.013532
DIPPROC	0.1670248	0.0784466	-2.13	0.037	0.3239414	0.0101083
VACCTECH	0.3438676	0.189149	1.82	0.074	0.0344868	0.722222
MILKTECH	1.144874	0.1391917	8.23	0.000	0.8664493	1.423299
HDSKINPRO	0.1440233	0.0693982	-2.08	0.042	0.2827046	0.0053421
MKTFRMPRO	0.1148897	0.1624228	0.71	0.482	0.2100043	0.4397838
cons	11.15882	0.8252472	13.52	0.000	9.508079	12.80956
Sigma	0.4647876	0.038634			0.387508	0.5420671

4.20 Effects of the socio economic characteristics on Nguni cattle development

The results as presented in table 34 further showed that gender had a positively significance at $P \leq 0.05$, this means that a unit increase of gender in the study area leads to an increase in total farm revenue. Land-ownership had a negatively significance at $P \leq 0.10$, this could be attributed to majority of the beneficiaries not rearing the cattle on their own land rather on leased or rented farms. Contrarily, the size of farm in hectare had a significant positive impact at $P \leq 0.01$ which could imply that the size of the farm has a carrying capacity for the number of Nguni cattle as they increase. Cattle rearing experience had a positive significance at $P \leq 0.05$, which implies that a unit increase in the years of cattle rearing experience of respondents means that a unit increase

also is recorded in the livelihood of respondents. The farming experience was negatively significant at $P \leq 0.10$ and this could imply that some respondents did not have any farming experience before becoming the Nguni cattle project beneficiaries.

Extension visits also had a positive significant impact at $P \leq 0.10$, this implies that access to extension service and advisory service by respondents will improve the living standard and increase production. However, some of the variables were not significant, and these included age, marital status, educational level and household size which can imply that this socio-economic characteristic do not contribute to the effect of Nguni cattle development project.

Table 34: Effect of respondent's socio-economic characteristics on Nguni development project beneficiaries

Number of obs= 74, F (9, 64) = 4.74, Prob> F = 0.0001, $R^2 = 0.5002$, Adj $R^2 = 0.4159$

Loginc	Coef.	Std.Err.	T	p> t	[95% Conf.	Interval]
AGE	0.0297421	0.1007655	0.30	0.769	0.1715601	0.2310444
GENDER	0.3952101	0.1547542	2.55	0.013	0.0864839	0.7039362
MARISTA	0.0021693	0.0668538	0.03	0.974	0.1313865	0.135725
HHS	0.0280927	0.0256419	1.10	0.277	0.0231329	0.0793184
LNDOWN	0.2520691	0.137475	-1.83	0.071	0.5263962	0.022258
HECTARES	0.0008534	0.0001704	5.01	0.000	0.000513	0.0011937
REAREXP	0.0693957	0.0290114	2.39	0.019	0.0115194	0.1272719
FARMEXP	0.0138945	0.008252	1.68	0.097	0.0303701	0.0025811
EXTVST	0.183354	0.0961619	1.91	0.061	0.0086394	0.3753474
_cons	10.21664	0.2447598	41.74	0.000	9.727676	10.7056

The adjusted R^2 was 50.0% meaning that only 50% of the changes that occurred in the dependent variable were explained by the selected independent explanatory variables.

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CHAPTER 5

5.1 SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1.1 Summary

This study focused on the assessment of extension and advisory services on Nguni development project beneficiaries in the North-West Province of South-Africa. Stratified random sampling technique was used to select 128 respondent out of 76 were willing and actually participated, Because of the stratification by the Nguni development project, beneficiaries from each project site had an equal chance of being selection. The structured questionnaire was used for data collection. The mean active age of the respondents was found to be between 51-60 years with an average of 55 years. It was discovered that the project was male dominated. Most of the beneficiaries were married, with the mean household size of 4 and 30.3% of the respondent had between 11-20 years of experience in farming.

The efficiency of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed and responsive to the ever-changing social, economic and political environment. This study focused on the assessment of extension and advisory services on Nguni cattle development project beneficiaries in the North-West Province of South-Africa. Random sampling technique was used and out of the total number of 187 beneficiaries in the project, a sample size of 128 beneficiaries was selected and only 76 beneficiaries participated in the study. The result showed that the average age of the respondents was found to be 55 years, male dominated, married with an average household size of 5 and 30.3% having between 11-20 years of farming experience. The beneficiaries had an average farm size of 400.5 hectares, 3-5 years of cattle rearing with majority (85.5%) recording a mortality rate of between 1- 3 cattle on their farms. The results further showed that 96.1% had access to extension and advisory services with 82.9% having improvements in vaccination techniques and cattle production areas, 93.4% kept Nguni cattle for the purpose of beef production, generating an average of R 50,000 as the total annual income. Gender, cattle rearing experience and extension visits had a positive significance at $P \leq 0.05$, and $P \leq 0.10$ respectively. Furthermore, land ownership was negatively significant at $P \leq 0.10$ affecting the performance of the project on increased productivity and income generation. The total annual income was influenced positively through the provision of vaccines and vaccination techniques at $P \leq 0.01$ and $P \leq 0.10$ respectively. Marketing strategies and opportunities were negatively significant at $P \leq 0.05$ and $P \leq 0.10$ respectively. The receptiveness of extension and advisory services by the respondents has contributed positively towards the project and generation of annual income.

5.1.2 Conclusion

From the research findings, it can be concluded that extension and advisory services contributed both directly and indirectly to the success of Nguni cattle development project by the provision of advises and information dissemination to the respondents. The results further showed both positive and negative level of significance regarding beneficiaries. The major reason why farmers kept Nguni cattle was for beef production, the impact of proper vaccination techniques and timing contributes towards the success of the programme. From the total income distribution of respondents, the results show that respondents generated sufficient income which assisted in respondents to continue to build a strong pillar of encouragement and to further continue participating in the programme by investing more of their time and financial resources into it.

In addition, it can be concluded that extension and advisory services played an important role in the Nguni cattle development project and it is evident in both positive and negative levels of significance which also has had the its effect on the well being of the beneficiaries due to amount generated from sales of produce.

5.1.3 Recommendations

Based on the findings, it is therefore recommended that:

1. Beneficiaries of Nguni Cattle Development Project should be increased and encouraged by aggressive dissemination of information through extension officers;
2. Continual subsidisation of vaccines by the government;
3. Better communication strategy between extension officers and beneficiaries should be developed to allow and foster better interaction in order to disseminate information on new or improved rearing techniques;
4. More and regular visits by extension officers to the beneficiaries;
5. Increased marketing opportunities and facilities should be identified to improve and encourage respondents in accessing and selling off their farm produce;
6. More infrastructure support should be provided in assisting the respondents to contribute to increased beef production;
7. Through extension and advisory services, the government should support and provide more funding to the respondents during natural disasters such as drought which kills animals and highly impact and affect production;
8. Further training programmes should be given to extension officers on Nguni cattle in other to assist them in disseminating timely information to the beneficiaries;
9. Introduction of drought relief fund for Nguni cattle development will go a long way in assisting farmers to deal with the loss of animals;

10. Extension and advisory services should continue promoting to raise pure breed Nguni cattle; and
11. Further research should be conducted to determine the effects of lack of market opportunities and income generation

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APPENDIX

NORTH-WEST UNIVERSITY MAFIKENG CAMPUS, DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION QUESTIONNAIRE ON THE ASSESSMENT OF EXTENSION AND ADVISORY SERVICES ON NGUNI DEVELOPMENT PROJECT BENEFICIARIES IN THE NORTH-WEST PROVINCE

Questionnaire number:

Municipality:

Date of interview:

Dear sir/ma,

Your assistance is required in providing correct answers to the following questions. The researcher is a student of the above mentioned department and school. Your answers will be confidentially treated and used for academic purpose only. Thanks and Regards!

INSTRUCTION: Please write and tick where appropriate

A. DEMOGRAPHIC AND SOCIO- ECONOMIC CHARACTERISTICS

1. Location: _____
2. Age (Years): _____
3. Gender: (a) Male [] (b) Female []
4. Marital Status: (a) Single [] (b) Married [] (c) Separated [] (d) Divorced [] (e) Widowed []
5. Educational level: (a) Matric [] (b) Diploma [] (c) Degree [] (d) Other []
6. Household size:
7. Farming Experience in (years):
8. Do you own land? (a) Yes [] (b) No []
9. How many hectares of land do you own?
10. If no, where do you farm on? (a) Family land [] (b) Communal land [] (c) Lease land [] (d) Other, please specify

B. CATTLE REARING

11. When did you apply for Nguni cattle? _____
12. How many cattle did you receive? _____
13. For how long have you been looking after your cattle? _____
14. Do you have any mortality rate recorded? (a) Yes [] (b) No []
15. If yes, how many casualty as been recorded? (a) 1- 3 [] (b) 3- 6 [] (c) 6 or more []
16. How often do you feed them? (a) Once daily [] (b) Twice daily [] (c) Thrice daily []
17. What do you feed them with? _____

C. ACCESS TO EXTENSION SERVICES

18. Do you have access to extension advice? (a) Yes [] (b) No []
19. How many times do you get this extension services visit per month? (a) Everyday [] (b) Weekly [] (c) Fortnightly [] (d) Once a month []
20. Who provides you with these extension services? (a) Government [] (b) Private [] (c) Others (specify) _____

21. From the table below, indicate which extension and advisory services you received

Extension and Advisory Service	Frequency of Availability				
	Always	Most of the time	Often	Rarely	Not at all
1. Provision of Drugs					
2. Provision of Vaccines					
3. Marketing strategies					
4. Marketing opportunities					
5. Cattle production					
6. Milk production					
7. Production of hides and skin					
8. General Training on cattle rearing					

22. How often do you use the following extension advisory services from the table below?

Extension and Advisory Services	Frequency of use				
	Weekly	Forth-Nightly	Monthly	Yearly	Not at All
1. Feeding techniques					
2. Dipping processes					
3. Vaccination techniques					
4. Milking procedures/techniques					
5. Hides and skin procedures					
6. Marketing of farm produce					

23. From the table below, indicate the degree of helpfulness of the Extension Advisory services to you

Constraints	Degree of helpfulness of the services on the constraint			
	Very well	Fairly	Poorly	Not at all
1. Non availability of food				
2. High transaction cost				
3. Veld fire				
4. Theft of animals				
5. Poor access to information				
6. Disease infestation				
7. Lack of market availability				
8. Predators invasion				
9. Lack of pasture availability				
10. Poor condition of livestock				
11. Lack of Infrastructure				
12. Low income				
13. Poor access to extension service				
14. Poor access to veterinary service				

24. Do the Extension and advisory service help in improving your cattle? (a) Yes [] (b) No []
25. If yes, indicate the area of improvements you had: 1. Milking/diary processes [] 2. Cattle production [] 3. Marketing practice [] 4. Hides and skin production [] 5. Feeding techniques [] 6. Vaccination techniques [] 7. Others specify.....
26. In your opinion, how can extension and advisory services rendered be improved?
.....

D. VACCINATION PROGRAMME

27. Do you vaccinate your cattle? (a) Yes [] (b) No []
28. If yes, how often do you vaccinate your cattle? (a) Before calving [] (b) After calving [] (c) Before weaning [] (d) After weaning [] (e) Other, specify
29. If no, please specify why
30. Are the vaccines always available at your disposal? (a) Yes [] (b) No []
31. If yes, how much do you pay for the vaccines?
32. If no, please specify why?
33. Below is a list of vaccines available, indicate the frequency of their availability to you for use:

Availability of Drugs/Vaccines	Frequency of Availability				
Drugs/vaccines	Every time I need them	Most times	Often times	Rarely	Not at all
1. <u>20/20 Vision 7</u>					
2. Anthrax/ lebeth					
3. Anaplasmosis/ Gall sickness					
4. Brucela/ Photso					
5. Blackquater/ Serotswana					
6. Botulism/ Mokokoma					
7. Lumpy skin/Lumpyvax					
8. <u>Nobivac 3-Rabies</u>					
9. Pasteurella					
10. Corynebacterium pyogenes					
11. Calf paratyphoid					

E. CORE ACTIVITIES OF NGUNI DEVELOPMENT

34. Why do you keep Nguni Cattle? (a) Dairy [] (b) Beef [] (c) Hides/skin [] (d) Others []
35. Did you receive any financial assistance when starting your cattle rearing? (a) Yes [] (b) No []
36. If yes, from where? (a) Government [], If yes, how much? _____
(b) Bank [] If yes, how much? _____
(c) Cooperatives [] If yes, how much? _____
(d) Others (Please specify) _____
37. If no, then how did you start your cattle rearing? Please specify.....
38. Have you attended any training programme(s) on cattle rearing before? (a) Yes [] No []
39. If yes, where? Please specify.....

F. MARKET ACCESS AND INCOME GENERATION

40. Do you have access to the market? (a) Yes [] (b) No []
41. If yes, where do you sell your cattle? (a) Funerals [] (b) Weddings [] (c) Auctions []
42. If no, what are the reasons for you not selling? (a) Lack of Transportation [] (b) High Mortality rate [] (c) Theft [] (d) Others []
43. How much income do you generate when you sell?
(a) <R1000.00 [] (b) R1000.00 - R1500.00 [] (c) >R1500.00 []
44. Do you belong to any cooperative society or social group that speaks on your behalf in terms of assistance and any other related matters? (a) Yes [] (b) No []
45. If yes, what specific assistance do you receive from your cooperative society and groups?
(a) Free money [] (b) Loan [] (c) Free cattle calves or breeds [] (d) Free livestock feed []
(e) Advisory extension services [] (f) Others (specify).....
46. How receptive are you as a cattle rearer to extension and advisory services around you: (a) Excellent [] (b) Very good [] (c) Good [] (d) poor []
47. Suggest other areas where you as a cattle rearer need improvement from intervention of Extension and Advisory services:
48. Total annual income (rands):