RESEARCH AND DEVELOPMENT PLAN FOR THE

LARGE STOCK AND SMALL STOCK MEAT INDUSTRIES IN SOUTH AFRICA

RED MEAT RESEARCH AND DEVELOPMENT (RMRD)

PLANNING COMMITTEE (R & D)

CATTLE AND SMALL STOCK

Version 2016-2018

Contents

1 EXECUTIVE SUMMARY

The Red Meat Industry acknowledges the need for Research and Development (R & D) and technology transfer. As there is invariably a scarcity of funds to do these, systems were implemented through which the industry contributes financially to R & D projects of merit. The funds available derive from the interest on the Red Meat Research and Development Trust (RMRDT) of South Africa and from statutory levies. The Red Meat Industry Forum (RMIF) applied for the establishment of these levies on slaughter stock and their products.

This document serves as business plan for R & D for the large stock (cattle) and small stock (sheep and goats) meat industries and was originally compiled in 2004, by the Planning Committee (R & D) Cattle & Small stock. The plan is revised annually and the most recent version should be used as a guide.

INDUSTRY VISION

To support profitable and sustainable large and small stock industries to contribute to the national economy and to social wellbeing.

RESEARCH MISSION

To provide the South African large and small stock industries with the latest scientific advancements to maintain their global competitiveness.

To develop world-class research, development and technology transfer programs to address the following focus areas:

Focus Area 1: Sustainable natural resource utilisation

Focus Area 2: Livestock production with global competitiveness;

Focus Area 3: Animal health and welfare;

Focus area 4: Animal products - quality and safety, nutritional value and preference;

Focus Area 5: The economics of red meat consumption and production in South Africa;

Focus Area 6: Predation Management; and

Focus area 7: Livestock theft prevention.

2 BACKGROUND AND DEVELOPMENT IN THE SOUTH AFRICAN RED MEAT INDUSTRY REGARDING THE FUNDING OF RESEARCH AND DEVELOPMENT

Since the 1930's, when the Meat Board supported the developmental research of the Dorper sheep, the organised Red Meat Industry in South Africa has contributed financially to R & D. Through ensuing years, the Meat Board and various individual organisations such as the cattle breeders' associations funded the establishment and functioning of Livestock Improvement Schemes i.e. the Central Performance Testing Stations for beef cattle, research facilities (at universities and the Meat Industry Centre at Irene) contributed to the execution of numerous research projects - many leading to post graduate qualifications of research personnel. Subsequent to the demise of the Meat Board the South African Meat Industry Company (SAMIC), the Red Meat Research and Development Trust (RMRDT) of South Africa and since 2006, the Red Meat Industry Forum (RMIF) of South Africa contribute financially to R & D concerned with red meat production processes and products derived from red meat producing livestock. The Red Meat Industry does not do the research itself but through RMRD SA structures outsources the task to recognised research institutions, such as institutes of the Agricultural Research Council (ARC), universities and Provincial Departments of Agriculture.

2.1 Structures concerned with R & D

The following structures are involved in the planning of R & D, obtaining and distributing of funds, and is depicted in Figure 1:

- Red Meat Industry Forum (RMIF) member representatives;
- Red Meat Levy Administration (RMLA);
- Red Meat Research and Development Trust (RMRDT);
- Red Meat Research and Development Project Committee (RMRD-PC);
- Red Meat Research and Development: Planning Committee (R & D) Cattle & Small stock; and
- Red Meat Research and Development: Planning Committee (R & D) Pork.

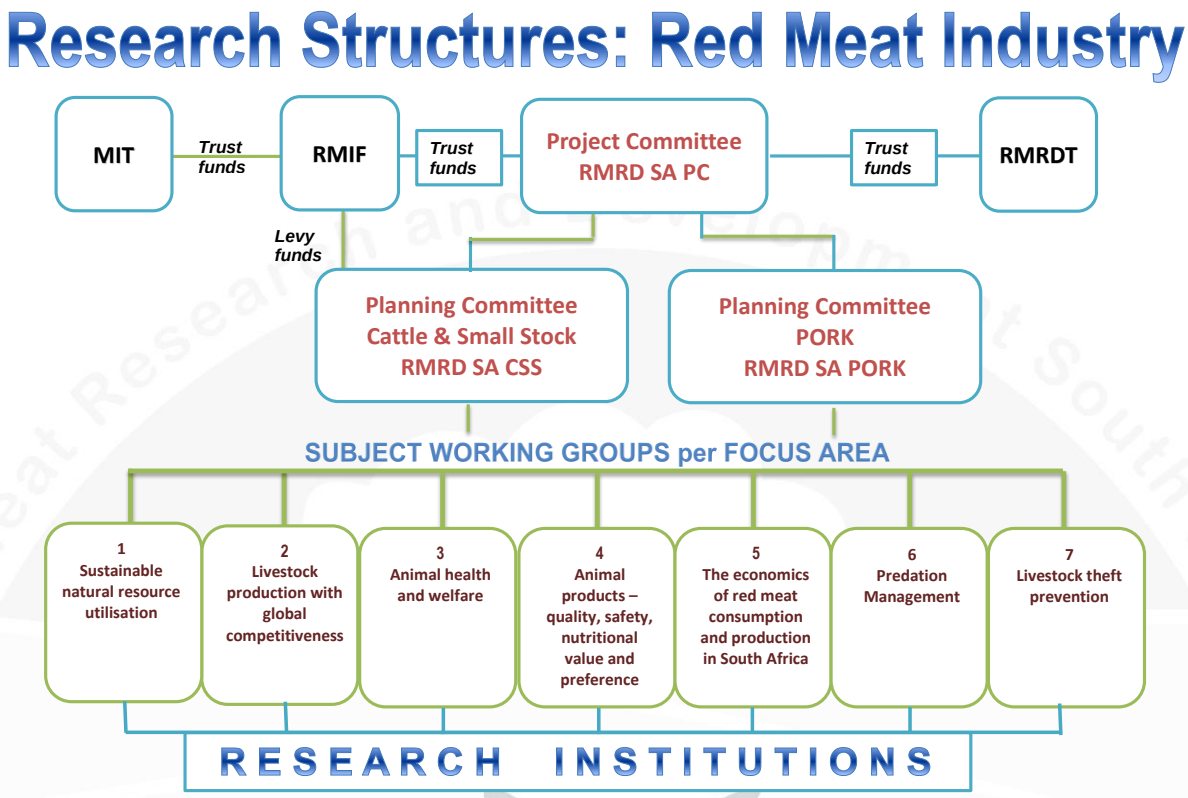


Figure 1: Research structures in the Red Meat Industry involved in the planning of R & D, obtaining and distributing of funds.

2.1.1 RMIF and RMLA

The Red Meat Industry Forum (RMIF) of South Africa represents all the nationally representative role player organisations and associations within the entire red meat value chain. Currently the RMIF Council consists of representatives from 13 voluntary member organisations and service level agreements are signed with 14 service providers. The RMIF was established in 1994 when the Agricultural control boards were disbanded and it was formally constituted in 1997 in accordance with the provisions of the Marketing of Agricultural Products Act, 1996 (Act no. 47 of 1996) as amended. It is thus regarded by government as a directly affected party. The key purpose of the RMIF is to negotiate for an enabling regulatory environment, to formulate Industry policy and strategy, to facilitate compliance to legislation, to identify, appoint and monitor service providers and to assist in sourcing funding to deliver on the mutually agreed essential functions to maintain a viable Red Meat Industry.

The Red Meat Industry determined a need for the continuation of a number of essential functions previously executed by the now disbanded Meat Board. In the period following 1994 certain of these functions were executed by SAMIC funded by the Meat Industry Trust (MIT) and then later some of the major industry role player organisations agreed to fund these functions on a Rand to Rand basis with the MIT as the Trust's capital base was being eroded. This funding method was an interim measure and not sustainable in the long run. In March 2005 the RMIF submitted an application for the introduction of a Proportional Transaction statutory levy in terms of the Marketing of Agricultural

Products Act, 1996 (Act No. 47 of 1996) as amended. In order to enhance the efficiency of levy administration and information collection, two ancillary statutory measures, namely registration and information collection, and the keeping and rendering of records and returns were also requested. The levy and measures are applicable within the boundaries of the Republic of South Africa and to red meat, red meat products (excluding hides and skins), processed pork imported into South Africa and live livestock exported from South Africa. The first levy period was from August 2005 to October 2007, the second levy period was from October 2007 to November 2010, the third levy period was from November 2010 to November 2014 and the fourth statutory levy application was approved by the Minister of Agriculture, Forestry and Fisheries on the 11th of November 2014 for a four year period.

The Red Meat Industry recognised that R & D and technology transfer should be done continuously on red meat production processes and on the products derived from red meat producing livestock. Therefore, R & D was acknowledged as a mutually agreed essential industry function and has been funded by a portion of the statutory levy collected and managed on behalf of the Red Meat Industry by the Meat Statutory Measure Services (MSMS).

MSMS is an organisation incorporated under section 21 of the Companies Act, 2008 (Act No. 71 of 2008) and was established on 16 August 2007 to manage the administration and enforcement of the Red Meat Levy Notices. The affairs are managed by a Board of Directors of 5 members elected by the 13 nationally representative role player organisations of the RMIF. The key purpose of MSMS is to serve, protect and promote the interests of all designated levy payers and the nationally representative role player organisations of the RMIF to maintain a viable Red Meat Industry.

MSMS contracted a private company, Red Meat Levy Administration (Pty) Ltd. (RMLA) to execute the administrative component entailed in the above function. RMLA oversees the collection and administration of the levy process. RMRD SA was appointed by the RMIF on submission of approved business plans and budgets for research projects by the Planning Committee (R & D) Cattle & Small Stock and the Planning Committee (R & D) Pork. This business plan contains the framework under which research projects can be conducted. The RMLA has similarly been appointed by SAPPO (South African Pork Producers Organisation) to collect a statutory levy per slaughter pig or live pig exported which are managed and allocated separately to the Planning Committee (R & D) Pork by SAPPO itself. A separate business plan has been developed for pork. As funds become available from the levy collections, RMLA transfers funds for the research function into the accounts of RMRD SA for further distribution to research projects at designated research institutions.

2.1.2 RMRDT

The Red Meat Research and Development Trust (RMRDT) of South Africa was established in 1997, through the initiative of the Meat Board's members in preparation for the envisaged closing of the Board in accordance with the Marketing of Agricultural Products Act, 1996 (Act no. 47 of 1996) as amended. The Meat Board donated R15 million to the Trust. The interest on this capital plus monies accrued over time has been used annually to fund research projects of merit. The Trustees of the Trust manage the financial affairs (including proper investment of funds), approve the research

projects budgets as compiled by the two Planning Committees, and make the funds available for the research projects to be conducted by the research institutions. Since 1998, between R1 million and R2.5 million has been allocated annually to R & D projects.

2.1.3 Project and Planning Committees and SAPPO's Portfolio Committee

Various committees have been formed in an advisory capacity to the RMRDT Trustees and the RMIF Council on R & D spending. These committees are representative of the various RMIF voluntary member organisation representatives, as well as of the groupings in the research fraternity (ARC and Universities). The committees identify the research required, evaluate and prioritise research project proposals and protocols, consider and approve budgets for individual projects, monitor progress and finally evaluate final reports of research projects. Eventually these committees inform the RMRD SA Project Committee (RMRD-PC) which projects should be funded. (Visit www.rmrdsa.co.za to view a list of R & D projects that have been funded since 1998). In addition SAPPO has an R & D Portfolio Committee which functions parallel to the Planning Committee (R & D) Pork.

2.1.4 RMRD SA

A. Planning committee

The Planning Committee (R & D) Cattle and Small stock is appointed by the Project Committee and consists of subject specialists and industry representatives. The Planning Committee moderates and approves the recommendations of the different Working Groups and is responsible for the final acceptance, prioritisation and allocation of funds to the different projects. The RMRD SA CSS will be composed as follows:

- All member organisation of the RMIF may nominate a representative;
- Two representatives from the Department of Agriculture, Forestry and Fisheries, the 1st representing cattle and the 2nd representing small stock;
- Three representatives from Higher Education South Africa (HESA), the 1st member representing agriculture and economics, the 2nd member representing animal health and the 3rd representing animal production;
- Two representatives from the Agricultural Research Council (ARC), the 1st member representing animal health and the 2nd representing animal production;
- Chairman of the PC (Project Committee);
- The RMRD SA Administrator;
- A representative of the food industry; and
- Convenors of subject working groups as specialists in their own right.

Any one member may represent more than one organisation at any time.

B. Subject Working Group (SWG)

Working Groups have been established to deal with the 7 focus areas, each with their respective areas of speciality. The committee members do not represent any institution or

group, but are on the committee due to their expertise and knowledge with the aim to evaluate the science of the research projects. The individual members are all experienced and have a very definite interest in research and vast industry knowledge. They operate independently and select projects for funding. To diversify the skills of the SWG and without losing scientific merit of the skills, members can be from the same institution but must be from different departments. One person can also not serve on two subject working groups, unless he/she is a convenor on a SWG and a member on another group.

Their function is to do the detailed work on research needs, project planning, evaluation, monitoring and budgeting as required by the Planning Committee.

The tasks of a subject working group include:

- Identification of research needs;
- Evaluating project proposals;
- Prioritising projects;
- Evaluating project protocols;
- Allocating funds to specific projects;
- Evaluating project progress and final reports; and
- Ensuring that results are made known.

SWGs only apply to the different areas of research for Cattle and Small Stock. No SWG exists for Pork.

2.2 Overview of the South African Red Meat Industry

South Africa comprises a total surface area of 1 224 997 square kilometres or 122.5 million hectares. Of this, approximately 84 percent or 103 million hectares is available for farming. A large part of the Republic is not suitable for crop cultivation, with the result that approximately only 11 percent can be cultivated. The greater part of South Africa, about 59 million hectares in total, is only suitable for extensive livestock farming, be it beef cattle, sheep, goats or game. It is therefore not a coincidence that the Integrated Sustainable Rural Development Strategy (ISRDS, 2004) identified livestock farming as the agricultural enterprise with the most likely chance of improving household food security and addressing poverty alleviation in the small-scale communal farming areas of South Africa.

The gross value of livestock products' contribution of total agriculture production has increased from 42% over the period 1995/2000 to 47% over the period 2006/2010. The demand for red meat has increased from 828 thousand tons in 2001/1 to 1197 thousand tons in 2008/9, with the per capita consumption increasing from 18.4kg to 24.5kg over the same period (Meissner et al. 2013). Of the 38 500 commercial livestock farms and agricultural units in South Africa, 12 000 are cattle farms, with 3 700 sheep (mutton) farms and 1 180 goat (meat) farms. Combined the employed 67 550 or 28% of the 245 000 people are employed in the livestock sector.

2.2.1 Animal production in the world compared to Africa and the RSA

Currently South Africa produces 21.4% of the total meat produced on the continent of Africa and 1% of global meat production. With a livestock industry contributing 34.1% to the total domestic agricultural production and providing 36% of the population's protein needs, it is logical that the Red Meat Industry has reached a stage where not only quantitative aspects of production are important but more emphasis will have to be placed on the biological and technological aspects affecting meat quality characteristics. It is vital to take cognisance of changing consumer tastes and preferences in dynamic local and international markets, therefore market and consumer related research is of utmost importance.

2.2.2 Gross value of certain individual agricultural products

During a 12-year period (1998 to 2010) the contribution of livestock to the total gross value of agricultural production has increased from 42% to 47%. The contribution of red meat to the total value of production of livestock products increased from about 25% in 1998 to over 30% in 2010. In terms of the total value of production, the Red Meat Industry's contribution increased from around 11% in 1998 to nearly 15% in 2010. The largest contributor was from cattle followed by sheep then goats and lastly pigs. Not only has the aggregate demand for red meat increased faster than the other agricultural and livestock products, but also the daily per capita consumption. The consumption of beef has increased from 33.7g/capita/day in 2000/1 to 46.8g/capita/day in 2010/11, an increase of 39%. While four times as much as that of pork in absolute terms, the increase in beef consumption per capita grew less than that of pork, which increased from 7.12g/capita/day to 12.6g/capita/day in 2010/11, an increase of 77%. The consumption of mutton and goat meat has declined marginally over the period, in comparison to white meat which increased by 62%.

From 2005/06 to 2010/11 the share of consumers' food consumption expenditure allocated to meat purchase increased slightly from 25.2% to 25.3%, while the share allocated to bread and cereals increased from 20.8% to 24.2%. During this period the share of total consumption expenditure allocated to food decreased from 14.4% to 12.8% (Statistics South Africa Income and Expenditure Surveys 2005/06 and 2010/11).

2.2.3 Scope of the Industry

The availability of statistics, and in particular that applicable to herd size, herd composition and the number of animals slaughtered, pertaining to the large and small stock sector remains a problem. Data published by the National Department of Agriculture, Forestry and Fisheries is according to several experts in the Red Meat Industry not an accurate reflection of the actual state of affairs in the Industry. Industry stakeholders are working together with the relevant government departments in an effort to rectify and improve statistics pertaining to the Red Meat Industry.

Global red meat consumption has trebled over the past four decades and increased by about 20% in the last 10 years. Similarly in South Africa, red meat consumption has increased by about 20% since

the early 1990's, and is projected to increase by a further 20% by 2023. Between 2007/08 and 2012/13, the gross value for beef and sheep meat increased by about 60% and 49% respectively.

Cattle numbers in South Africa ranged between 13.4 and 14.5 million head between 1996 and 2014 with 2014 estimated at 13.9 million head of cattle. The total number of animals slaughtered, however, varies greatly between 1.9 and 3.4 million head, with the average over the last five years being 3 million head. While the cattle herd in total is reasonably stable, the cattle sub-sector is highly dualistic. According to expert opinion 35 to 40 % of the total herd is owned by subsistence or emerging farmers thus approximately 5.5 million animals. Research on several aspects of the emerging sector has shown that this sector has not reached its full potential. For example it is estimated that off-take in this sector varies between 7.5 % and 10 %, which is significantly lower that the estimated 25 % in the commercial sector. As a result of the high mortality and low breeding rates, the cattle production amongst the small, emerging and subsistence sectors are declining. This is mainly as a result of poor genetic material and breeding patterns, disease, and inadequate marketing mechanisms. It is further estimated that a 50% improvement in veld and herd management in the communal sector could double the current production of livestock and livestock products. Production support of struggling commercial and smallholder farmers could therefore contribute to local economic development, and growth of the sector at large, while infrastructure such as strategically placed abattoirs can enhance participation and development.

Sheep numbers have declined from more than 29 million in the 1970's to 24 million currently, with about 4.6 million being slaughtered each year. An estimated 13% of the animals are in the subsistence and emerging sector; and this number is also declining over time. The main reasons for the drop in sheep numbers is stock theft and predation i.e. the financial implication of the latter caused farmers to invest in other agricultural enterprises.

Goat numbers are between 6 and 7.5 million and estimated to be on the increase. There is a rather dramatic shift from sheep (for mutton) to goat meat underway, since goats tend to be more hardy and resilient facing increasing adverse climatic conditions.

The growth in the game industry is increasingly impacting negatively on livestock numbers, especially commercial livestock numbers. Of all the livestock commercial units, 7 500 are in the game industry rapidly approaching the number of that of cattle, namely 12 000.

Total beef consumption is approximately 889 000 tons and total sheep meat, mutton and goat meat consumption approximately 180 000 tons. Consumption of beef and sheep meat per capita is respectively 16.7 and 3.7 kg; this is slightly up from the year 2000. Total beef and red meat per capita consumption as reported by the National Department of Agriculture, Forestry and Fisheries is significantly higher, but as indicated it is believed that this is an over estimation. An important observation is that the current figures on consumption indicates that the decline in total and per capita consumption has probably been reversed, but that much still needs to be done to ensure sustainable growth in consumption.

South Africa remains a net importer of all products derived from large and small stock. Imported beef averaged around 32 000 ton per year since 2003 (this includes meat from other SACU countries). Weaner calves imported from Namibia varied significantly, but on average imports totalled 170 000 annually since 2003. Sheep meat imports into South Africa average 50 000 tons annually since 2003. Cognisance should be taken that the introduction of the Namibian Small Stock Marketing Scheme had a significant impact on the number of live animals imported, i.e. since 2004 with the introduction of the Scheme live imports from Namibia had declined significantly, to one live animal: six carcasses. Total amount is 1 million irrespective of carcasses or live animals.

An important issue to take cognisance of within the South African socio-political-economic environment is that the potential of the animals in the subsistence and emerging sub-sectors has not been unlocked.

2.2.4 Towards new horizons for the Industry

The sustainable production of food has become an issue of much attention and research given the rapidly increasing demand, as indicated earlier, yet dwindling resources. Some of the main challenges and concerns for consideration are:

- Natural resource use and environmental impact;
- Intensification of livestock production;
- Genetic pool;
- Land and labour reform; and
- Sustainable production.

- **Natural resource use and environmental impact**

Agriculture in South Africa uses about 63% of freshwater and occupies 79% of the country's total land area making it one of the sectors with the heaviest environmental footprint. Additionally, nutrient levels exceed recommended water quality guidelines for plant life in all but one of South Africa's 20 largest river catchments. Many studies have highlighted the occurrence of pesticides in water resources as well as its possible effects on food safety and public health. Agriculture also contributes to 5% of the country's total net greenhouse gas emissions, mainly through enteric fermentation in ruminant animals.

Available water resources, within the context of climate change (generally speaking implying for the most part hotter days accompanied with shorter but more intense rainfall events, shifting seasons, a shorter rainfall period, and more intense drought events), leading to favourable conditions for the rampart growth and spread of invasive organisms, including invasive alien plants, but also disease vectors, are but a few of the daunting challenges the livestock farmer is facing, and increasingly so. The livestock farmer has to adapt to these changes and mitigate the impacts of declining productive capacities.

- **Intensification of livestock production**

Given the demand pull and increasing cost of livestock production, the need for reducing the unit cost of production with an increasing number of livestock being produced in intensive production systems has intensified over the past couple of decades. This intensification of the livestock production does not come without its associated challenges, such as concerns on animal welfare, antibiotic residues, growth promotants, environmental issues and a rise in biosecurity-related risks and other unintended consequences of the intensification process.

- **Genetic pool**

While well-controlled among the top-end stud-farmers, the issue of an increasingly narrow gene pool of the animals herd among smaller-scale, emerging and subsistence farmers is a challenge. A lower fertility rate, reduced rate of growth, and thereby the lower volumes of livestock products produced per unit of area per hectare is leading to a further reduction in sustainability.

- **Land and labour reform**

The economic production of livestock, actually of any commodity, requires market stability. Without this stability within the marketplace the sustainable production of livestock is at risk. Such risk, given the importance of food production, is not only a risk to the sector, but to the national economy.

- **Sustainable production**

The sustainable production of livestock implies appropriate actions that will lead to increasing the volume of livestock products per unit of land and water use combined with an improvement in animal health and decline in pollution and chemical use.

This implies that for the most part much of the top-end stud and commercial farmers are at the threshold of what is possible in terms of meat production, yet the challenge is to do so using fewer resources/inputs. There remains a vast opportunity, however, through improved genetic material and better management systems to increase the production among especially small, emerging and subsistence farmers. This will require innovative systems of extension from state departments together with skills transfer in co-operation with farmers of different scales.

2.3 Red meat value chains

The consumer's decision to buy meat products forms the basis of and is the initiating event in the subsequent development of the Red Meat Industry value chain. Due to the heterogeneous composition of consumer groups, consumers have widely divergent expectations of the product, their understanding of "value" being the most important criteria i.e. the quantity and quality characteristics of

the product relative to other types of food and consumer commodity options. In this value package the consumer requires a reasonable price in a marketing service that is attractive and contains the necessary information. Ultimately the consumer eats meat because he / she enjoys it.

The quantity and quality characteristics of red meat that eventually reach the consumers are affected by one or more of the various pre-slaughter and post-slaughter factors. These factors are the genetics, physiology and environment of the animal, the slaughtering process; and finally the storage, processing, marketing and consumption conditions of the meat products. Figure 2 shows the links in the beef value chain as an example, namely producers, middlemen and consumers.

Agriculture has some of the strongest backward, forward and employment multipliers in the economy. This makes agriculture, and notably livestock production being the dominant sector, of strategic importance. Not only for food production and food security, but also for the national economy.

The main components of the beef value chain include feed manufacturers and distributors, commercial and emerging producers, feedlots, auctioneers, abattoirs, butchers, other meat processors, exporters, importers, wholesalers, formal retail and informal retail. The beef supply chain has become increasingly vertically integrated, with the major market players (especially feedlots) owning not just their own feedlots, but also abattoirs, processors, tanneries and distributors. Some feedlots have integrated further down the value chain selling their branded products directly to consumers through their own retail outlets.

The previous dominant role of the auction system, where wholesalers bought carcasses, has disappeared since deregulation. Wholesalers are now increasingly purchasing live slaughter animals directly from farmers or feedlots on a bid-and-offer basis (i.e. they take ownership of the animal before the animal is slaughtered). The animal is then slaughtered at an abattoir of the wholesaler's choice and the carcass is subsequently distributed to retailers.

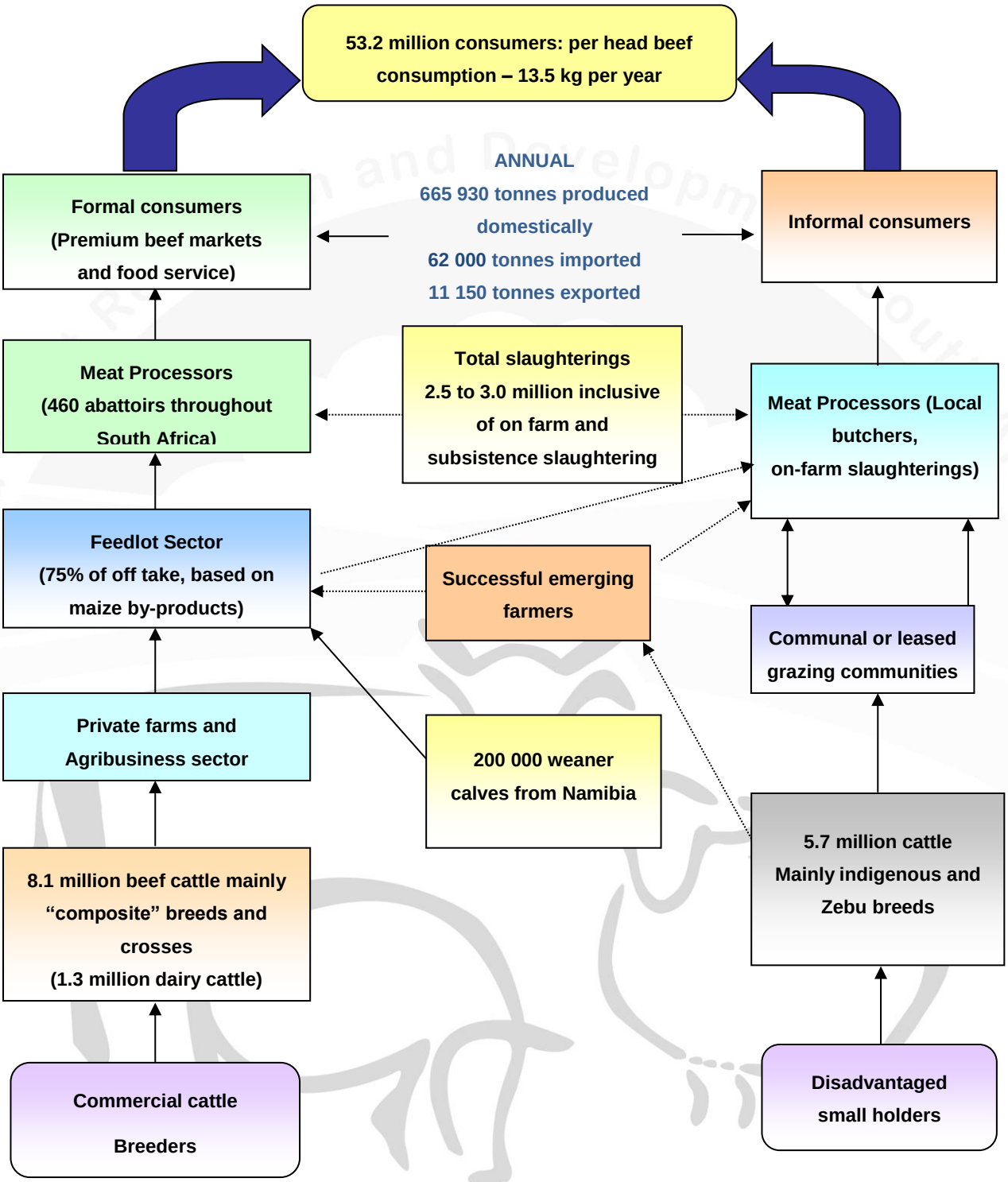


Figure 2: Beef Value Chain (Figure adopted from Dave Ford with values provided by BFAP, 2013)

With the tremendous growth in the beef industry over recent years, fuelled by the rising demand from a more affluent middle class, there has also been an increase in the number and capacity of abattoirs. Abattoirs are part of either the formal system (feedlots, wholesale, municipal) or they are owned by

farmers and small businesses (informal). Although beef is marketed mainly fresh, chilled or frozen, it is also used in the manufacture of processed foods.

The following are considerations to achieve sustainability in the livestock value chain:

- The intensity of resource use, especially water and energy, in the production of feed, livestock rearing, and in abattoirs and other forms of processing;
- The management of intensively produced waste, especially manure and runoff, and abattoir waste;
- The use of chemicals in livestock production (for health management) and processing;
- Reducing carbon footprint – mainly linked to feed production. Imported meat has a higher footprint owing to the carbon emissions associated with long-distance shipping of chilled/frozen product;
- The level of real free market opportunities as opposed to high concentration and monopolies in parts of the secondary and tertiary value chain (high degree of vertical integration);
- The use of GM-containing feeds in livestock rearing and an inability on the part of the consumer to ascertain which products contain GM maize to make a personal informed choice;
- The use of growth hormones in livestock rearing and an inability on the part of the consumer to ascertain which products contain growth hormones to make a personal informed choice; and
- Opportunities within the value chain for sustainably produced livestock to be processed, marketed and promoted in a differentiated manner, for example, organic beef has not been able to gain market entry.

3 BROAD OBJECTIVES FOR THE SOUTH AFRICAN RED MEAT INDUSTRY

The aim of the Red Meat Industry is to provide sought-after red meat products at affordable prices taking into account the local consumer preferences, international standards and the conservation of the environment. The specific aim of the RMRD SA and its Project Committee is to co-ordinate and fund research projects.

Focus areas for research across the total spectrum of sectors which are involved in the Red Meat Industry have been identified and are prioritised within focus areas and outcomes. Priorities within focus areas may change as the need within the Industry change. See the next two sections in this document.

*Climate change and the water foot print are cross cutting in nature across subject field specific research. Therefore green text in all focus areas relates to climate change and blue text relates directly to the water foot print.

4 RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER FOCUS AREAS

Research is focused on the furtherance, accumulation and improvement of knowledge in the livestock and related sciences through original and other investigations and methods of a scientific nature with the advancement of livestock production as the objective. Development is closely linked to research as it refers to activities by which knowledge acquired through research is utilised. Technology transfer refers to the transfer of knowledge and techniques and processes for the application thereof.

Focus Area 1: Sustainable natural resource utilisation

The environment, i.e. land, water and climate, creates a particular type of vegetation with its unique problems and production potential for animal production. The vegetation resource forms the basis for the livestock industry in the RSA. Stock farming should therefore be carried out within the confines of the environment. The degree, to which the vegetation resource within a particular environment is utilised, has a direct effect on its productivity in terms of wool, meat, mohair, etc. To promote animal production and minimise stock farming risks, we should allow ourselves to be led primarily by the natural resource. Allowing ourselves to be led by other factors without placing the primary factor, namely the vegetation resource and its condition, first, will lead to regret at a later stage on the part of those involved in animal production in the long term. The environment provides (supply) and the animals require (demand) a specific quantity of feed of a particular quality. If the supply and demand is not synchronised, no breeding, animal health or stock management programme will be able to rectify this imbalance.

South Africa is blessed with a rich diversity of flora and fauna, some with enormous potential in providing adapted and unique favourable characteristics to the overall plant and animal gene pool. These should be identified and conserved to sustain biodiversity and be utilised in genetic advancement programmes to promote improved and sustainable small and large livestock production systems. Research and development should aim to sensibly combine indigenous favourable genes with adapted exotic ones to enable more efficient and competitive livestock, food and fibre production systems, in addition to enhancing the economic stability of rural farmers and communities.

Focus Area 2: Livestock production with global competitiveness

Production of foods and fibre derived from livestock has a major impact on the South African agricultural economy. Identification and use of livestock with appropriate genotypes will have a major impact on quality of products used for food, fibre, international competitiveness and efficiency of production. Research integrating nutrition, genetics, reproduction, physiology, microbiology, immunology, molecular biology and the production system and environment interaction, lead to increased production efficiency, sustainability, animal and environmental well-being and high quality products that are imperative for the economical viability of animal agriculture.

Agricultural production is increasingly practiced in such a systems relationship by optimising the entire production chain form the primary production systems, through post harvesting, transport and marketing to value adding both on and off farm. Production systems R & D is the combination of genetic improvement with sound natural resource utilisation (both animals and plants) nutrition, forage management, physiology, product technology and economics of production. This will ensure a sustainable production enterprise through the best allocation of limited resources. This new concept of production systems must be developed into a scientific discipline that encompasses the different research disciplines. The focus must be the furtherance of animal science and related disciplines through innovative systems research and other investigations.

Climate change represents a feedback-loop in which livestock production both contributes to the problem and suffers from the consequences. The impact of global warming and continued uncontrolled release of greenhouse gasses (GHG) has twofold implications for the livestock industry, and consequently food security. Firstly, the continuous increase in ambient temperature is predicted to have a direct effect on the animal, as well as on food and nutrition security, because of changes associated with temperature itself, relative humidity, rainfall distribution in time and space, altered disease distribution, changes in the ecosystem and biome composition. Secondly, the responsibility of livestock production is to limit the release of GHG (i.e. the carbon footprint) and water use (i.e. the water footprint) in order to ensure future sustainability. This can be done through improved production efficiency, breeding to reduce the carbon footprint of livestock products by implementing new or adapted climate smart production systems, by use of known and new technologies that can limit GHG emissions and turn waste into assets.

Focus Area 3: Animal health and welfare

Efficient and profitable farming as well as safe and wholesome products require that animal health is maintained at an optimum level. Zoonoses are a potential threat to human health and therefore need appropriate measures to prevent human infection. Both domestic and international trade is also partly dependent on the control, eradication or prevention of certain diseases which have international importance, like Foot and Mouth Disease. These diseases require a range of effective measures to limit or eliminate their impact on the industry. Safeguarding the livestock industry from animal disease by promoting animal health ensures sustainable and profitable production as well as competitiveness in the market. Ensuring animal welfare is essential to farming systems, firstly because it is ethically correct, secondly because it underlies good production, and thirdly because it is expected by consumers.

Optimal animal health can only be realised provided that there is sufficient knowledge and expertise available regarding the causes, contributory factors and effective diagnosis of each disease. The influence of management practices, nutrition, socio-economics, and genetic resistance or resilience on many diseases, are major factors which determine the impact of health or disease on livestock farming. This knowledge underpins the understanding of the epidemiology of diseases and their

economic effects on production and animal welfare. The effects of diseases on animal products as they in turn affect human health are also essential components. Such knowledge enables the establishment of safe, cost-effective, reliable, practical and appropriate diagnostic procedures and control measures to be implemented. To be acceptable, control measures (whether they be eradication, limitation, and surveillance, official control, preventive or treatment-based) must also be safe, cost-effective, reliable, practical and appropriate for existing conditions. Animal welfare can only be assured when there is sufficient knowledge of the behavioural and other requirements of animals and how this is affected by various farming systems and practices.

Focus area 4: Animal products - quality and safety, nutritional value and preference

Livestock production faces increasing competition in the domestic and global market place. South Africa, with no price support systems should move beyond only producing greater quantities of livestock commodities cheaply as possible. Higher quality products and commodities must be converted into useful value-added food and non-food products to target the sophisticated and export market. Products must also be protected from contamination or loss of quality post-harvest to ensure marketability and consumer acceptance. Research must also be responsive to consumer demands for high quality, safe products that are produced in an environmentally friendly manner.

Red meat safety problems can cause either human illness or economic losses and threaten the international competitiveness of agricultural products. Red meat safety and in particular the control of food borne pathogens and residues, must therefore be an important concern in research programmes. Red meat safety links with quality/value to support food security and healthy diet. Studies to maximise quality/value and identify nutritional and medicinal attributes in indigenous and other substances are also important.

Focus Area 5: The economics of red meat consumption and production in South Africa

Animal production has contributed above 45% of the gross value of agricultural production over the past five years, while the share of red meat has increased from 30% of the value of livestock production to above a third over this same period. Furthermore, approximately 70 percent of South Africa's total area of 1.2 million km² is only suitable for livestock production. As per capita incomes increase in South Africa, the diets of the emerging middle class changes to incorporate more animal proteins, including poultry meat, eggs, red meat and dairy products – and red meat is the only one of these product categories whose share of total livestock production has increased over the past five years. Thus the industry is well placed to grow, and in the process to contribute to the wider economic development of South Africa, both in the production areas by creating livelihoods and increased levels of welfare for the rural population, and in the urban areas where ever more sophisticated consumers require more and more built-in services in the products that they buy. The sector could play a vitally important role in alleviating poverty by means of income generation and as a source of protein. The

sector also stands to gain from globalisation since South Africa is known to produce good quality meat products. Research support should therefore assist in targeting or developing sustainable markets for enterprises (including SMME's) so as to enable this sector to play its rightful role in the economy.

Furthermore, past experience has shown that the most limiting factors to commercialisation of the emerging red meat sector are supply-side constraints such as lack of appropriate infrastructure, poor access to production animals and inputs, poor access to usable technical and market information and to well-functioning marketing and credit systems. The purpose of commercialising the emerging red meat sector is to address these constraints and ensure that farmers produce efficiently, have easy access to all the available markets and can make informed choices on which ones to use.

Secondly and equally importantly, commercialisation of the emerging sector should encourage efficient utilisation of the natural resources (especially the veld) both on privately controlled land and on communal land-based enterprises. Therefore, the major areas of focus should be to ensure that the farmers are able to run viable livestock enterprises that are environmentally and economically sustainable.

Development programmes for commercialising the emerging sector should be cognisant of the fact that it is not homogenous but consists of the following groups:

- Emerging livestock farmers on private land. These either own the land or lease it and hence have some autonomy over their livestock enterprises.
- Commercially-oriented producers on communal land. Their access to and use of grazing land and livestock infrastructure is highly influenced by the community in which they farm
- Predominately subsistence livestock keepers on communal land for whom livestock production is not considered as major income generator.

However, whether from subsistence or commercially-oriented production systems, the Red Meat Industry would like to see that as many as possible of the market ready livestock enter the food chain. Ultimately, the competitiveness of the sector should be improved to the extent that the producers and society at large benefit.

Focus Area 6: Predation Management

The inadequacy of research is not limited to South Africa but an international phenomenon. Regarding predation management there is a paucity of relevant scientific publications on predation in southern Africa, particularly for the medium-sized predators: only 36 articles have been published on the ecolgy of the black-backed jackal (derived from 27 separate studies). Most articles (23) were published before 2000, only 13 have been published since 2001 of which four (4) were published between 2006 and 2010. The list of scientific articles on caracal is even shorter and also outdated.

In the past it was officially recognised that predators / damage causing animals impacted on livestock and official systems were used to control predators. From the 1960's to mid-1990's hunting clubs were

actively controlling damage causing animals in parts of South Africa. When official predator control systems were stopped in the 1990s, official recording of predator control activities also became virtually non-existent. Some isolated private predator control initiatives continued, because it offers business opportunities for the individuals. As a result institutional memory has been lost and currently reliable information on the impact of predation on livestock is not readily available.

Predation by black-backed jackals (Canis mesomelas) and caracal (Caracal caracal), two medium-sized predator species, occur widely and is believed to be increasing. Losses of sheep and goats are also caused by vagrant domesticated dogs (Canis familiaris), especially near cities and towns. Compared to the losses caused by these three species, predation by leopard (Panthera pardus), brown hyaena (Parahyaena brunnea) and cheetah (Acinonyx jubatus) also occur, but in relatively isolated cases and on a smaller scale.

The direct cost of predation on sheep and goats in the five (5) major small livestock producing provinces was estimated to be R 1.4 billion. Feedback suggests that cattle are also increasingly impacted by predation and estimated to be R 383 million.. Predators do not distinguish between owners of livestock or the scale of operations and it is suspected that small-scale farmers in communal farming areas are particularly affected by predation. Fragmented efforts to manage predators contribute to the current untenable situation in South Africa. It calls for an urgent and coordinated approach to manage predation and reduce its impact on the livestock industries. Unless the negative impact of predation is substantially reduced, it has serious consequences for food security and continued employment in rural South Africa.

Lessons can be learnt from a similar scenario in the USA where predation is ostensibly handled professionally and competently by the Wildlife Services of the USDA-APHIS. South Africa needs an official system of coordinated predation management which will provide the necessary framework and capacity for building institutional memory, thus fulfilling the roles and functions of setting policy, coordination, training, extension, research, and monitoring. These activities will inform the development of Best Management Practices (BMP) for wider application. Livestock farmers and wildlife ranchers must participate as equal partners in a joint initiative of coordinated predation management by accepting responsibility to safeguard their animals and control predators. The envisaged system of coordinated predation management will render official support to farmers and ranchers with appropriate training and extension

*Orange text in all focus areas relates to predation management.

Focus area 7: Livestock theft prevention

The paramount objectives of red meat producers in the world are sustainable, profitable and humane production of livestock in the conquest amongst others to ensure food security. Obstacles for the red meat producer in search of the conquest is regarded as economical in nature and caused by two major external factors namely animal health and direct financial losses. This research area deals with livestock theft as direct financial losses to red meat producers. Determining the impact and

consequences of the direct losses on red meat producers is challenging as there is a serious inadequacy of research on the topics of livestock theft in South Africa. The inadequacy of research is not limited to South Africa but an international phenomenon. Regarding livestock theft there are very few scientific publications in southern Africa although livestock theft has been addressed extensively in popular journals only scientific studies have been conducted on the topic. These publications focussed on focusing on livestock theft in Kwazulu Natal in 2003, another using Lesotho as focal point in 2006 and one in 2013 focusing on The Extent of Livestock Theft in South Africa and another in 2015 focusing on The role of social media in combatting livestock theft.

Livestock theft is an ancient criminal offence and a persistent problem for the red meat producer, notwithstanding in South Africa very few research has been done on the topic. The Red Meat Research Development Trust (RMRDT) recognise this neglect and decided to include the topic as a research focus area. The RMRDT research focus areas regarding livestock is in accordance with the definition of stock in the Stock Theft Act, (Act 57 of 1959) which defines livestock as “any horse, mule, ass, bull, cow, ox, heifer, calf, sheep, goat, pig, poultry, domesticated ostrich, domesticated game or the carcase or portion of the carcase of any such stock”. This will also include the poaching wildlife for research purposes. Currently cattle, sheep and goats comprise roughly 87% of all livestock stolen in South Africa and require the attention of researchers. The losses of the specific red meat species due to livestock theft varies from species to species month to month and year to year. The number of species stolen has a direct impact on the economic value and losses of producers and varies accordingly. The current estimates are that livestock theft contributes to approximately R500 million to producers but this estimates does not provide for the losses within the whole criminal justice system. An alarming conclusion is that according to Statistics South Africa only 25 to 30% of all livestock theft cases are reported.

Research in this area should aim to describe and compare explain and develop theoretical aspects such as: the criminal justice communities lack to implement an appropriate investigative support system for livestock theft cases. This is a niche field, where knowledgeable forensic support is often unavailable.

5 RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER PER FOCUS AREA

Focus Area 1: Sustainable natural resource utilisation

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
A. Forage resources and management	The production potential of rangelands is limited and can be optimised by making available adapted, nutritious, and highly productive forages. New forage and pasture cultivars and ecovars with higher nutritive quality and resistance to diseases, insects and tolerances to limiting conditions (low fertility, drought and low water availability, heat stress etc.) and competition from other plants (weeds and mixtures), are needed to optimise the efficiency of utilisation of veld by livestock. Management of forage availability from pastures, veld and conserved forages to maximise seasonal distribution, yield and quality is one of the greatest limitations in enhancing livestock productivity. New forage production and management practices are needed to assist farmers to maximise economic efficiencies and facilitate the integration of veld livestock production systems.	i. Complete fodder flow programmes using alternative forages to complement shortcomings (quality and quantity) of veld to improve the efficiency of a livestock production system. ii. Breeding and release of new forage and pasture cultivars with higher nutritive quality, less CH_4 emissions during rumen fermentation, resistance to diseases and pests, and tolerant to limiting conditions (soil fertility, drought and low water availability, high temperatures, competition from weeds, etc). iii. Acquire, preserve, evaluate describe and enhance genetic resources and develop new knowledge and technologies to increase the productive capacity and usefulness of plants as forages. iv. Pasture systems whereby production is optimised per unit area (kg meat/ha) with highest profit, and where applicable addressing the usage of organic fertilizers vs nitrogen fertilization. v. Improved forage management strategies to maximise efficiency in livestock production systems with minimum negative impact on the environment and biodiversity of the habitat. vi. Correction of nutritional deficiencies in optimal animal production.
B. Veld monitoring and management	Environmentally sound management of livestock on veld types is fundamental to sustainable livestock production. Veld monitoring and management systems are needed to help pastoralists maximise economic efficiencies in livestock production while avoiding negative impacts on the environment. Increased knowledge of the natural processes (competition, fire, herbivore impact, carbon and nutrient cycling, water use, energy capture and flow and vegetation change) which control productivity and promote stability of veld types is required to develop better approaches to their management. A thorough understanding of the basic biology of veld types is needed to provide the pastoralist with the best information for managing pastures and veld.	i. Techniques to rehabilitate non productive areas and avoid further degradation by improving veld condition to maximise livestock production. ii. To provide pastoralists with veld management strategies to maximise the productivity of veld and thus the efficiency and competitiveness of their livestock enterprise and simultaneously prevent degradation of the resource. iii. Provide the stock farmer with information regarding the interaction between the animal, the vegetation resource and the impact of the variable climatic factors on the quantity, quality and consistency of feed availability and so adapt his management to minimise the financial risk. iv. Management strategies to reduce enteric methane and nitrous oxide emissions and water use, and improving efficiency in South African vegetation-based production systems.
C. Pastoral risk management and decision support systems	Management decision-making by pastoralists would be greatly enhanced by the availability of risk identification / evaluation and decision support systems. The provision and development of databases based on sound research results should provide the necessary inputs for the development of risk management and decision support tools.	i. Provide decision support tools whereby the stock farmer can be informed on time of environmental risks (e.g. drought and/or floods) and extreme events (e.g. fire) so as to employ strategies to minimise the negative consequences on his production system and future resource productivity. ii. Provide data on alternative forage sources re species, varieties, agronomic requirements, management requirements, stocking rates and expected profit margins /

		ha for a range of climates and production systems.
D. A systems approach to livestock production	A systems approach can be defined as the utilisation of the principles of genetics, nutrition, physiology, genetic resources, range and forage management, product technology and economics to support practical and profitable animal production by integrating research into farming practice. This will ensure a sustainable production enterprise through the best allocation of limited resources, and fulfils an important coordination function between the different disciplines of animal production.	i. Studies of the whole enterprise and production cycle of animals. ii. Understanding of species interaction (including wildlife) in the farming enterprise. iii. Studies on integrated crop/ animal production systems. iv. Decision support systems to assess the impact of selection decisions on the efficiency of the production systems since many economic relevant traits interact, such as the use of sires that modify energy requirements (through altered weaning weight, mature weight, milk production, etc) will influence stocking rates.
E. Herd management	Efficient livestock production encompasses a vast number of factors including biological, environmental, input, market and infrastructure elements.	i. Improved management techniques related to health, reproduction, nutrition, heat stress, water use, selection, gene flow, economic and other market related aspects established. ii. Supplementary feeding during periods of increased stress, eg drought, wintering, gestation
F. Environmental protection	Protection of the environment (in terms of ecosystem, wetlands, waste management and prevention of erosion and pollution) and maintenance of biodiversity are paramount for plant and animal resources, and in sustainable small and large livestock production systems. Research to combat these adverse influences should be specific for particular circumstances but also holistic to support integrated approaches.	i. Information and methodologies to maintain ecosystems and wetlands, prevent erosion and pollution and to manage agricultural wastes and effluents. (eg. manure and other fermentable waste, soils and crops) ii. Information and methodology to reclaim eroded and polluted resources.
G. Restoring the value of grasslands/rangelands	Widespread neglect and degradation of grazing land has led to high incidences of poverty in many rural areas. The degradation of grasslands also results in environmental losses e. g. erosion, CO2 emissions, water loss and biodiversity loss.	i. The environmental and economic value of grasslands restored, while its social and cultural functions is preserved. ii. Assessment of existing policy, legislation, strategies, projects and programs aimed at improving the grassland resources for sustainable animal agriculture iii. Increased carbon sequestration in biomass, improved climate change resilience and improved production efficiency.

Focus Area 2 : Livestock production with global competitiveness

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
Focus Area 2A: Livestock production with global competitiveness: Breeding, physiology and management		
A. Breeding / Genetics	Sustainable development of more productive and efficient livestock herds / flocks will be required to increase production. This will involve both identification of immediate tactical management activities to improve production and productivity (output per unit of input) of current herds, as well as re-establishment of long-term strategic programmes of comparative evaluation and continued genetic improvement. In both cases, accurate and consistent decisions based on objective information and a thorough understanding of the key input-output relationships involved in livestock production will be required. Recording performance is required to provide information for sound decision-making and to establish key input-output relationships. It is also particularly important to provide the comprehensive and consistent information that is necessary to fairly compare indigenous exotic germplasm and to support long-term genetic improvement towards an appropriate bio-economic development objective.	i. Animal recording and Improvement A national beef cattle and small stock database with information on appropriate production and reproduction information, baseline performance information, traceability of products, to supply primary users with information needed for management decisions and the genetic improvement of their stock. ii. Maintenance and enhancement of genetic variation Identification of genes or gene markers related to economically important traits or adaptation Develop and maintain a gene bank and supporting database to preserve genetic diversity and identification. iii. Genetic improvement **Properly developed selection criteria and breeding objectives to accelerate the selection response towards efficient and profitable beef cattle and small stock production.** iv. Genomics, DNA Technology and Services Marker identification and detection for utilisation in the genetic improvement of animals
B. Breeding to reduce the environmental impact	An effective way to reduce the carbon and water footprint from livestock is to reduce the livestock numbers and increase the production per animal, thereby improving their productivity. Increased productivity generates less GHG emission per unit of livestock product. Production efficiency can be improved through breeding and there is sufficient genetic variation in South Africa's livestock genetic resources to facilitate breeding for improved production efficiency.	i. Breeding objectives/selection criteria that improve cow-calf efficiency ii. Alternative feedlot traits that will improve efficiency and reduce the environmental impact **iii.** Early-in-life indicator traits and selection criteria/ breeding objectives to improve fertility in beef cows
C. Reproduction efficiency	The overall goal is to improve reproduction efficiency of livestock. Research will focus on improving reproductive performance of livestock through genetics, nutrition, health and management within the constraints of a particular environment. Research advances and new biotechnologies will be developed to reduce losses due to reproduction problems in all species and maximise output of high quality products. Research should be aimed to increase the understanding of the biological mechanism underlying normal growth and development of the musculoskeletal system, lactation, digestion, and nutrient metabolism.	i. Physiological processes contributing to efficiency differences among animals in terms of reproduction rate understood and quantified. ii. Behavioural and physiological understanding of climate-related effects such as heat stress on livestock reproductive efficiency and overall productivity iii. Reduced cost systems for managing replacement animals in the breeding herd established. iv. Improved reproduction components and parameters for use in production prediction models. v. Improved cryopreservation, sexing, and in vitro production of semen and embryos. vi. Animal growth and development to improve cattle and small stock production and the control and manipulation of muscle growth, metabolism, and mammary function. **vii.** Proper understanding of specific nutrient regulated biological responses.
D. Livestock genetic resources	South Africa's diverse gene pool of indigenous and locally developed livestock breeds and strains of foreign origin should be protected and screened for more efficient commercial use. These aims should be supplemented with biological criteria and economic variables (e.g. using deterministic and stochastic models) to ensure viability and	i. All livestock breeds and strains characterised in terms of scientific principles. ii. Setting up of systems and models dealing with breeding plans for small populations of livestock species to counter inbreeding.

	sustainability of new or smaller settlements and to manage risk in high turnover operations.	**iii.** Setting of breeding objectives and proper gene flow planning, thereby securing commercialisation and utilisation of animal genetic resources
Focus Area 2B: Livestock production with global competitiveness: Animal growth, nutrition and management		
E. Nutrient intake and utilisation	The most efficient supplementation of nutrition for every production cycle must be established, since nutrition is the single most costly component in livestock production. Sub optimal nutrition causes production losses and increases disease susceptibility. Research is required on nutrient intake and utilisation to improve livestock nutrition.	i. Chemical composition and availability of nutrients in current and potential feedstuffs, and waste products; ii. Methods to screen and study nutrient damage through treatment and anti-nutritional factors; iii. Nutritional requirements of ruminants iv. Waste products, e.g. bio-fuel residues as feeds sources, with specific emphasis on low input feeding systems v. More efficient use of nutrients, especially for production functions; vi. Usage of feed supplements, additives, prebiotics and biotherapeutics. vii. Optimising feed intake and digestive efficiency.
F. Manipulation of nutrition to reduce methane	Methane production by ruminants is one of the largest sources of anthropogenic methane and it will be an advantage if CH4 production can be reduced via nutritional approaches. There are many practices that are effective, but not appropriate for long term mitigation of CH4 emissions in ruminants. It is therefore necessary to develop long term strategies to suppress CH4 production, without detrimental effects on the performance of the animal.	i. Development of prediction models to estimate methane production from feed quality and nutritive characteristics. ii. Use of feed additives (eg. Ionophores) and other methods to enhance propionate production in the rumen at the expense of methane as hydrogen acceptor.
G. Baseline information on GHG and carbon sequestration and the effect of climate change	CH4 results primarily from enteric fermentation of plant material in the digestive tract of animals and its emission is therefore the concern and responsibility of livestock farming. It is the responsibility of the livestock sector to understand the release of GHG (i.e. the carbon footprint) and water use (i.e. the water footprint) in order to ensure future sustainability. Climate change is associated with changes in temperature, relative humidity, rainfall distribution in time and space, and changes in ecosystem, biome composition, woody species encroachment and alien plant invasion. The effect on food security should be understood.	**i. Techniques to accurately measure GHG, carbon sequestration and the water footprint** **ii. A database of national and regional emission figures that should be regularly updated according to international (IPCC) specifications in order to evaluate carbon sequestration and the water footprint.** **iii. Effect of climate change on nutrition and food security in terms of food availability, stability of food supplies, access to food and food utilisation.**

Focus area 3: Animal health and welfare

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
A. Animal welfare	Establishment and refinement of all farming or processing practices which lead to the introduction and maintenance of acceptable animal welfare standards, commensurate with good farming practice and profitability. This is also essential for ensuring consumer acceptance and international trade in animal products. This includes management, nutrition, housing, shelter, handling, farm procedures, reproduction, health care, transport, pre-slaughter handling and slaughter. They should take cognisance of the "5 Freedoms" ("freedom" from pain and discomfort, hunger and thirst, injury and disease, fear and distress, and to perform essential behavioural patterns) as well as "the 3 R's" (Reduce, Refine, Replace).	i. Establishment and codification into law of comprehensive national minimum and optimum standards for management, nutrition, housing, shelter, handling, farm procedures, reproduction, health care, transport, pre-slaughter handling and slaughter. These guidelines must compare favourably with similar codes set up internationally. ii. Improvements in production and processing practices which lead to improvements in animal welfare commensurate with producer efficiency or profits. Establishment and improvement of cost-effective and humane measures to provide livestock with acceptable shelter, handling management, health care, transport, pre-slaughter handling and slaughter. This will result in better consumer acceptance and more effective use of inputs.
B. Aetiological Studies	This comprises the development and refinement of knowledge using appropriate cutting-edge technology (like molecular biotechnology) of the essential cause (the pathogen or toxin) which together with the sufficient causes (contributory factors) gives enough epidemiological knowledge to enable appropriate control measures to be taken.	i. Precise genetic characterisation of microscopic pathogens to enable appropriate epidemiological studies, diagnostic tests and vaccine or other control measures to be undertaken. ii. Proper genetic characterisation of important ectoparasites as this knowledge may affect surveillance, diagnosis or control measures. iii. Full genetic characterisation of important endoparasites as this knowledge may affect surveillance, diagnosis or control measures. iv. Accurate Identification of toxins which influence animal production. v. Development of appropriate knowledge bases of disease prevalence and surveillance for identified important diseases. vi. Implementation of disease status certification systems in support of livestock trade. vii. Knowledge of geographic or evolutionary origins of pathogens and changes which occur in respect of virulence, resistance to treatment or response to vaccines, and disease transmission. **viii.** Recognition of disease conditions previously unknown in South Africa due to, for example climate change.
C. Animal / Pathogen / Environment Interactions	Knowledge of all the contributory (sufficient cause) factors which contribute to the establishment and severity of disease is vital to understanding and controlling important diseases. Understanding immunological response, including at cellular and molecular level, allows inter alia for better vaccine development. Knowledge of vector/host/pathogen interactions allows for the understanding of the epidemiology of diseases and thus enables risk assessment to be undertaken. Effects of toxins from any source (plants, feed, organisms, and environment) depend on many factors which must be understood to devise effective control or prevention. The ability of the host to resist diseases or their effects (resistance and resilience) forms a vital part of understanding these interactions. The impact of nutrition and management is also an essential part of this interaction. The financial impact of disease and control measures must	i. The influence of contributory influences like nutrition and management are elucidated and available for practical implementation to lower the impact of diseases. ii. Knowledge of all environmental interactions that enables the development of better, integrated and holistic disease control strategies. **iii.** The influence of disease on production economics will be quantified and therefore national risk assessment and control measures can be undertaken.

	also be understood and calculated to ensure that diagnostic, surveillance and control measures are optimised.	
D. Diagnostics	The improvement of existing or introduction of new diagnostic technology to enable the rapid, precise, sensitive, reliable, practical and cost-effective identification of a range of pathogens or toxins will contribute to better disease control.	**i. The establishment of efficient diagnostic tests using appropriate technology to enable the detection of a range of important diseases.** **ii. This technology will enable effective disease or toxin monitoring, and thus disease status certification, which may impact on the economics of the industry.** **iii. Good diagnostic procedures enable the accurate determination of the economic impact of disease on animal production.**
E. Disease control strategies	Control strategies must be developed which are sustainable, biologically sound, economically justifiable, ecologically acceptable, internationally recognised and fully integrated with practical farming and product processing systems. Such strategies demand a comprehensive knowledge and the availability of technology for determining the aetiological factors which contribute towards disease, as well as appropriate diagnostic and surveillance methods.	i. Effective, reliable and cost-efficient vaccines become available, using appropriate available technologies. ii. Alternative and complementary strategies are developed to control diseases on a holistic, sustainable and integrated basis. iii. Management and nutritional strategies are established to minimise the impact of disease. **iv.** New and / or improved systems and drugs to treat diseases.

Focus area 4: Animal products - quality and safety, nutritional value and preference

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
Focus Area 4A: Animal Products, Quality and Value-adding		
A. Quality	Research should clarify the roles of product composition, molecular structure and physical state in determining quality and functionality. Genetic improvement and research of processes should maintain or enhance product quality during harvest, storage, transport and marketing. New knowledge is needed to understand the genetics affecting product development and improve control and manipulation of physiological systems supporting muscling, growth, metabolism, and mammary function. Research will focus on identifying genes that influence product, factors directing nutrient partitioning toward protein and less fat to improve efficiency, enhanced nutrient composition in livestock products and improved meat tenderness.	i. New knowledge derived from a better understanding of the microstructure and biochemistry of muscle and fat and their relationships with meat quality characteristics facilitate development of a variety of new products. ii. Better understanding of the inherent mechanisms that maintain quality characteristics of meat should allow for genetic manipulation to maximise desired traits, to limit variability in quality characteristics and to improve processes that can extend the life of these desirable traits. iii. Improved knowledge regarding the genetic control of value-added traits to assist in developing new and improved meat and other livestock products. iv. Assessment of genetic variation in meat quality and the evaluation of the role of candidate genes in beef characteristics with a view to breed for improved product quality, eg. meat with less fat and/or better distribution (inter-muscular fat). v. Development and implementation of technology that can measure meat quality characteristics on live animals for breeding purposes vi. The characterisation of South African beef genotypes for genes associated with beef quality characteristics.
B. Value adding	Research should enhance knowledge of product development and processing, and specifically emphasise new and novel products that can enter niche export markets on the one hand but also underdeveloped local markets. Innovative processes should be created and existing ones adopted to manufacture new or value-added products. Application of these innovative technologies could expand the range and value of livestock products and reduce the ratio of cost of production to market value. Sources of natural products are expected to be identified for use as nutraceuticals, pharmaceuticals, biopesticides and other innovative applications	i. Affordable and suitable meat and meat-containing products to satisfy the needs of sophisticated domestic and international consumers and the needs of the meat processors to obtain suitable carcass balancing. ii. New technologies to convert processed by-products into useful value-added products such as fat substitutes, high-quality animal feeds, improved textiles, hides and skins, pharmaceutical ingredients, enzymes and cosmetics. iii. Useful products from low value and waste products such as slaughter offal and manure to increase the overall efficiency of utilisation.
Focus Area 4B: Red Meat Safety, Nutritional Value, Consumerism and Consumer Behaviour		
C. Safety	Among the desirable qualities of foods, is the absence of chemical residues, pathogens and spoilage organisms. Urgent research is required for reliable and rapid methods to detect and eliminate pathogens and reduce the risk of chemical residues from drugs, food additives, herbicides, pesticides and environmental contaminants in/on livestock throughout the pre-harvesting and post-harvesting processes. Improved techniques and management procedures to extend product shelf life for both formal and informal markets are urgently needed. Monitoring and service programmes should focus on quality surveys, establishment of sustainable surveillance programmes, meat safety systems and the use of microbial indicators as food safety and quality standards to ensure safe foods.	i. Improved products and processes of extending shelf life during storage to optimise nutritional value and safety, to reduce waste, improve efficiency and allow new uses that are currently limited or not feasible. ii. The means to ensure that the food supply is safe for consumers and that food (imported and exported) meet foreign and domestic regulatory requirements. iii. Scientific information on which to base guidance or meat safety programmes that effectively controls the presence of pathogens and toxic residues in livestock foods. iv. Minimal pathogen and chemical residues in livestock being presented for slaughter. v. Infrastructure, materials, equipment and systems to ensure the safe handling and storage of animal products.
D. Nutritional	Information on the nutritional composition of foods and bio-availability of nutrients is essential for food programmes,	i. Determine the composition, quality and bio-availability of nutrients in red meat and red meat products.

value	preventative medicine and dietetics, and the provision of appropriate diets for individuals and communities. Extensive information is required for key, restaurant, fast and indigenous foods. These, in addition, need to be sensory appraised to determine consumer acceptance and, where applicable, to recommend modification. A more nutritious red meat supply can be generated by defining the basis for modifying the health promoting properties of foods, which can be achieved through biotechnology, genetics and new food processing techniques. Foods, which promote health beyond providing basic nutrition, are known as "functional" foods. They have the potential to promote health in ways not anticipated by traditional nutrition science. The development of functional foods using functional food ingredients / substances / properties is needed. Amongst others, this may assist in strengthening the human immune system to combat the contraction or transfer of e.g. HIV and AIDS and malnutrition related diseases.	ii. Information of nutrient density of red meat and red meat products. iii. Sensory appraisal. iv. Generate a more nutritious red meat supply by conducting research that defines the basis for modifying the health promoting properties of foods and food components, and make beneficial changes in the composition of foods (using biotechnology, genetics and processing techniques). v. Extended dietary guidance to enhance public confidence in animal food supply and to improve the scientific basis for more effective food assistance programmes by making available a comprehensive database to dieticians and nutritionists.
E. Consumerism / Consumer behaviour	Probably the most intriguing science is to understand the behaviour of consumers. It entails continuous investigation to understand how consumers behave to different market stimuli. Consumer behaviour involves, amongst other things, issues pertaining to food safety considerations, product quality, buying patterns and fashion statements by Adam Smith that "Consumption is the sole end and purpose of all production". Hence the success of production and market penetration to a large extent will be determined by the success of how consumer preferences and whims have been taken into account or researched.	i. New or adapted products on the market adhering to consumer preferences and tastes. ii. Improve the ability of role players to adhere to what consumers want in an affordable and sustainable manner. iii. Provision of information that could be fed back into the production and processing systems.

Focus Area 5: The economics of red meat consumption and production in South Africa

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
A. Value chain analyses	The macro and micro marketing environment and forces driving the marketing of livestock products have changed drastically since 1994. Traditional trends in processes are no longer applicable, whilst consumers' tastes and preferences have also changed. Within this milieu producers and firms must find markets where they can sell their products at a profit. Research should focus on understanding the commodities' and products' markets better and identifying opportunity gaps. This also entails investigation into up-to-date and relevant processes and structures that could support the supply chain from a marketing point of view.	i. A proper understanding of changing market trends, domestically and internationally: • To ensure and support strategic management and marketing in the Red Meat Industry. • To act pro-actively on changes in market trends, rather than re-actively. • to nurture better relationships amongst role players
B. Risk analysis and management	The agricultural firm is faced with the management of market, labour, etc. Central to these management functions are decisions related to risk bearing. Risk and uncertainty are products of imperfect knowledge and a changing environment. Hence, sources of imperfect knowledge need to be identified and addressed. Risk management therefore considers the chances that the risk will occur and secondly access consequences given current risk management practices. Research should focus on identification of the range of options for treating each particular risk, evaluation of different options, make recommendation on selecting the most suitable one, and monitoring implementation.	i. Increased ability of industry to identify possible risk factors that could compromise existing businesses. ii. Increased ability to quantify different risk elements and provide guidance accordingly to mitigate risk.
C. International trade	South Africa has clearly demonstrated its willingness and enthusiasm to participate in Free Trade Agreements with other countries. In addition, South Africa is also member of the WTO that governs international trade rules to which South Africa must comply, e.g. Sanitary and phytosanatory standards, reducing tariffs, improved market access and reducing support to farmers. That will surely have an impact on supply, demand and prices of livestock products in South Africa. There also exists a need to establish South Africa's international competitiveness and to link it to factors that may influence it. This also involves, for example, the issue of traceability and it could be implemented. It is vitally important that research is focused on such issues in a pro-active manner so as to guide producers, agribusiness and policy makers of the possible outcomes.	i. Proper evaluation of policies and trade agreements to measure the possible implications for the industry. ii. Provide support to government during trade negotiations that involves the Red Meat Industry. iii. Generate relevant and applicable information related to the possible impact and opportunities that may arise from globalisation that could support decisions by role-players. iv. Export support: • Enhance the state of knowledge pertaining to export, producers, regulations, market requirements, etc. to support management of existing and new exporter orientated companies / firms, as well as government. • Act as source of information (e.g. standards and regulations) to support government.
D. Policy assessment	Policy assessment is crucial for proper governance, not only for government, but also for producers and agribusiness. Policies provide the guidelines for strategic planning, but on the other hand could hamper industry potential. Hence research aimed at analysing the impact of policies could greatly enhance the ability of this industry to function properly in a dynamic environment. Also, such research could improve the ability of government to identify necessary changes in policies needed for sustainable development.	i. Policies which are conducive to growth and wealth creation in the Red Meat Industry, as well as protecting the environment. ii. Continuous improvement in modelling systems to determine the impact of exogenous and policy changes
E. Commercia-lisation (formal and informal markets) of the emerging sector	Successful development depends on effective integration of technology, functionality and resource use. It is important to understand the differences between the commercial and non-commercial livestock sector. Understanding the differences is essential for efficient market development and research since the two sectors may require different approaches for wealth creation.	i. Access to information and removal of constraints that limits market development and access to commercial markets. ii. Appropriate methods to commercialise, empower and build capacity within farmer groups, for example: • Capacity building through Continuous Improvement and Innovation;

		• Correct pastoral risk management as a result of the availability of risk identification / evaluation and decision support systems; • Revival of dual purpose beef and dairy ranching production systems. iii. Increased competitiveness through coordinated technical farmer support programmes iv. Sustainable extensive and intensive production systems through on- and off-farm research and development. v. Novel products for the second economy to penetrate markets and promote consumer health. vi. Alternative feed sources and alternative feedstuffs (e g. to replace maize). vii. Grassroots innovations that focus on bottom-up solutions for sustainable development that respond to local situations and the interest and values of the communities.
F. Technology transfer and training	The needs of the beef and small stock industry workforce should be anticipated to provide information, products, services, and educational material. Innovative ways should be developed to assist with user friendly technology transfer. Research results should be captured in database and analysed and packaged in ways that will facilitate improved access to and dissemination of information. These systems should also enable preservation of valuable and important documents and work to ensure availability of such collections to current and future interest	i. Well-planned and managed information databases that is accessible ii. Production manuals and educational material on software, audio-visual collections and the printed medium. iii. Valuable livestock agricultural documents stored in computerised and hard copy format. iv. Innovative information products and IP items developed. v. Customised material to fit the needs of all sectors (and levels) of the Beef Cattle Industry. vi. Assistance programs and training for emerging and commercial producers.
G. Integrated models for more efficient management	The amount of information on livestock production efficiency is difficult to use without the aid of computer-based technology. This technology application is needed to improve management decisions and strategies that will yield the greatest economic return. Such models will contribute to identifying gaps in scientific knowledge. Furthermore, since “organic” farming is becoming more important in the national and global context, relevant concepts and practices should be addressed primarily through integrated systems and modelling.	i. Information and decision support systems for continuous improvement in small, large, organic and intensive operations. ii. Utilisation of biological and economic parameters in computer simulations to optimise beef production units. iii. Provision of decision support systems for managing climate impact and risk of livestock production.

Focus area 6: Predation Management

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
A. Scientific assessment (Institutional memory, which is best contained in a national system of coordinated predation management)	Create a comprehensive understanding of the nature and scope of the issue of livestock and wildlife predation through a formal scientific assessment. This will provide baseline data and relevant information on the extent and impact of predation in South Africa. This institutional memory will serve to inform a system of coordinated predation management, incorporating the roles and functions of setting policy, coordination, training, extension, research, and monitoring. These activities will inform the development of Best Management Practices (BMP).	i. A national database highlighting the current state of knowledge regarding the main predators of livestock and game in South-Africa, their impact and management that is available for use by all role players and stakeholders to inform strategic and tactical planning for predation risk management and revision of stock predation policy. ii. A national system of coordinated predator management that can play a marked role in reducing the impact of predation. iii. Determine hotspots for predation activity to be targeted as a high priority.
B. Best Management Practices (BMP)	Lessons learnt from predation management activities should be incorporated in BMP for implementation over a wider scale.	i. Ensure that appropriate methods and equipment are available for predator control activities. ii. Serve as basis to inform a strategic approach for more effective and coordinated predation management.
C. Predation management methods and equipment	There is no single method or piece of equipment to stop or mitigate the impact of predation. Non-lethal and lethal methods and equipment must be conceived, designed, developed and evaluated for efficacy and incorporation in BMP.	i. Develop new methods and equipment. ii. Implementation of appropriate and sustainable on-farm predator-livestock control-management systems or methods and equipment.
D. Appropriate content and methodology for training	Knowledge, skills and experience on predation control activities are currently locked-up in a few individuals only and must be transferred as a high priority to a larger group of operators (predator specialist hunters), farmers and wildlife ranchers.	i. Specific content of training manuals and training courses aimed at transferring skills to operators in the field of predation control. ii. Specific content of training manuals and training courses aimed at transferring skills to farmers and wildlife ranchers regarding predation control.
E. Appropriate content and methodology for extension	Paradigm shifts are urgently needed on a wide front, from farmers and producers to policy makers and the general public. Extension is needed to manage human-wildlife conflict and is best conducted when effective methodologies are applied by extension specialists.	i. Informed official decision making based on recent information regarding predation. ii. Inform livestock and wildlife ranching industries in order to manage human-wildlife conflict. iii. Inform society about the need for predation management.

Focus area 7: Livestock theft prevention

NUMBER / COMPONENT	OBJECTIVE STATEMENTS	OUTCOMES
A. Institutional memory, which is best contained in a national system of coordinated and livestock theft prevention	Create baseline data and relevant information on the extent and impact of livestock theft in a GIS environment for South Africa. The institutional memory will serve to inform a system of coordinated livestock prevention, incorporating the roles and functions of setting policy, coordination, training, extension, research, and monitoring. These activities will inform the development of Best Management Practices (BMP).	i. A national database is available for use by all role players and stakeholders to inform strategic and tactical planning for livestock theft prevention management. ii. A national system of coordinated livestock theft prevention that can play a marked role in reducing the impact of livestock theft.
B. Best Management Practices (BMP)	Lessons learnt from livestock theft prevention theft activities should be incorporated in BMP for implementation over a wider scale.	i. Ensure that appropriate policy, methods, equipment and resources are available for livestock theft prevention activities. ii. Serve as basis to inform a strategic approach for more effective and coordinated livestock theft prevention.
C. Causal factors and livestock prevention	There is a variety of factors and modus operandi that cause livestock theft. As no coordinated efforts are in place to concur the crime research should inform the producers as to minimise the impact of the crime	i. Development of strategies for policing in the area of livestock theft as an agricultural crime ii. Profiling livestock thieves according to types of livestock stolen iii. Focusing issues concerning livestock theft prevention iv. Impediments to investigation such as a lack of community support in contributing to the difficulty of prosecuting livestock thieves. v. Improving the policing of livestock theft, communities need to implement improved knowledge sharing, agricultural training for police officers, and improving stock identification and movement techniques. vi. Identify livestock theft as both a local and a cross-jurisdictional issue in order to increase red meat producers reporting rates for livestock theft and enhance the system of communication among police officers to render better police management of the problem
D. Appropriate content and methodology for training	Knowledge, skills and experience on livestock theft prevention prevention are currently locked-up in a few individuals and police officials only and must be transferred as a high priority to a larger group of red meat producers	i. Specific content of training manuals and training courses aimed at transferring skills to police officials in the field of livestock theft prevention. ii. Specific content of training manuals and training courses aimed at transferring skills to farmers and wildlife ranchers regarding livestock theft prevention.
E. Appropriate content and methodology for extension	Paradigm shifts are urgently needed on a wide front, from producers to policy makers and the general public. In managing crime prevention effective policies and methodologies are applied.	i. Inform official decision making based on recent information regarding livestock theft. ii. Inform livestock industry in order to manage crime prevention. iii. Inform society about the need for livestock theft prevention.
F. DNA Technology and Services	DNA Markers can be used to select for economically important traits, heat stress and disease resistance. Here use can be made of Quantitative Trait Loci (QTLs). A QTL is a “locus that affects a measurable trait that shows continuous variation. The measurable trait depends on the cumulative action of many genes”. Marker assisted selection can accelerate genetic progress. It is envisaged that disease resistance and other economically important traits can be identified using QTLs. DNA profiling can be used to confirm parentage, including case of multi-sire mating in beef cattle herds and is a powerful instrument in the identification of individual animals. The micro satellites used for the profiles should be standardised according to the	i. DNA technology established and expanded: ii. As a deterrent for stock theft. (e.g. Lid Cat); iii. For genetic detection (e.g. of species) and modification including GMO detection and services. iv. Marker identification and QTL detection for utilisation in the genetic improvement of animals. **v.** Studies on micro satellites as useful criteria for marker assisted selection for beef quality.

	International Society of Animal Genetics (ISAG); otherwise results between laboratories are not comparable. The establishment of DNA profiles is an accepted tool for use by the SAPS in stock theft cases and is generally accepted as evidence by the courts.	
G. Infrastructure equipment and practices for animal production	Sustainable animal production requires provision of cost effective, appropriate infrastructure and equipment to ensure an optimal environment for animal growth / production. This includes systems to provide food and water.	i. Design equipment and working methods to decrease the epidemic of stock theft, eg Animal identification systems that are cost effective, easy to use, robust, reliable and secure (eg RFID ear tags). **ii.** Appropriate software systems for accessibility by industry and relevant institutions (eg SAPS) to expand management possibilities associated with animal identification, eg systems that can monitor unauthorised movement of animals.

6 POLICIES AND PROCEDURES RELATING TO THE FUNDING OF PROJECTS

6.1 Funding policy

The policy of the RMRD SA is to finance projects executed by any recognised research institution, dealing with agricultural research. Such institutions include the Department of Agriculture, Forestry and Fisheries, Provincial Departments of Agriculture, Institutes of the Agricultural Research Council, all Universities and Agricultural Colleges.

Funding for research and development is made available from the RMRDT and RMLA. In the case of RMRDT funds the policy is to maintain the proportion of the initial capital from the various species' when financing projects for the various sectors, which was as follows:

Beef	65, 67%
Small Stock	15, 28%
Pork	9, 02%
Hides, Skins and Leather	10, 03%

In cases where a project is directed at more than one "species", the funds for the project are allocated proportionally from the funds of the "species" concerned. In the event of shortage of funds from a particular "species fund" to fully fund such a project, the Planning Committees can decide whether they would fund more than their agreed portion for a particular project.

6.1.1 Use of Funds

Generally, project funds can be divided into personnel costs, overhead costs and operational costs. Only in exceptional circumstances will the RMRDT or RMLA fund 100% of such costs of a project. The approach is that projects are supported but it is expected from the research institution to be suitably equipped with the appropriate personnel and equipment. Part of the operational costs of a project will be funded, e.g. costs of experimental animals, feed, laboratory consumables, computer software, etc.

Funding is also provided for technology transfer opportunities focusing on the project, e. g. workshops, seminars, popular articles and publications.

Funding of capital equipment and the establishing of demonstration units are normally not considered. Such requirements should nevertheless be stated in the budget submission of the projects.

No overhead costs will be funded and personnel costs will only be considered when project based contract appointments are required to execute the project. This must be clearly stated in the budget and must be indicated as a separate cost item and not included in the salaries. If scientific expertise is required from outside the institution (local or abroad) for specific aspects of the project and it has financial implications, such expenses will also be considered for funding on condition it is stated as such in the protocol.

Attendance of national and international Congresses, Conferences, Symposia, etc. will not be funded unless the purpose of attendance is to present the findings of a funded project at a scientific gathering. Such funding will be limited to one person and one event and will be within reasonable amounts.

The funding of routine operations in functional service laboratories (e.g. Diagnostic Laboratories) and schemes (e. g. Livestock Improvement Schemes and Range and Forage Units) is generally not considered.

6.1.2 Requirements for Project Leaders

Project leaders should have a tertiary qualification (degree or diploma) from a recognised tertiary institution. In the case where the project leader is a student, an alternative project leader who is in the employment of a recognised research institution, must also be indicated and this alternative project leader must undertake to complete the research if the student fails to do so.

All veterinarians and para-veterinary workers are required to be registered with, or authorised by the South African Veterinary Council in terms of the Veterinary and Para-Veterinary Professions Act (Act 19 of 1992) before they can work in their profession. Similarly, the Natural Scientific Professions Act, (Act 27 of 2003) that came into effect on 16 February 2004, requires all natural scientists to register as such with the South African Council for Natural Scientific Professions. The Act does not give time limits within which scientists must register with the Council after the commencement of the act; however it is clear that natural scientists must register for them to practice in any of the fields mentioned in the Act.

The Engineering Profession Act (Act 46 of 2000) also requires compulsory registration of all persons practicing their profession.

As from 2009 it will thus be required that the project leader be registered with the relevant professional council with the exception of agricultural economists. If the project leader is not registered with the relevant council, an alternative project leader that is registered must be nominated to sign off all progress and final reports as well as any publications that may emanate from the research.

6.1.3 Intellectual Property Rights (IP)

The results of research projects funded by the Trust or Statutory Levy fund are regarded as public knowledge. No trade or intellectual property rights regarding such research or its results may be retained by the researcher.

6.1.4 Ethical Committee

Animal experimentation must be conducted within standard ethical norms, where applicable. A statement indicating that the Ethical Committee of the institution has approved the project must be included in the Methodology section. Where the institution does not have an Ethical Committee, a declaration of compliance must be included in the Methodology section.

6.1.5 Duration of Funding

All projects will be funded for a maximum of three years. If the continued funding of a project is required after three years, a submission for the further funding of the project will be required which will be evaluated according to the policy and procedures related to the funding of projects that are applicable at that stage.

6.1.6 The types of R & D projects that are funded

"Research" has the meaning of the definition in the Agricultural Research Act namely the "furtherance, accumulation and improvement of knowledge in the agricultural and related sciences through original and other investigations and methods of a scientific nature with the advancement of agriculture as its object".

Similarly "Development" means "the activity by which knowledge acquired through research is utilised" and "Technology Transfer" means "the transfer of knowledge, and techniques and processes for the application thereof".

A. Industry-orientated Research

Financial support is given to projects which aim to improve the production, marketing, processing and quality of slaughter stock and their products, irrespective of whether such slaughter stock and their products have been produced by commercial or resource-limited producers, and irrespective of whether such marketing and processing are done in the formal or informal sector.

The general approach is to give financial support to specific research projects of which the results are expected to have a practical application in the Red Meat Industry (industry orientation) by, amongst other things, more efficient production of slaughter stock and improved utilisation of red meat, red meat processed products and other products of slaughter stock.

In this regard, the needs of the appropriate industry are to be established at grass roots level and conveyed to the Planning Committee.

B. Problem-orientated Research

In certain cases, specific research can be commissioned by the client (e. g. a producers organisation), with the aim of solving a specific problem. In such cases the full cost of research can be covered, if it is required. In this way highly qualified professional scientists at research institutions are deployed to solve a specific problem.

C. Fundamental Research

Fundamental (explorative) research by primarily postgraduate students at tertiary and research institutions may be supported as well as post-graduate assistantships in connection

with projects which are being funded by the RMRDT, provided it is related to the needs of the industry.

D. Research of National Importance

Although it is expected that the State is responsible for funding research of national importance, the RMRD SA does fund research of national importance to complement funding by the State. The RMRD SA is further inclined to favour those projects which are of general concern, rather than of own affairs (by an individual role-player organisation). The RMRD SA however, relies heavily upon the opinion of the individual role-player organisations for motivating the importance of specific projects for the particular industry.

6.2 Procedure

Standard forms are used for project proposals and protocols as well as for progress and final reports. The procedure generally entails the following steps:

- Call for project proposals;
- Project idea and proposal;
- Evaluation of project proposal;
- Project protocol requested;
- Evaluation of project protocol and allocating of funds;
- Approval of funds;
- Compiling agreement;
- Supplying funds;
- Evaluation of progress; and
- Evaluation of final report.

6.2.1 Applications

Applications for proposals / protocols are considered twice a year (normally February and September) and must be submitted before 15 January / 15 August to the office of RMRD SA for consideration in the next meeting. Applications must be submitted on the prescribed forms available from RMRD SA or the website (www.rmrdsa.co.za).

6.2.2 Payments

Payments of the amount granted will be made according to the signed contract. After evaluation of progress (annually); funds will be released for subsequent years of research. Upon satisfactory evaluation of the final report and popular article at project conclusion; the last 20% of the final year's funding will be released.

6.2.3 Reports

A progress report must be submitted to the office of RMRD SA on an annual basis before 15 January / 15 August for evaluation and consideration during the following meeting. Progress reports must be submitted on the prescribed forms available from RMRD SA or the website (www.rmrdsa.co.za).

A final report on the project must be submitted to the office of RMRD SA on completion of the project for evaluation by the Planning Committee.

6.2.4 Appraisal Process

The following are considered when a project proposal / protocol is considered and prioritised:

- **Necessity / Importance of the Research**
  - The extent / severity / importance of the problem;
  - The uniqueness of the problem;
  - The extent of the information already available;
  - Who is already working on the problem?
- **Composition of the Research Team**
  - Is there proper coordination?
  - Extent of collaboration with other groups;
  - The track record of the proposers will be taken into account;
  - The expertise of the team is important, i.e. are there enough experts involved?
- **Infrastructure of the Institution**
  - Facilities in place at the institution;
  - Equipment available at the institution.
- **Time Scale**
  - Duration of project - is it realistic, necessary and affordable?
- **Financial Support**
  - Are other funders already involved? (It is an indication of trust in the capacity of the research team).
  - Are there commercialisation possibilities?
  - Value for money - e.g. impact of results in relation to investment by RMRDT.
  - Is the budget clear and realistic?
- **Experimental Design**
  - Welfare and ethics;
  - Correctness of design;
  - Correct test methodology;
  - Correct statistical analysis.

- **Performa Submission**
    - All proposals / protocols should be submitted in the standardised formats provided by the RMRD SA.
- **Prognosis**
    - What are the chances of success?
    - What would be the impact on the sector?

The protocol form makes provision for long and short term objectives. Annual progress reports are measured against the achievement of short-term goals, and final reports against the achievement of long-term goals.

Annual reporting is accompanied by the re-application for funds and offers the opportunity to alter certain aspects in the specific project protocol – as long as this does not substantially alter the programme and contributes to the achievement of goals, it can be readily approved.

Should the progress be unsatisfactory, it shall be the task of the RMRD SA (through the Project Committee and Planning Committee) to terminate funding of that project – even if money has already been spent on it.

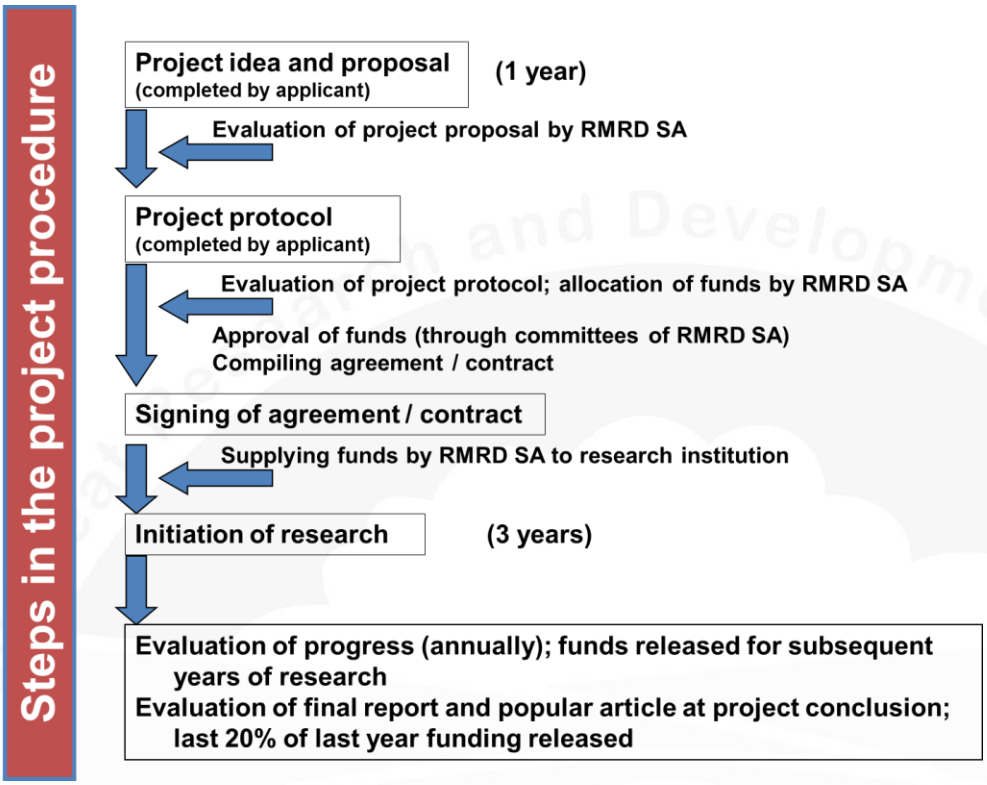
The RMRD SA reserves the right to cancel any agreement and claim from the recipient recovery of all funds already paid, together with accumulated interest, as well as any other damages that may have been suffered as a result of the foregoing.

6.2.5 Time schedule

The Planning Committee meet at least twice a year and project proposals, protocols, progress reports and final reports can be submitted for consideration at any of its meetings. Such documents must reach RMRD SA and/or the Project Committee at least 4 weeks before a meeting. The documentation will then be distributed to the different Working Groups for their inputs and the conveners of the Working Groups must return their consolidated inputs to the RMRD SA and/or Project Committee at least 2 weeks before a meeting.

Once a project proposal has been accepted in principle the RMRD SA and/or Project Committee will inform the project leader and the responsible institution, and will furnish them the specific date on which a full protocol must be submitted.

When a protocol has been accepted the RMRD SA and/or Project Committee will see to it that the Agreement is signed as soon as possible. The Agreement is a contract and will include the due dates for progress reports and the final report and the project leader will be reminded annually of these due dates.



7 MONITORING RESEARCH AND DEVELOPMENT

7.1 Evaluation and monitoring of R & D projects

The Planning Committees have through the years developed procedures and score cards according to which proposals and protocols for research projects, progress reports, final reports and popular articles for publication are judged. These procedures are adapted when needed but are considered efficient.

7.2 Dissemination of research and development results

During the course of a project, it generally occurs that the research personnel take part in information days, present posters or papers at symposia and even publish technical or scientific articles. These must all be mentioned in the progress and final reports to the Planning Committees. Copies of published material are also submitted to the Committees at their regular meetings for the attention of the representatives of the various role-players' associations.

The submission of a popular article together with a final report of a project has been made compulsory. Both these are evaluated to form an opinion of the final report and the value of the project to the particular sector of the Red Meat Industry.

Once the final report and popular article has been approved by the RMRD SA and/or Project Committee, the projects will be submitted by the RMRD SA for industry publications. Firstly it will be

submitted to the monthly publication RED MEAT ROOIVLES and will be included in an RMRD SA annual publication 'Executive summaries' which include all projects completed in a particular year. It will be submitted and released for publication electronic or printed to specific commodity organisations (e.g. RPO, NERPO, RMAA, SAMIC) and may be released for publication in popular media of choice.