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Advancing a holistic systems approach for sustainable cattle development programmes in South Africa: Insights from sustainability assessments

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Abstract

Efforts to exploit the central roles of cattle to drive agriculture and rural development in low-income countries recorded limited success owing to their narrow focus on modernizing and commercializing low-input cattle farming. Most programmes failed to take cognisance of the heterogeneous range of complex relationships between the environmental, economic, social and institutional challenges that limit low-input cattle farming. The current qualitative literature review evaluates the environmental, economic and social sustainability delivery impacts of the leading cattle development programmes in the low-input farming sector in South Africa using a holistic systems approach. A mixed method procedure involving stratified sampling was used to allocate local and international-based programmes while, purposive sampling was used to select programmes with wider scale of operation. The review then draws on the crosscutting key constraints emerging from the case studies to provide a better grounding for subsequent sustainability sensitive recommendations. Local-based cattle development programs advanced more market-led interventions while, their international-based counterparts had more interventions including, soil and rangeland improvement. The narrow focus by both local and international developmental programs is inadequate to address a wide array of environmental, economic, social, technical and institutional challenges faced by low-input cattle producers in South Africa.

Keywords: Cattle development programmes; low-input farmers, sustainability, holistic systems approach.

1. Introduction

Cattle production has been identified as a core source of food, disposable income, critical socio-cultural functions as well as a major capital reserve that can be used to finance other farm investments in low-input farming systems (Herrero et al., 2014). In South Africa, the low-input farming sector comprises of subsistence farmers on communal land and commercially-oriented farmers on either communal or private land (Netshipale et al., 2017). The latter are beneficiaries of the post-independence land reform programmes and are collectively referred to as emerging farmers (Cousins, 2008). Commercially-oriented farmers on communal land were offered small grants under Settlement Land Acquisition Grant (SLAG) scheme (Netshipale et al., 2017). As a result, several SLAG beneficiaries pooled their grants to purchase and share a single commercial farm (Netshipale et al., 2017). Commercially-oriented farmers on private land received large grants under the Land Redistribution for Agricultural Development (LRAD) scheme to purchase individual farms (Netshipale et al., 2017).

Constraints to low-input cattle farming restrict the benefits accruing to the whole farming system. In light of this, many low-income countries, either with their own resources or with the assistance of local and international funding organizations, have embarked on approaches to strategically exploit the central role of cattle to influence wider agricultural and rural development in low-input farming systems (Tedeschi et al., 2015). In many cases, however, the cattle development interventions have prioritised economically driven benefits of cattle at the expense of environmental and social principles and have not directly translated to improved household food, income and social security (Tedeschi et al., 2015). As a result, low-input farmers remain entangled in persistent ‘poverty traps’ (Tedeschi et al., 2015).

According to Oosting et al. (2014) the discourses proposed and implemented by most cattle development programmes have not been connected to the realities of low-input cattle producers. In particular, the narrow focus on commercialization of the low-input cattle farming system suggests a lack of understanding of the complexities and diversity of constraints surrounding these systems (Oosting et al., 2014). In this regard, Gerber et al. (2013) suggested a focus that transcends just economic benefits to also consider the environmental and social impacts of beef cattle farming. The economic, environmental and social components represent the three dimensions of sustainability (Latruffe et al., 2016) with governance sometimes added as the fourth one (Graeub et al., 2016).

Low-input cattle farming is a complex system where numerous factors and processes interact, often across geographic, institutional and governance scales (Herrero et al., 2009). Such complex causal structures often imply trade-offs between the positive and negative consequences of fragmented actions (Herrero et al., 2009). As such, managing cattle development programmes in low-input cattle farming sector requires that interlinked planning and regulatory actions be tackled simultaneously and considered for their long-term impacts, and preventative rather than remedial actions are required (Tendeshi et al., 2011). The traditional single-faceted and fragmented approaches forego numerous synergistic benefits arising from coordinated action across sustainability sectors (Dahal, 2011). As a result actions often fail to have the intended effect if changes on other parts of the system are not implemented at the same time (Dahal, 2011). The potential for harnessing positive synergies, may be a greater motivating factor for using a holistic systems approach than the identification of negative/cautionary trade-offs. Positive synergies advances the progress towards the sustainability of systems including, low-input cattle farming system (Astier and García-Barrios, 2012).

Sustainable cattle farming implies improving productivity through more efficient use of locally available natural resources, environmental stewardship and social justice (Gayatri, 2016). Integrating the concept of sustainability may, however, not be a panacea for successful delivery of cattle developmental programmes but could facilitate holistic intervention strategies that might result in a wide range of benefits for low-input producers (Bernués et al., 2011). A systems approach is economically sustainable as it is inclusive of different types and a wider range of economic values attached to goods and services provided by low-input cattle farming (Searcy et al., 2014). In this context, it is recommended to analyze the sustainability of cattle development programs from a holistic systems perspective. The current qualitative literature review, therefore, evaluates the economic, environmental and social delivery impacts of the major cattle development programmes in low-input cattle farming areas of South Africa using holistic systems approach. The review then proposes a set of key agricultural sustainability sensitive recommendations that can be drawn on during the designing, implementation and exiting phases of cattle development programmes in low-income countries.

2. Selection of case studies of cattle development programmes in South Africa

Cattle development programs critically analysed in the current study were initially allocated to the local and international strata using the stratified sampling technique. From each stratum, two programs were purposively selected based on their wider implementation in various communities South Africa. Ultimately, the selected cattle-based development programmes were; the Nguni Cattle Programme, The National Red Meat Development Programme (NRMDP), the Australian Centre for International Agricultural Research (ACIAR) programme and the Heifer Project South Africa (HPSA). The two local and two international-based programmes selected in the current review are by no means exhaustive of all the interventions

by cattle development programmes conducted in South Africa. However, their general attributes summarised in Table 1 are typical of various development programmes in South Africa.

2.1 The Nguni cattle programme

The Nguni cattle programme was initiated in Amathole District Municipality of Eastern Cape Province (ECP) in 2004 (Mapiye et al., 2007). It was then expanded to other district municipalities in Eastern Cape Province and later to six other provinces; Limpopo (2006), North West (2006), Northern Cape (2006), Free State (2008), Mpumalanga (2008) and KwaZulu Natal (2008; DeWaal, 2014). The objective of the programme was to establish and conserve Nguni nucleus herds and/or upgrade the cattle herds to Nguni type for both subsistence and commercially-oriented cattle producers (Tada et al., 2012). In each province, a tripartite partnership was established among Industrial Development Cooperation (IDC), Provincial Department of Agriculture and a local university. The IDC was the main contributor, which provided financial assistance to acquire Nguni cattle and additional grants for support services. The Provincial Department of Agriculture provided technical support staff and facilitates relevant infrastructural development in beneficiary communities. The local university provided research and training services on cattle farming including reproduction, animal health, rangeland production, marketing and financial management.

Selection of beneficiaries was based on key pre-existing conditions including cattle farming and entrepreneurships skills, ownership or proven physical access to sufficient fenced grazing areas, rangeland management plan with specified stocking rates and existence of a development committee (Mapiye et al., 2007). The development committee was in charge of rangeland management, lobbying for government support services and

133 overseeing the redistribution of animals to subsequent beneficiaries upon repayment of loans
134 (Tada et al., 2012). In addition, a local programme manager was employed as a link person
135 between beneficiary communities and the programme partners.
136
137 Individuals or communities that met the selection criteria received an interest-free loan of
138 pregnant Nguni heifers and a bull for a period of five years (Dean, 2017). The number of heifers
139 received varied with provinces, for example 30 were given in Eastern Cape and 50 in Limpopo.
140 An attempt was made in Limpopo to replace the Nguni bulls with an Angus bulls to produce
141 F1 crosses with high nutrient utilisation efficiency, growth rates and carcass yields (Mapiye et
142 al., 2018). Formal arrangements were made with commercial feedlots to buy the F1 crosses for
143 finishing and retail supermarkets to market meat as Angus beef (Dean, 2017). However, the
144 Angus bulls failed to survive under the harsh climatic conditions and low management levels
145 of commercially-oriented cattle producers (Mapiye et al., 2018). The Angus bulls were
146 subsequently replaced by Nguni bulls and previous arrangements made with retail
147 supermarkets nullified (Mapiye et al., 2018).
148
149 Loan repayment after five years was through a similar herd or cash equivalent of the herd at
150 the set repayment date (Fakudze, 2015). The herd or its cash equivalent would be passed on to
151 other beneficiaries for horizontal expansion of the programme. According to Dean (2017) a
152 total of 3 661 head of cattle valued at about R39,7 million had been distributed to 113 farmers
153 on 96 different farms comprising of individual commercially-oriented cattle producers,
154 community trusts and co-operatives since the inception of the programme in Limpopo
155 province. The loan repayment was reported to be slow with less than 20% of the beneficiaries
156 having completely repaid after the first ten years and the majority still at various stages of
157 repayment (Mapiye et al., 2018).

158

159 **2.2 The National Red Meat Development Programme (NRMDP)**

160 The Eastern Cape Red Meat Project was initiated by ConMark Trust in 2005 to provide an
161 ordered informal marketing system for low-input producers through organised cattle auctions
162 (ConMark, 2013). The programme was then changed to the NRMDP in 2013 after the
163 Department of Rural Development and Land Reform (DRDLR), in conjunction with the
164 National Agricultural Marketing Council (NAMC) and local municipalities expanded the
165 programme nationally (Nyhodo et al., 2014). The fundamental goal of the programme was to
166 develop red meat production hubs which were primarily used to connect subsistence and
167 commercially-oriented cattle producers to formal markets (NAMC, 2013). This was achieved
168 through bringing the point of cattle sales closer to farmers by establishing or renovating auction
169 pens, assisting farmers to organize auctions and buyers days and negotiating pre-slaughter sale
170 agreements between farmers and abattoirs (NAMC, 2013).

171

172 The NRMDP facilitated the construction of low-cost custom feeding centres (CFCs) in the
173 recipients' communities where cattle were managed and finished using commercial feed for 90
174 to 120 days prior to marketing (NAMC, 2013). The NAMC provided subsidised commercial
175 feed for cattle and salaries for personnel working at the centres (Myeki et al., 2014). The
176 programme was attractive to farmers as it improved cattle condition thereby enhancing local
177 markets, formal marketing opportunities and creating employment for local people (Mkhabela,
178 2013). Capacity building was achieved through undertaking guided visits to feedlots, auctions
179 and abattoirs to offer on-site training (NAMC, 2013).

180

181 The programme was designed to build cattle producers' understanding of the structure,
182 operation and requirements of formal markets (NAMC, 2013). There are currently 22 CFCs

across South Africa with carrying capacities of between 150 and 400 cattle. The CFCs provide services to communities within an average radius of 100 km. The CFCs encounter common challenges including violation of induction conditions by farmers who bring old and/or sick cattle, inadequate feed, inconsistent feed deliveries, inability to supply the high volumes to formal markets, insufficient breeding stock (supply base), high staff turnover and a lack of production and marketing information. However, CFCs have successfully provided convenient marketing places with low transaction costs and an improved bargaining power for producers who, subsequently, receive high prices for their cattle than they would through formal marketing channels.

2.3 Australian Centre for International Agricultural Research (ACIAR) projects

The ACIAR jointly initiated a binational project for northern South Africa and Zimbabwe in the mid-1990s (MacLeod et al., 2008). South African partners included the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Limpopo Department of Agriculture (LDA) and the University of Limpopo (MacLeod et al., 2008). The project explored the suitability of a range of ley-legume species for improving forage availability for ruminant livestock in low-input farming areas (MacLeod et al., 2008). Tropical legumes, including *Chamaecrista rotundifolia* (Wynn cassia) and *Stylosanthes scabra* (shrubby stylo) were identified to have considerable potential for improving forage availability in both South Africa and Zimbabwe (Whitbread and Pengelly, 2004). However, the communal land tenure system and limited financial resources of low-input cattle producers were the major barriers to the successful adoption of the legume technologies in the sector (MacLeod et al., 2008). Recommendations were then made to redirect the legume technology project to commercially-oriented producers who were presumed to be more favourably endowed with land and financial resources (Winter, 2011).

Phase 2 of the ACIAR project dubbed the 'Beef Profit Partnerships' (BPP) was jointly initiated in 1999 by the Australia-based Cooperative Research Centre for Beef Genetic Technologies and the Agricultural Research Council (ARC) in Limpopo and North West provinces of South Africa (Burrow et al., 2008). The goal of the project was to improve indigenous cattle genotypes to enable low-input producers to achieve continuous improvement of profitable production and marketing of beef (Burrow et al., 2008). The selection criteria for recipient low-input cattle producers involved producers from a previously economically disadvantaged background who used indigenous breeds and/or their crosses and whose enterprises had the potential to become viable businesses (Burrow et al., 2008). Selected cattle producers made a commitment to measure their cattle through membership of the Beef Performance Testing Scheme in South Africa. In addition, producers were expected to demonstrate interest in improving profit and lifestyle by committing to meet the formal beef market specifications. Recipient producers and locally-based support staff had to be willing to work in self-selected local groups or networks which would hold continuous improvement meetings every 60-90 days for 5 years (Burrow et al., 2008). Finally, the cattle producers were required to be willing partners in a marketing group, alliance or beef improvement network (Burrow et al., 2008).

The project targeted six recipient teams in each Province (i.e., Limpopo and North West), with each team comprising up to 20 cattle producers but in some cases, the team represented an entire community of up to 400 people. A one-day workshop was conducted to develop the understanding necessary for programme activities and to give participants confidence in decision making (Burrow et al., 2008). Benchmark experiments showed that growth rates, feed efficiencies, incidence of diseases and meat quality of steers from low-input producers' herds mimicked that of commonly used commercial breeds, albeit, lighter induction and carcass

weights (Burrow et al., 2008). An opportunity, therefore, exists for cattle breeds from low-input producers to meet the specifications of South Africa's commercial beef markets (Clark *et al*. 2005). Funds for this project ended in 2006 at a time when networks had been expanded to 24 BPP recipient teams across five new South African provinces namely; Mpumalanga, Gauteng, Eastern Cape, Free State and Kwa-Zulu Natal (Burrow et al., 2008). It was believed that adequate capacity was built to enable recipient communities to continue with the initiatives.

The third phase of ACIAR project was initiated in Limpopo Province in 2004 as a reappraisal of the first initiative. The objective was to promote sound rangeland management practices and investigate the potential of introduced forage legumes, in particular *Stylosanthes* species, as fodder banks for improving feed supply and nutrition for commercially-oriented cattle producers (Burrow, 2015). Selection of recipients was based on discussions with senior managers, local government extension staff, municipal authorities, and the recommendations of the previous ACIAR herd and market improvement project. Following this process, 300 commercially-oriented farmers on communal land and 72 commercially-oriented farmers on private land were selected (Fisher and Hohnen, 2012).

The programme focussed narrowly on rangeland improvement opportunities as organisers made critical assumptions that the recipient commercially-oriented cattle producers were familiar with basic animal production and financial management systems commensurate with commercial operations (Burrow, 2015). During the implementation of the programme it became evident that the participating commercially-oriented cattle producers and the local extension staff, had limited knowledge of rangeland management, cattle production principles and practices (Burrow, 2015). Central practices of sound grazing management, such as, feed

budgeting were not appreciated and as a result calving rates remained low (MacLeod et al., 2008). The organisers then made conscious decisions to reappraise the approach taken by the programme and focus on developing capacity through a range of training courses in rangeland management, cattle husbandry and financial management.

2.4 The Heifer Project South Africa (HPSA)

The HPSA was initiated in 1999 in the Eastern Cape, Limpopo and KwaZulu Natal provinces (HPSA, 2008). The programme was run in partnership with the DRDLR and other non-governmental organizations, including, Miseror, EU and Wesbank (HPSA, 2008). The programme's aim was to use cattle to provide food and income, thus, alleviate hunger and poverty in low-input farming areas while, preserving the environment (HPSA, 2008). This was assumed to be achieved through training farmers on environmentally-friendly cattle farming practices and entrepreneurship skills, creating and operating businesses corresponding to their talents and skills. Beneficiaries were selected, through recommendations by the community leadership, from the poorest communities and priority was given to women headed households (HPSA, 2008).

Selected households were trained and provided with gifts of seeds, tree seedlings and cattle to start their own small farming businesses (HPSA, 2008). Recipients were expected to share the skills acquired as well as to pass on their gifts to other households in need to ensure a ripple effect of benefits (HPSA, 2008). The project used community dip tanks as focal points to organize farmers into cattle associations. The project also created jobs at each dip tank in the form of some microbusinesses comprising block making, the production and sale of animal skins and haymaking. By the year 2012, a total of 8030 households had received assistance but the number of jobs or individual businesses created was not reported (HPSA, 2008). The heifer

283 project has been criticized for its claims of promoting sustainable agriculture while the training
284 offered to farmers, especially on animal health, was largely based on conventional cattle
285 farming practices (HPSA, 2008).
286
287 **3. A holistic systems approach to sustainable cattle development programmes**
288 The polarized ideological and operational priorities of various cattle development programmes
289 make it difficult to have common purpose engagement about how to effectively address
290 concerns in the low-input cattle farming system. Thus, a discussion that looks at the
291 programmes' respective impact on sustainability is helpful to bridging the ideological and
292 operational divide between the programmes. Table 2 presents a summary of impacts of the
293 major cattle development programmes in South Africa. Insights from holistic systems approach
294 to sustainability assessments can help to shift discussions towards more open dialogue about
295 context-specific cattle farming concerns (Shilomboleni, 2017). That may also provide the
296 grounding for effectively rethinking the approach to developing and managing cattle
297 development projects, and the type of policy and institutional support required.
298
299 In drawing insights from sustainability assessments a set of key indicators corresponding to
300 the four pillars of agricultural sustainability namely; economic viability, environmental
301 stewardship, social justice and governance were derived (Khwidzhili and Worth, 2017).
302 Economic viability was indicated by access to markets, income opportunities and decreasing
303 the level of risk. Environmental stewardship included, maintaining and increasing biological
304 productivity and conservation of natural resources. Social justice indicators included food
305 security and sovereignty, gender equality, capacity development and youth involvement. Given
306 that all the sustainability indicators have strong links to policy, the impact of cattle development
307 programmes would inevitably require engagement with governance mechanisms (Vanlauwe et

al., 2014). As such, the impact of cattle development programmes to each of the selected indicators will be discussed along with the relevant governance implications. All the mentioned indicators, however, do not entirely identify the main areas where important contributions could be made in low-input cattle farming systems and may be contested in the broader platform.

3.1 Economic impacts of cattle development programmes

The design and implementation of the development programmes seem to be based on the preconception that the low-input cattle farming sector should be modernised and commoditised (Faku and Hebinck, 2013). The preconception reflects a lack of understanding by programme organizers on the complexity of the low-input cattle farming system which is often framed around multiple production goals (Moraine et al., 2017). In this context, cattle development programmes must first establish the priority goals of producers and then co-design programmes with producers in line with their established goals. Overall, economic interests of low-input producers are often lost in the drive by cattle development programmes to improve their participation in formal beef value chains.

3.1.2 Access to markets

All the case studies of cattle development programmes mentioned in the current review intended to improve formal market participation by low-input producers. The Nguni cattle and ACIAR programmes successfully demonstrated that indigenous cattle breeds could be raised to formal market specifications (Thompson et al., 2010). Muchenje et al. (2008) further reported that the physicochemical meat quality attributes of Nguni cattle are comparable to, while, fatty acid composition and organoleptic quality supersedes that of exotic commercial beef breeds. These superior meat quality characteristics were recommended to be used for

marketing beef from Nguni cattle to health conscious consumers (DeWaal, 2014). Ironically, save for the Limpopo-IDC Nguni cattle programme, which sort to market the Nguni-Angus F1 crossbreds as Angus beef in local retail shops, no formal arrangements were made with abattoirs to purchase cattle from the low-input sector.

In cases where producer-abattoir contractual arrangements were in place, the operational levels of the low-input cattle farming systems was not adequate to supply sufficient volumes of cattle required by the formal market (Marandure et al., 2016). Besides, the formal beef carcass classification system used in South Africa penalises the older and emaciated animals often sold by low-input cattle producers and favour young well-muscled animals (Chingala et al., 2017). Considering this, the top-down intervention by the Nguni cattle, NRMDP and ACIAR programmes to organize farmers into marketing groups to meet the volumes and quality demands of the formal market was inappropriate (Ndoro et al., 2015). Marandure et al. (2016) reported that low-input cattle producers were not comfortable with forward contracts as they felt indebted. Besides, the programme overlooked the ability of farmers to self-organise into functional groups that can consistently match their production levels to the demand created by facilitated marketing arrangements.

Low-input cattle producers faced intense competition from established commercial farmers after the deregulation of the meat industry through the Marketing and Agriculture Act number 47 of 1996 (Meissner et al., 2013). On a global scale, van Wijk (2014) attributed the agrarian crises to globalized food and agricultural systems through liberalized agricultural markets and structural adjustment policies besides unfavourable climatic or economic conditions of low-input farmers. FAO (2003), further indicated that subsidised imports due to trade liberalization policies weakened farmers' competitiveness in their own markets, thereby, exacerbating

poverty in Africa. Creating more localized food systems with short and fair distribution chains between producers and consumers are critical to reverse challenges associated with the globalized food system in this regard (Shilomboleni, 2017). Most low-input producers prefer informal cattle markets where cattle on hoof fetch higher prices than what they realize from formal markets (Marandure et al., 2016). Moreover, cattle sold on the hoof provide local buyers with the benefits of the fifth quarter products, including offals that are considered a delicacy by most rural consumers. The fifth quarter products are regarded as an extra quarter above the four quarters of the animals' dressed carcass after slaughter which contains the main cuts of both prime and processing meat (Lloyd, 2013).

Efforts to systemize the informal marketing of cattle as attempted by the NRMDP could be a beneficial intervention. However, Lubungu et al. (2012) asserts that marketing is not the primary production goal of most low-input producers who prefer essential 'flow products' provided by cattle which include, draught power, milk, manure, a live bank, medium for traditional payments and assets of inheritance among others. Unlike 'end-products' such as, meat and hides/skins, 'flow products' generate a regular cash income or represent consistent availability of other benefits relative to the period that the animal stays on the farm (McDermott et al., 2010). Thus, selling animals, especially young stock, is not desired by low-input producers as it results in the loss of flow products (Herrero et al., 2010; McDermott et al., 2010). The preference for flow products by low-input producers is often underestimated in many cattle development programmes which are market-oriented (Wolfgang et al., 2003).

3.2.2 Decreasing the level of risk

Cattle development programmes are viewed as advancing the corporatization of Africa's agriculture through implementation of a model based on high-priced input packages that carry

heavy economic risks for farmers (Shilomboleni, 2017). Khapayi and Celliers (2016) further explained the source of heavy economic risks for farmers as the persistently upward global trend of farm input costs while, farm gate prices are either constant or extremely volatile. Furthermore, low-input cattle producers reside in marginal areas with poor access to infrastructure, which increases the costs of transporting external inputs into and products out of the system (Wolfgang et al., 2003). Instead, the single focused goal of commercialization ostensibly serve the primarily interests of a few but powerful corporates and offers no valid solutions for food security challenges of the low-input cattle producers (Holt-Giménez and Altieri, 2013; Ainembabazi et al., 2018).

The animals given by the Nguni cattle programme and the HPSA offered a form of credit facility to recipient low-input cattle producers, the majority of whom do not have collateral to access loans through the formal systems (Otieno, 2012). A lack of clearly stated penalties to loan defaulters might, however, discourage the low-input producers from repaying the loans even if they could afford to. The loans may be considered as gifts by producers which may encourage reluctance to repay for horizontal expansion to new recipients (Sirohi, 2010). According to Faku and Hebinck (2013) in many African societies, including South Africa, it is considered a bad cultural habit to turn down a gift of cattle. Thus, low-input producers still accept cattle even if they might not prefer the breed or have the capital to repay them. Nevertheless, low-input producers seem to prefer diverse cattle breeds with large adaptive and production differences which compromises resilience against shocks in extreme climate, low management levels or volatile markets (Theunissen et al., 2013). Theunissen et al. (2013) predicts that indigenous and theirs non-descript crossbreeds will gain more importance in the region as the effects of climate change become more pronounced owing to their adaptation to the local environment.

3.1.3 Income opportunities

Marandure et al. (2016) reported higher cattle market offtake rates leading to increased household income since the inception of the NRMDP. A final report of the BPP also revealed positive economic impacts where the programme increased revenue to the recipient commercially-oriented farmers by an average of R16 000 (US$ 1 212.12) per producer per year (Burrow et al., 2008). It is estimated that the BPP programme increased profits to the subset of farmer teams that measured gross margins by an average of about R7 500 (US$568.18) per producer per year (Burrow et al., 2008). This income was largely generated from 'flow products' of cattle, for example, through milk sales, draught power hire, manure for fertiliser and energy (McDermott et al., 2010). However, low-input cattle producers prefer varied income sources to add to the diversity of income and to improve resilience at the household level (Shah et al., 2013). In this regard, only the HPSA promoted diversity of household income sources by facilitating income generation from crops, handicrafts, trade, wage labour and/or remittances (Shiferaw et al., 2014). Besides meeting household needs, such as paying for health care and education, improved household income aid investment in other agricultural enterprises and towards environmental stewardship (Shah et al., 2013).

3.2 Environmental impacts of cattle development programmes

From an environmental perspective, it is recommended that cattle development programmes should prioritize sustainable use of local resources (Broom et al., 2013). The cattle development programmes mentioned in the current review showed that reliance on externally sourced resources often present problems. For example, the Angus bulls introduced in the Limpopo-IDC Nguni programme failed to survive under commercially-oriented farmer's

socio-environmental conditions and the legume species introduced by the ACIAR were unsuited to the local climatic and edaphic conditions.

3.2.1 Maintaining and increasing biological productivity

3.2.1.1 Soil productivity

The foundation of environmental sustainability that is capable of supporting optimum cattle productivity encompasses maintenance and improvement of soil quality (Rosa and Sobral, 2008). According to Rosa & Sobral (2008) environmental degradation often arise from prolonged exploitation of land-use systems without consideration of soil conservation and or improvement. A good soil system provides a satisfactory environment for sustainable rangeland productivity, which supports optimum livestock productivity (Thorne and Tanner, 2002; Rosa García et al., 2012) and consequently increase farmers revenue. None of the programmes reviewed in the current article had direct goals related to actively improving soil productivity, although, the ACIAR legume programme may have soil improvement intention through biological nitrogen fixation (Mapiye et al., 2006). This is not unusual given the fact raised by Shilomboleni (2017) that low-input cattle producers shun interventions with no direct income or food security benefit. Fertile soils should have a capacity to recycle vital nutrients and to maintain a diversity of organisms that minimize disease and parasite outbreaks (Shilomboleni, 2017). It is essential for cattle development programmes to incorporate soil productivity along with other intended objectives. Continual improvements are necessary as removal of cattle from the system through sales and/or mortality export nutrients from soils, and these have to be replaced to avoid soil degradation (Conant et al., 2017), which in turn reduces vegetation biomass and quality (Holt-Giménez and Altieri, 2013).

3.2.1.2 Vegetation productivity

457 The interventions of the ACIAR programme including rangeland restoration, reinforcement
458 and management as well as requirements for rangeland management plans by the Nguni cattle
459 programme had potential to improve forage biomass and quality for cattle. The cost of
460 reinforcing, restoring or establishing the necessary infrastructure for rangeland development is
461 often well beyond the limited financial resources of most low-input cattle producers (Stür et
462 al., 2013). Reluctance to invest in rangeland improvement by low-input producers could also
463 indicate a tragedy of the commons where unequal individual benefits from such public goods
464 discourages collective development interests (Hardin, 1968). A combination of poor climatic
465 and edaphic conditions coupled with heavy encroachment by bush mopane, Vachellia and
466 Acacia species also disqualified the introduction of viable populations of forage legumes on
467 most recipient farms (MacLeod et al., 2008).
468
469 Cattle producers may view rangeland improvement initiatives as straining their already
470 constrained labour, capital and other agronomic inputs resources that are often prioritized for
471 food and cash crop production (Amary, 2016). This is particularly true given the fact that
472 rangeland management plans are often linked to specified conservative stocking rates which
473 might be viewed by low-input cattle producers as potentially limiting their stock numbers
474 (Gayatri, 2016). Recent studies suggest that communal rangelands have adapted to overgrazing
475 overtime, in such cases, it is important to recalibrate their carrying capacity (Faku and Hebinck,
476 2013). The HPSA goal of enhancing rangeland management by adopting agroecology can be
477 emulated in future cattle development programmes (Holt-Giménez and Altieri, 2013).
478 According to Lovell et al. (2010), agroecology replicates the model of traditional agriculture
479 to improve the productivity of ecological landscapes, by optimizing practices, such as nutrient
480 cycling and forage diversity using low-input technologies. The principles of agroecology were
481 proven successful in meeting the food security needs of low-input farmers living in marginal

environments in Africa, Asia and Latin America (Holt-Giménez and Altieri, 2013). Improved rangeland production consequently improve cattle productivity (Chaudhry, 2008).

3.2.1.3 Cattle productivity

The Nguni cattle programme and the HPSA provided the essential raw materials for production in the form of interest-free cattle loans. All the case studies of cattle development programmes mentioned perceived the low-input cattle farming system as archaic and unproductive system, needing to be replaced by modern, intensive, market-oriented system (Segnon et al., 2015). For example, the reliance of the NRMDP intervention on custom feeding of cattle using externally sourced commercial feed and veterinary inputs. Such costs are beyond the majority of low-input producers, thus are not economically sustainable. In addition, the animals that were not in the CFCs were subjected to suboptimal growth largely due to inadequate nutrition and poor veterinary care (Tedeschi et al., 2015). The use of diverse breeds also provides raw materials to exploit heterosis and opportunities to maximize high productivity and profitability (Tada et al., 2013). Generally, indigenous breeds such as, the Nguni are small framed but they are adapted to local disease and parasites, have low feed requirements, are fertile and maintain high productivity under extreme climatic conditions, which suit the low management levels of most low-input farmers (Nyamushamba et al., 2017). Exotic breeds, on the other hand have large frames but fail to thrive under low-input farmers' management due to their need of a high plain of nutrition, veterinary drugs and low tolerance to heat stress. Crossbreeding, is therefore, recommended to combine the hardy characteristics of indigenous cattle with high growth traits of the exotic breeds.

3.2.2 Conservation of natural resources

3.2.2.1 Conservation of indigenous forage genetic resources

By encouraging good grazing management the programmes reviewed in the current study, serve for the NRMDP, promoted conservation of forage genetic resources. This is essential given the fact that low-input cattle producers often fail to balance ideal management of resources with optimum cattle production per unit agricultural area (Goswami et al., 2017). Many aspects of rangeland resources such as, quality and quantity (Metzger et al. 2005; Bernués et al. 2011), species and community biodiversity (Snyman and Fouché, 1993), vegetation dynamics, shrub invasion (Rosa García et al., 2012), are also modified by grazing livestock (Rook & Tallowin 2003). Therefore, inventories of rangeland resources should precede any extensive cattle developmental program as a matter of principle. LaCanne and Lundgren, (2018) explained that most rangeland biodiversity is lost through land degradation because of a combination of deforestation and overgrazing. Even the NRMDP indirectly contributed to forage resource conservation by removing cattle from rangelands thereby, reducing grazing pressure. However, interventions by the ACIAR programme might be viewed as anti-conservation as it introduces alien species to rangelands which might lead to loss of indigenous biodiversity as they become outcompeted. Questions may also be raised on the approach by the HPSA that involved distributing the same seed and animal genotypes across different agro-ecological areas.

3.2.2.2 Conservation of indigenous cattle genetic resources

The organizers of the ACIAR and the Nguni cattle programme presented the Nguni as an environmentally friendly, sturdy and easy-to-handle breed that should be kept pure to maintain its unique organic beef attributes and develop a niche market locally and internationally (Bester et al., 2003). The adaptation of the Nguni breed to marginal environments characterised by vegetation of low nutritive value, extreme climatic conditions, high prevalence of diseases and parasites and low management regimes is indeed beneficial to low-input cattle producers (Tada

et al., 2013). However, most local feedlot operators dislike the Nguni breed because of its small frame, low growth rates and carcass yield (Chingala et al., 2017).

Faku and Hebinck (2013) also reported that most low-input cattle producers, having been accustomed to non-descript crossbreeds for over 60 years, have grown to appreciate and value some of their qualities, such as, larger frame sizes and carcass yield compared to Nguni cattle (Faku and Hebinck, 2013). This is confirmed by numerous studies that reported non-descript crossbreeds as the most common breed kept by low-input cattle producers in South Africa (Scholtz et al., 2008; Mapiye et al., 2009a; Nowers et al., 2013). Over the time the non-descript crossbreds also developed relative adaptation to the local climate, diseases and parasites, marginal feed resources and management regimes of low-input cattle producers compared to pure exotic breeds (Faku and Hebinck, 2013). Nonetheless, Nyamushamba et al. 2017 expressed the importance of conserving the indigenous cattle genetic material, including the Nguni, as raw materials for crossbreeding.

3.3 Social impacts of cattle development programmes

The social values of cattle are clearly not prioritized in the market-based interventions by most cattle development programmes. Social challenges that characterize low-input cattle farmers including, food insecurity, gender disparity, low intergenerational succession rates and lack of sustainable cattle farming knowledge among others are complex and would require a holistic systems approach to understand them (Ayantunde et al., 2011). Kruska et al. (2003) mentioned that improved targeting and dissemination of interventions with positive impacts on cattle farming requires a thorough understanding of the overall system and the environment in which the low-input farmers operate.

557 *3.3.1 Food security and sovereignty*

558 In general, all the cattle development programmes under review either directly or indirectly
559 sought to enhance household food security by providing animals or improving their production
560 and marketing (McDermott et al., 2010). In reality, household food insecurity remain prevalent
561 in low-input farming systems (Jacobs, 2012), indicating inadequacy of narrow market-led focus
562 of most cattle development programmes. Such interventions were dismissed by Otte et al.
563 (2005) as having failed to adequately feed the world in a sustainable manner. Save for the
564 HPSA where the poorest households were identified through recommendations from the
565 community leadership, other programmes discriminated against non-cattle owners and those
566 with small herds who are more food and income insecure.

567

568 The Nguni cattle programme and the HPSA have the potential to contribute towards food
569 sovereignty through provision of animals to farmers. Food sovereignty was defined by Holt-
570 Giménez and Altieri (2013) as right of people to healthy and culturally appropriate food
571 produced through ecologically sustainable methods, and their right to define their own food
572 and agricultural systems. The food sovereignty model endeavours to put those who produce,
573 distribute and consume food at the heart of the food system, rather than the demands of markets
574 and corporations (Holt-Giménez and Altieri, 2013). In light of this, development programmes
575 which promoted the raising of indigenous cattle breeds using local resources were implemented
576 within the prescripts of the food sovereignty model. However, none of the programmes
577 followed the other food sovereignty principle that farmers should grow food for self-
578 sufficiency purposes and be embedded in locally-based markets as opposed to national and
579 global value chains (Shilomboleni, 2017). The state should be a prime guarantor of food
580 security and sovereignty as it can enforce the legal nature of various entitlements to promote
581 the social and economic conditions necessary to secure individuals' access to food and ensure

582 fair and stable food prices (Letty and Alcock, 2013). In South Africa, the mechanisms by which
583 agricultural policies are expected to alleviate poverty and enhance food security are not
584 inherently clear (Jacobs, 2012).
585
586 *3.3.2 Gender equality*
587 Only the HPSA clearly stated the goal of providing cattle and other means of production to
588 women so as to elevate their social status (Achandi et al., 2018). According to Kristjanson et
589 al., (2010), elevated social status often translates to access or even authority over a broader
590 base of community resources. The elevated status gives women the necessary leverage to lobby
591 for support from government and other organizations in parallel with their male counterparts
592 (Njuki et al., 2011). Shah et al. (2013) expressed that women are better at allocating scarce
593 resources and sharing knowledge about production than men. Overall, resources (i.e., food and
594 income) under the control of women are more likely to be used to improve family welfare as
595 women spend up to 90% of their income on their families (Hausmann et al., 2011). Such
596 qualities are essential in improving food security and strengthening social networks that are
597 responsible for horizontal knowledge transfer within and between communities (Kristjanson et
598 al., 2010).
599
600 With the exception of HPSA, the focus of the rest of the cited development programmes on
601 cattle, is likely to discriminate against women who are often left in charge of smaller livestock
602 species such as poultry and small ruminants, while men delegate themselves to cattle and other
603 larger livestock (Njuki et al., 2011; Myeki et al., 2014). In fact, some cultures prohibit women
604 from owning cattle, limiting the potential for gender equity in low-input cattle farming systems
605 (Njuki et al., 2011). This is despite the fact that women are often left in charge of households
606 by their husbands when the latter seek off-farm employment (Meijer et al., 2015; Njuki et al.,

607 2011). Overall, HPSA involved community leadership in identifying the poorest households in
608 need of assistance, which could have significantly contributed towards reduction of societal
609 inequalities. Other development programmes were discriminating against cattle ownership and
610 this may have fuelled societal inequities.
611
612 *3.3.3 Youth involvement*
613 The focus of the HPSA on training local young people as communal animal health workers
614 created a nucleus of custodians of information within communities which is essential given the
615 inefficient extension services in low-input farming areas (Mwacharo et al., 2009).
616 Unfortunately, none of the other programmes under current review actively targeted the youths.
617 The youth have a critical role of providing progressive management strategies which are
618 essential for the sustainability of low-input cattle farming systems. Youths involvement in
619 development programmes stimulates their interests in cattle farming, helping to counter the
620 long-term challenge of lack of intergenerational succession which seriously threatens
621 sustainability of low-input cattle farming systems (Dapaah et al., 2001; Nakano et al., 2018).
622 Thus, youth involvement in cattle production is an important indicator of the continuing
623 existence of the system in future (Nqeno et al., 2011). As with women, capacity building of
624 young people essentially guarantees wider horizontal knowledge transfer as they have wider
625 communication networks.
626
627 *3.3.4 Capacity building and knowledge transfer opportunities*
628 There were clear capacity building benefits provided for low-input producers by all the cattle
629 development programmes case studies. The interactions during training presented
630 opportunities for developing functional social networks and fostering unity among low-input
631 cattle producers (Segnon et al., 2015). Nakano et al. (2018) mentioned the importance of

632 training programmes to be coordinated to ensure they communicate the same message and
633 provide win-win benefits to both low-input cattle producers and programme organisers.
634 Continuous improvement cycles instigated by the ACIAR programme is essential in building
635 know-how on consistent monitoring and adjustment strategies for their production practices.
636 The implementation of the HPSA, including its training protocol, is based on the principles of
637 agroecology and this advances the operationalization of sustainability through more rationale
638 and efficient use of local resources to improve cattle production (HPSA, 2008). The basis of
639 the HPSA training could be adopted in designing future cattle development programmes.
640

641 **4. Designing, implementing and exiting strategies for sustainable cattle development**
642 **programmes**

643 All cattle development programmes prefer their technologies to be implemented longer after
644 their active engagement with various communities. As such, it is essential for cattle
645 development programme organizers to consider a sustainability-based holistic systems
646 approach when developing their design, implementation and exit strategies. A two-phase
647 protocol is proposed for use in low-input cattle development programmes consisting of a design
648 and implementation phase with the exit phase running in parallel with the later as presented in
649 Figure 2.
650

651 **4.1 Design phase**

652 The cattle development programmes under the current review reflected limited understanding
653 of the complexity surrounding low-input farming systems. In that regard, it is crucial to conduct
654 extensive consultations with local stakeholders, including, cattle producers, community
655 leaders, local extension officers, local government officials and other researchers in the area.
656 Stakeholders' perceptions on the challenges and opportunities of the low-input cattle

657 production system provides the basic understanding of the system required for designing more
658 appropriate interventions (Kruska et al., 2003). Stakeholders should take a leading role in
659 suggesting strategies for new broad-based interventions that cover the environmental,
660 economic and social aspects of low-input cattle production as well as, a desired implementing
661 and exit strategies for the programmes (Mascarenhas et al., 2015). In the same regard,
662 stakeholders can also be requested to suggest the selection criteria for recipients as well as,
663 relevant organizations, groups or departments that can be approached for partnerships in the
664 new endeavours. This critical step is often not considered in most development programmes,
665 including those under review. The programmes fail to acknowledge that low-input cattle
666 producers have loads of inherent valuable knowledge and experiences spanning hundreds of
667 years that they can share (Kruska et al., 2003). This provides useful input towards designing of
668 relevant and sustainable interventions. In contrast, cattle development programmes draw their
669 knowledge from a mixture of scientific, idealistic and even romantic views developed within a
670 fixed time frame (Kruska et al., 2003).
671
672 We propose the selection of a committee comprised of local producers, leadership, public and
673 private enterprises that will assist with co-designing and co-administration of the actual
674 intervention strategies with the organisers. The committee will also form part of the
675 transitioning phase that will eventually assume total responsibility of activities upon exiting of
676 the programme after its implementation period (Rogers and Macías, 2004). Early consideration
677 of exit strategies is critical as some positive technological interventions are often lost after
678 respective cattle development programmes withdraw their support at the end of their
679 implementation period (Gardner et al., 2005). According to Davis and Sankar (2006) transition
680 and exit strategies are best co-developed with farmers and local stakeholders to ensure a

sustained source of resources, technical and managerial capacity, and sustained motivation of beneficiaries and service providers after the project ends.

Coates et al. (2016) identified three approaches to exit strategies namely; phase-down, phase-over and phase-out. Phase-down refers to gradual reduction of programme inputs offered to recipient communities. Phase-over refers to the transfer of programme activities to another entity such as a local committee, a research institution, a branch of local, regional or national government, or other local or international funding organizations (Rogers and Macías, 2004). This phase also includes capacity building of recipient farmers who will eventually assume responsibility of activities (Coates et al., 2016). For best sustainability prospects community members can be left with the responsibility of programme activities which can be regularly monitored by a selected institution. Phase-out refers to abrupt removal of programme inputs or activities without any arrangements for their further use. This is common in self-sustaining programmes whose resources requirements change once their objectives are achieved (Gardner et al., 2005). Finally, the components required as well as the contents of training material can be organized in preparation for implementation of the programme.

In view of the limited coordination between different cattle development programmes (Sirohi and Chauhan, 2010) which compromises continuity, the protocol proposes the establishment of a management database which will inform on successes, failures and lessons learnt during implementation of various programmes. The database can be maintained by local the institutions involved in the project. The primary purpose of the database will be to integrate activities of various cattle development interventions to encourage coherent adoption of technologies. At the same time, a more coordinated delivery of interventions will address the current challenges where conflicting interests of various programmes might confuse the

706 recipients (Makkar and Ankers, 2014). The management database could also save as a
707 monitoring and evaluation tool for the cattle development programmes.
708
709 **4.2 Implementation phase**
710 Implementation of programme activities should be informed by what stakeholders suggest in
711 the design phase of the proposed framework. This includes selection of recipient low-input
712 farmers using stakeholders' recommendations mentioned in the design phase. This is opposed
713 to the top-down approach of unilaterally developing a criteria for selecting recipients as
714 practiced by most cattle development programmes (Faku and Hebinck, 2013) including those
715 under the current review. Of the programmes under the current review, only the HPSA selected
716 recipients at the recommendation of local community leadership, as such, appropriate
717 beneficiaries were identified.
718
719 Another important sustainability aspect which is considered by all the cattle development
720 programmes under the current review is capacity building. The training material of the different
721 cattle development programmes can, however, be synchronized, possibly through the proposed
722 management database, to allow consistent knowledge delivery and skills development (Fraser
723 et al., 2006). Farmer training forms the second step of the implementation phase of the proposed
724 protocol (Figure 2). It is also important to emulate the continual improvement strategy of the
725 ACIAR programme where cattle producers meet once every 60 to 90 days for programme
726 introspection and effecting changes where necessary (Fisher and Hohnen, 2012). This step is
727 important to ensure that programme activities constantly align to prevailing conditions in
728 recipient communities. The process also helps to instil the skills of continually improving
729 activities to adapt to developing circumstances. Finally, preparations can be made for

730 horizontal expansion of the programme before the implementation cycle is repeated again by
731 selecting new recipients.
732
733 Overall, the concept of sustainability is often not considered during performance monitoring
734 and evaluation of cattle development programmes (Searcy et al., 2014). In fact, to the authors'
735 knowledge, there is no existing framework designed to incorporate sustainability in the
736 performance measurement of cattle development programmes in the low-input farming sector.
737 Sustainability evaluation ensures that the performance of cattle development programmes
738 essentially transcends beyond economic gains to include environmental and social benefits in
739 line with the multi-faceted challenges and pluralistic production goals of low-input farmers
740 (Olde et al., 2016). A holistic systems approach is, therefore, required to ensure that the
741 performance of cattle development programmes is evaluated in the context of sustainability to
742 address the diverse challenges and pluralistic production goals of low-input farmers (Searcy et
743 al., 2014).
744
745 **5. A holistic systems approach to sustainability evaluation of cattle development**
746 **programmes: Application potential in low-input farming areas**
747 A holistic systems approach can be used to facilitate the development of sustainability
748 evaluation and monitoring framework for cattle development programs in low input
749 farming areas (Searcy et al., 2014). The framework can help organizations involved in cattle
750 development programmes to measure progress towards their goals. In the process, the
751 organizations will develop understanding of the current situation, the key issues that should be
752 addressed, and the options available (Chakravarti, 2018). However, there are many challenges
753 associated with the design, implementation, and evolution of a robust sustainability evaluation
754 and monitoring framework (Bockstaller et al., 2015). The challenges include developing

linkages between the measures, integrating the measures with existing internal initiatives, and accounting for non-financial issues in the system. This is worsened by the fact that performance measurement system must always be context-specific (de Olde et al., 2018).

A holistic systems approach can help stakeholders to address many of the challenges inherent in the design, implementation, and evolution of a sustainability evaluation and monitoring framework (Searcy et al., 2014). In particular, a holistic systems approach is useful in developing the process of creating a sustainability evaluation and monitoring framework (Sala et al., 2015). However, a holistic system approach do not absolutely guarantee the successful design, implementation, and evolution of an appropriate sustainability evaluation framework in all cases but, can provide the needed direction and serve as tests of validity throughout the process (Searcy et al., 2014). It can also provide insight into how organizations involved in cattle development projects can develop a sustainability evaluation and monitoring framework tailored to their unique needs.

6. Conclusions

Overall, the market-led interventions by both the local and international cattle development programmes narrowly focused and inadequately addressed a wide array of environmental, economic, social, technical and institutional challenges faced by low-input cattle producers in South Africa. The current review demonstrated that a holistic systems approach provides both the structure and flexibility required to guide the design, implementation, and evolution of sustainable cattle development programs in the low-input farming areas in South Africa. The review also indicates the usefulness of a holistic systems approach in developing the process, structure and content of a sustainability evaluation and monitoring framework.

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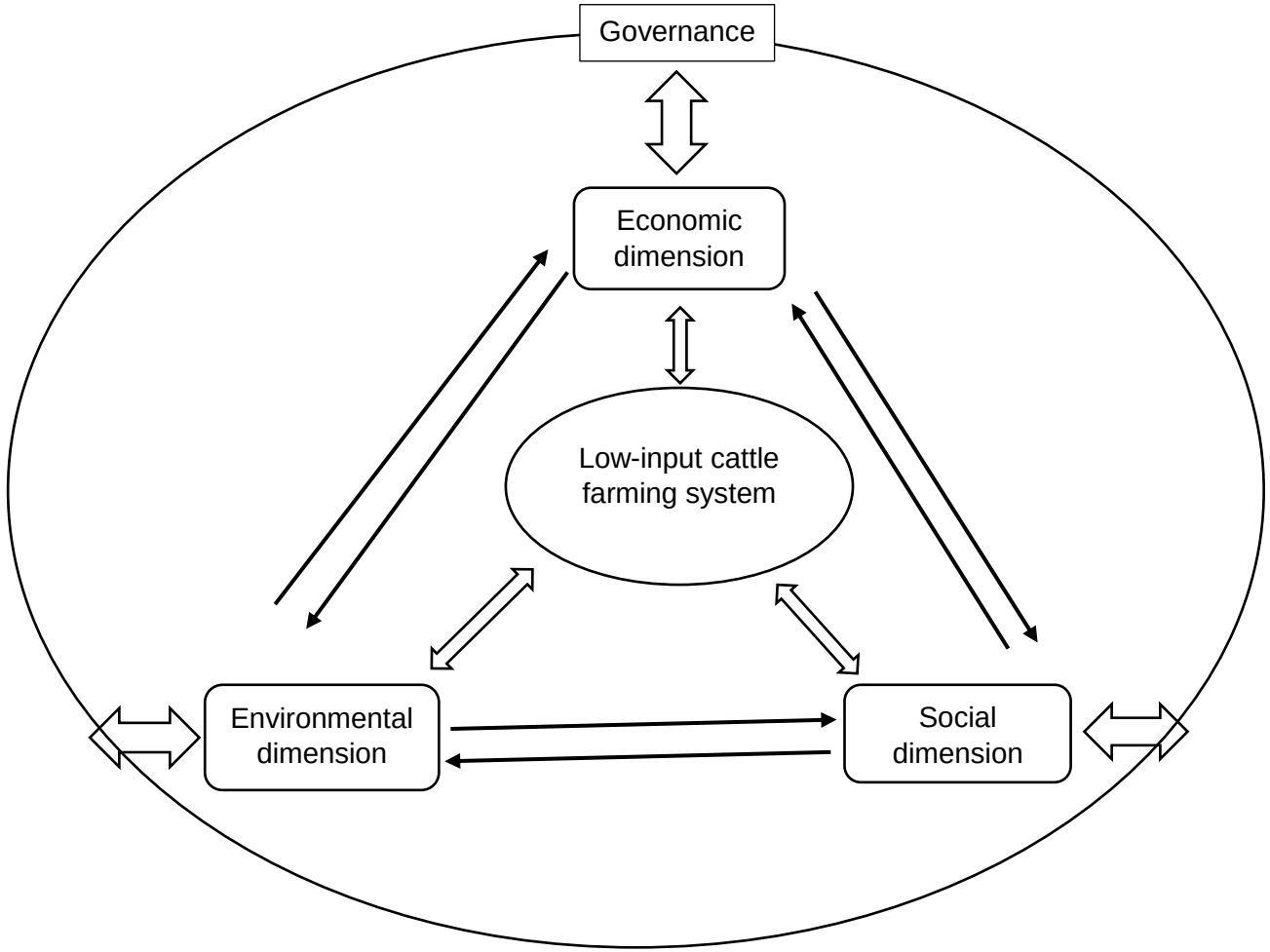
Governance
Economic dimension
Low-input cattle farming system
Environmental dimension
Social dimension

1114 **Figure 1:** The interactions between the low-input cattle production system and the sustainability dimensions

1115 **Table 1:** Attributes of selected cattle development programmes in South Africa

	Nguni cattle programme	**National Red Meat Development Programme (NRMDP)**	**Australian Centre for International and Agricultural Research (ACIAR) programme**	**Heifer project**
Aims	To establish Nguni nucleus herds and upgrade the cattle herds to Nguni type in low-input communities	To develop red meat production hubs to improve productivity, increase income and employment for rural folk	To investigate the potential of introduced forage and ley-legume species as fodder banks for improving feed supply and animal nutrition for low-input cattle producers	To reduce hunger and poverty
Partners	Industrial Development Coorporation, the Department of Agriculture and a local university	National Agricultural Marketing Council, Department of Rural Development and Land Reform	Agricultural Research Council, Limpopo Department of Agriculture, Centre for Scientific and Industrial Research Organization	Heifer Project South Africa, Department of Rural Development and Land Reform, Miseror, EU and Wesbank
Target area	National	National	Limpopo and North West provinces	Eastern Cape and KwaZulu Natal provinces
Target producers	Subsistence and commercially-oriented producers	Subsistence and commercially-oriented producers	Subsistence and commercially-oriented producers	Subsistence and commercially-oriented producers
Approach	Top-down approach	Top-down approach	Top-down approach	Community-based
Number of beneficiaries	233 by 2012	13 communities	Not specified	8 030 households by 2012
Rangeland management plan	Yes	No	Yes	Yes
Cattle breeds promoted	Nguni	Not specified	Indigenous breeds and their crosses	Indigenous

1116

1117 **Table 2:** Economic, environmental and social impacts of selected cattle development programmes in South Africa

The Nguni cattle project			
	Ecological	*Economic*	*Social*
Positive	Promotes sustainability through facilitating ecologically friendly free-ranging conditions	Offers means of production through cattle loans	Offers training and skills development for capacity building
	Promotes use of adapted hardy breeds suited to low-input producers	Provides opportunities for improved household income	Strengthens social coherence and social networks through interaction of cattle producers
	Requires a rangeland management plan for effective use of natural resources	Proved market-related merits of the Nguni breed	Cattle offered elevates the social status of the programme recipients
			Engagement with local extension officers technical staff and researchers helps to motivate farmers
Negative	Lacks practical soil and rangeland improvement strategies	No clearly stated penalty against loan defaulters affects loan repayments	A top-down approach: lack of stakeholder consultation
	Monitoring of rangeland management not comprehensive	Market-led focus inadequate to address multiple challenges of producers	Disregards the breed preferences of cattle producers
	Promotion of a single breed is against low-input cattle producers practices of multiple breeds to improve resilience	Fuels economic inequity in communities	Exclusion of non-cattle owners aggravates societal inequity
	The Nguni x Angus Limpopo-IDC ideology could negatively affect conservation of indigenous genetic material		Requires castration of all other bulls in the community against cultural principle of some cattle producers
The National Red Meat Development Programme (NRMDP)			
Positive	*Ecological*	*Economic*	*Social*

	Custom feeding centres reduces grazing pressure	Improves body condition of market cattle	Job creation for locals
		Facilitates formal market access and systemize the informal market	Capacity building through training
		Improves cattle market offtake rates in low-input communities	Enhances social coherence and strengthens social networks through farmer interaction
Negative	Dependence on costly external inputs	Only concerned with market animals	A top-down approach: lack of stakeholder consultation
	Lacks practical soil and rangeland improvement strategies	No arrangements made with abattoirs for formal sales	Does not concur with the multifunctional roles of cattle in low-input production systems
		Exclusion of non-cattle owners aggravates economic inequity	High staff turnover which leads to a waste of resources through regular staff training
		The external inputs carry a heavy economic risk for cattle producers	Lack of proper knowledge among members on how the CFP operates
			Conflicts arising from different members opinions of how the CFCs should be operated
Australian Centre of International and Agricultural Research Project			
	Ecological	*Economic*	*Social*
Positive	Encourages rangeland management	Rangeland development translates to sustainable improvements in cattle productivity	Equips low-input producers with pasture development, cattle and financial management skills
	Improves biodiversity	A model to inform farmers' decisions about inputs and the mix of activities needed to maximise profit from commercial markets was produced	Enhances social coherence and strengthens social networks through farmer interaction
	Intends to improve animal nutrition	Used the continuous innovation and improvement strategy to manage,	

		implement and continuously exploit opportunities for positive impact in society	
Negative	Projects that narrowly focusses on pasture development and not cattle production were not prioritized by producers in terms of resource allocation	Puts a strain on constraining financial, labour and other material resources.	Intervention does not directly improve food and income security
	Might introduce invasive species	Poor infrastructure to support pasture development	The project was implemented on a small proportion of the population of commercially-oriented livestock producers in Limpopo province.
The Heifer project South Africa (HPSA)			
	Ecological	*Economic*	*Social*
Positive	Promotes sustainable cattle production	Facilitates market access	Facilitates establishment of effective community management institutions
	Concerned with ecological conservation strategies	Improves household income and diversity of income	Offers training and skills development for capacity building
	Uses local breeds preferred by cattle producers	Provides livestock even to non-livestock owners, thereby, fostering societal equity	Enhances social coherence and strengthens social networks through farmer interaction
	Enhances productivity by promoting agroecology		Job creation for locals
			Provides a mix of species other than cattle, thus, improves stability of the farming system
			Promotes gender equity by empowering women
			Assists producers to lobby for government support

Negative	Seeds and animals offered are universal		No consultations on what to help to provide beneficiaries
			Promotion through small stock might not be of prime importance to low-input cattle producers

1118

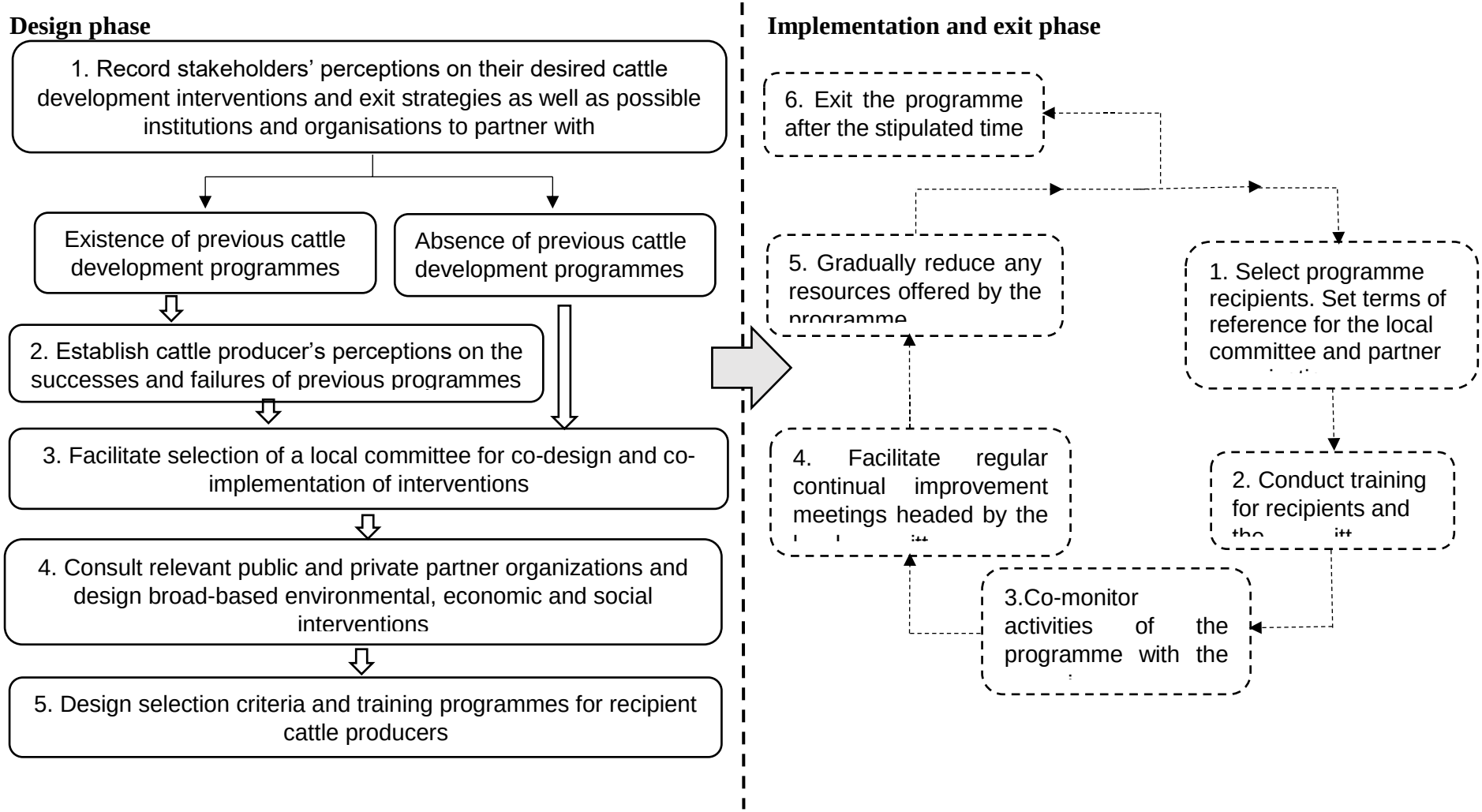
Design phase
1. Record stakeholders' perceptions on their desired cattle development interventions and exit strategies as well as possible institutions and organisations to partner with
Existence of previous cattle development programmes
Absence of previous cattle development programmes
2. Establish cattle producer's perceptions on the successes and failures of previous programmes
3. Facilitate selection of a local committee for co-design and co-implementation of interventions
4. Consult relevant public and private partner organizations and design broad-based environmental, economic and social interventions
5. Design selection criteria and training programmes for recipient cattle producers
Implementation and exit phase
6. Exit the programme after the stipulated time
5. Gradually reduce any resources offered by the programme
1. Select programme recipients. Set terms of reference for the local committee and partner
4. Facilitate regular continual improvement meetings headed by the
2. Conduct training for recipients and
3.Co-monitor activities of the programme with the

Figure 2: Proposed protocol for designing, implementation and exiting strategies of cattle development programmes