**Running title:** Traceability of Cattle among Nguni Cattle project Beneficiaries

**A Brief Report on the Traceability of Cattle for Commercialization among Nguni Cattle Project Beneficiaries in Eastern Cape, South Africa**

**Authors’ contributions**

Malusi Ndumiso and Falowo A Bamideleconceptualized and design the work; Malusi Ndumiso and Falowo A Bamidele collected and analyzed the data; Malusi Ndumiso, Falowo A Bamideleand Emrobowansan Monday Idamokoro visualized the results; Malusi Ndumiso, Falowo A Bamideleand Emrobowansan Monday Idamokoro wrote the paper; Hosu, Y. Sunday provided intellectual support and logistics for manuscript writing and submission and financial support

Malusi Ndumiso 1,2, Falowo A Bamidele1,3, Hosu Y Sunday4, and Idamokoro M Emrobowansan 4 \*

1 Department of Livestock and Pasture Science, University of Fort Hare, Alice 5700, Eastern Cape, South Africa

2 Grootfontein Agricultural Development Institute, Middelburg 5900, Eastern Cape, South Africa

3 Department of Animal Science, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria

4 Faculty of Commerce and Administration. Department of Economics and Business Sciences, Walter Sisulu University, P/Bag X1, Mthatha 5117.

\*Correspondence: [mondayidamokoro@gmail.com/](mailto:mondayidamokoro@gmail.com/) [eidamokoro@ufh.ac.za](mailto:eidamokoro@ufh.ac.za); Tel.: +27833343640

**Novelty statement**

Irrespective of the benefits contributed by cattle, communal farmers face a significant number of challenges that restrict them from generating income from their livestock.

We found out that there is dearth of information regarding proper traceability of cattle in several parts of Eastern Cape Province of South Africa. This is because most communal farmers are unable to give accurate information about the health and management status of their cattle. This however, impact negatively in the projected income generation from cattle sales for the communal farmers.

**Abstract**

The objective of the study was to assess the impact of traceability in commercialisation of cattle across Nguni Cattle Project beneficiaries. A total of 120 Nguni cattle beneficiaries were interviewed using a semi-structured questionnaire across six district municipalities (Amathole, OR Tambo Alfred Nzo, Joe Gqabi, Chris Hani and Sarah Baartman) of the Eastern Cape Province. Data on cattle records, and identification methods were analysed using Freq and Chi square test of SPSS (Version 24). The results showed that 74.2 % beneficiaries were not keeping cattle records during the study. The Joe Gqabi municipality had the majority (80 %) of beneficiaries who were keeping records, while OR Tambo and Amathole had the majority of beneficiaries who were not keeping records with 87.5 % and 83.3 % respectively. About 49 % of beneficiaries were using Ear-notching as their cattle identification method, while 28 % and 23 % were using Branding and Ear-tagging respectively. Education and formal livestock training had a strong association with record keeping. Many famers were not keeping record, therefore fail to partake in the formal market, thus receiving high returns. It can therefore, be concluded that majority of the Nguni project beneficiaries were not keeping cattle records, however, famers who are land owners keep cattle records. This had negative effect on traceability of several cattle, as there were no details of cattle health status and the location in which the cattle were reared.

**Keywords:** Local farmers, cattle, breed identification, livestock production

**Introduction**

Cattle traceability was developed to enhance ownership, registration in breed associations and record keeping for animal performance and health status (CFIA, 2018). According to CFIA (2018), traceability is said to be the ability to follow the processes that an item or group of items go through from one supply chain to the other. Livestock traceability’s basic elements include animal identification, location identification and animal movement from the point of rearing to market weight. In addition, DAFF (2011) reported that it is compulsory for every livestock species to have identification as per the Animal Identification Act (Act No. 6 of 2002). Cattle identification is one of the crucial ethical aspects as it involves human health, cattle production, preservation and management. Cattle can be reared in different locations and eventually be traded before slaughter. Likewise, the slaughtering process of cattle can occur far away from the animal’s original location, and it will lack the original information about the authentic source of the cattle.

The freedom of animal movement from one location to the other increases the risk of spreading animal diseases, and thus lead to contamination of meat products (Brester et al. 2011). Therefore, knowing the origin of cattle is a significant determining factor about the health status of the cattle and the quality of the meat products. Zhao et al. (2017) in their study argued that confirming the health status of living cattle and identifying diseased animal early is important for increased consumer’s awareness and source demands, food safety in the supply chain. Cattle traceability does not only help in controlling the spreading of diseases, but also increase chances for beef exports. According to Brester et al. (2011), beef importing countries have adopted the use of traceability systems for their products and such systems are emerging as the requirements for market access. However, Musemwa et al. (2008) and Van Schalkwyk et al. (2012), reported that the majority of smallholder famers sell their cattle on informal markets where there are no requirements for proper animal records. One of the reasons for smallholder famers to be unable to use formal markets is their inability to meet market standards such as keeping the records of the cattle and rearing less desirable breeds by the formal market.

In most countries indigenous cattle breeds have been regarded to be of lower market value than imported breeds because of their small market weight. These assumptions have resulted to a reduction in the use of indigenous breeds while increasing the use of exotic breeds. In contrast to these assumptions, exotic breeds are susceptible to harsh environmental conditions such as tick borne diseases, feed scarcity and poor feed quality that are prevalent in most communal areas (Muchenje et al. 2008a). Exotic breeds require a high level of dietary supplementation especially during dry season to maintain body condition. For instance, the indigenous breeds such as Nguni have been re-introduced to most communal areas in the Eastern Cape Province of South Africa due to their adaptive qualities including resistance ability to parasites, and production of high quality beef comparable to imported breeds (Muchenje et al. 2008b).

Initiations for development programmes to repopulate Eastern Cape with indigenous breeds in communal areas have been made. Among other development programmes, the Nguni Cattle Project has been established where a number of Nguni heifers and bulls are distributed to selected communities so as to build the nucleus herd (Fuller 2006). The first programme began in 1998 which was specifically aimed at reintroducing the Nguni breed in the Eastern Cape Province (Musemwa et al. 2008). The Eastern Cape Nguni Cattle Project is the partnership of the University of Fort Hare (UFH), the Eastern Cape Department of Rural Development and Agrarian Reform (ECDRDAR) and Industrial Development Cooperation (IDC). The project was established due to the high performance of Nguni cattle with adaptive traits to harsh environments. According to the report from University of Fort Hare Nguni Cattle Project (Fuller 2006), farmers in selected areas were provided with 10 in- calf heifers and two bulls with the aim of building nucleus herd. After the period of five years the community gives back 10 heifers and two bulls to the project and then passes it to another community within the Eastern Cape Province (Raats et al. 2004). The requirements for giving out the 10 in-calfs and two bulls for this project is that, there must be a grazing area which should be fenced for the cattle and the farmers must practise a rotational system of grazing for the animals (Mapiye et al. 2007). Furthermore, another requirement was that, the existing bulls in the community should be replaced by registered Nguni bulls either by castration or culling (Musemwa et al. 2008). The major role of the project is to develop a niche market for Nguni products (beef and skins) and to introduce communal farmers to global market through production and product processing (Raats et al. 2004). The project also aimed at training farmers on cattle management. The project development committee were saddled with the responsibility of training farmers, redistributing animals within different communities and to develop infrastructures such as holding pens where it is lacking in the local communities (Musemwa et al. 2008).

Irrespective of the benefits contributed by cattle, communal farmers face a significant number of challenges that restrict them from generating income from their livestock. These includes lack of cattle records which are commonly required by the formal markets such as; date of birth, pedigree records and animals’ health status. Most communal farmers are unable to give accurate information about when the cattle were dosed and what type of remedy was used. This may impact negatively in income generation from cattle sales for the South African economy, as communal areas is known to have the highest livestock production in the country. The objective of the study was, therefore, to report the current status as it relates to traceability on the commercialization of cattle across Nguni Cattle Project Beneficiaries from the Eastern Cape of South Africa.

Materials and Methods

Experimental site description

The study was conducted in six district municipalities of the Eastern Cape Province in South Africa, namely Amathole, O R Tambo, Alfred Nzo, Joe Gqabi, Chris Hani and Sarah Baartman where the Nguni Cattle Project has been initiated and nurtured. The geographical coordinates and pedo-climatic conditions of the study areas are shown in Table 1. The permission to carry out the study was approved and issued by the University of Fort Hare Ethical Clearance committee.

Data collection

Six district municipalities (Amathole, O.R Tambo, Alfred Nzo, Joe Gqabi, Chris Hani and Sarah Baartman) in the Eastern Cape Province, where the Nguni Cattle Project has been initiated were the selected areas for the study. The sample size of the study was 120 beneficiaries. All the Nguni Cattle Beneficiaries in these municipalities who were willing to participate were interviewed.

Before the commencement of the data collection, a pilot study was done, where 10 farm aid workers in the University of Fort Hare Farm who were also farmers, were randomly selected for the interviews with the use of questionnaires to be used for the study target group (Nguni Cattle Project beneficiaries). The aim of the pilot study was to ensure that famers understand the concept and the objectives of the study. The pre-testing was also conducted for the betterment of questioning style and to ensure the appropriate time duration for the subsequent interviews of respondents.

After the completion of the pilot study, the questionnaires were ready for the main study. The data was collected from the respondents using a structured questionnaire. The questionnaire was designed in a way that it comprises; cattle record keeping, cattle buying and identification methods. The Enumerators that assisted in data collection understood IsiXhosa and English since most respondents were Xhosa speaking people and few needed explanation in English. The enumerators were informally trained as how to approach and record the information obtained from the respondents.

Statistical analysis

The data collected from the Beneficiaries of the Eastern Cape Nguni Cattle Project was coded and captured in Microsoft Excel (Ms Excel). The frequencies of the cattle buying, record received when buying, formal training received by farmers, record keeping and identification methods was analysed using Freq of SPSS. The Chi square test was used to determine the degree of association between categorical variables; demographic information, livestock formal training and cattle traceability of the beneficiaries of the Nguni cattle project.

Results and discussion

**Demographic characteristics of the Nguni cattle project beneficiaries**

The results of the current study show that, of the 120 interviewed Nguni farmer beneficiaries, 85.8% were males, while only 14.2% were female (Figure 1). This accords with the results of Gwala et al. (2016) who found that in the agricultural sector of rural areas in South Africa, male famers are dominating. The results show that 60.8% of beneficiaries were above 60 years followed by 51-60, 41- 50 and 31-40 with the percentages of 28.3%, 8.3% and 2.5% respectively. Chris Hani district municipality had the highest number of beneficiaries (84.6%) above 60 years, while Joe Gqabi had the lowest number of beneficiaries (40%) at the same age range. Majority (94.2%) of the beneficiaries interviewed were married, while 5% and 0.8% of the beneficiaries were widowed and single, respectively. About 47.5% of beneficiaries had primary education (Grade 1-7) followed by those with secondary education (Grade 8-12) with 37.5 %. These results agree with the findings by Gwala et al. (2016) who found that about 59% of Nguni beneficiaries in two villages of the Eastern Cape Province had the primary education (Grade 1-7). The results also reveal that the majority (55 %) of the beneficiaries mainly depend on social grants and old pensions from the state. This is in agreement with the finding of Molefi (2015) who found that about 45% of the respondents in Mpumalanga mainly depended on pension as their primary source of income.

**Knowledge, record of cattle trace and formal training received by the beneficiaries of the Nguni Cattle Project**

As shown in Table 2, the majority of beneficiaries (80%) were not buying cattle during the study. All the famers who were not buying cattle reported that their reason for not buying was having enough stock that breeds itself. The majority of beneficiaries who were buying cattle reported that they buy bulls to breed with their stock. All the beneficiaries in Joe Gqabi municipality were not buying cattle followed by Amathole (88.3%) and OR Tambo (75%) beneficiaries (Figure 2). This may be due to the fact that most of the famers in these municipalities owned land with their desirable herd sizes. Figure 2, showed that out of the 120 interviewed beneficiaries, 62.5% did not receive cattle records when buying cattle, while 37.5% claimed to receive records. These results show that traceability is one of the major livestock management aspects that need to be addressed as it contributes to health status of the individual cattle and the herd population at large.

The Nguni beneficiaries who received formal livestock training such as animal handling, health and nutrition training were tied at 50 % with those who never received formal training (Figure 4). Sarah Baartman was the leading municipality with 91.7 % of beneficiaries obtained formal training, followed by Joe Gqabi and Alfred with 80 % and 50 % of beneficiaries as shown in Figure 5. The OR Tambo and Chris Hani municipalities had the highest number of beneficiaries (81.2 % and 76.9 %) who had never received formal livestock training. These municipalities are mostly dominated by remote villages that were far from the town, hence the study have found these implications.

**Record keeping by the beneficiaries of the Nguni Cattle Project**

Figure 6 showed that 74.2 % beneficiaries reported that they do not keep cattle records, while only 25.8 % were keeping records during the study. The types of cattle records that were asked about included cattle birth date and weight, parent’s performance records and dates of medication application. The current study agrees with Mapiye et al. (2009) and Hangara et al. (2011), who reported that about 85 % and 95 % of famers were not keeping records in communal areas of South Africa and Namibia, respectively. All the famers who were not keeping records reported that they keep the records in mind without writing them. For instance, on medication, they use their knowledge of withdrawal period before they can consume the meat from injected animal. However, the inability to keeping records have the effect on their participation to the formal market such as abattoirs and feedlots as these records are required. Figure 7 showed that Joe Gqabi was the only municipality with the majority (80 %) of beneficiaries who were keeping cattle records during the study. As reported before, famers in this municipality are land owners and are making use of different marketing channels, therefore they require records to have access to the formal markets. OR Tambo and Amathole had the majority of beneficiaries who were not keeping cattle records, with 87.5 % and 83.3 % beneficiaries respectively; therefore, these municipalities are less able to sell their animals to the formal markets.

**Types of identification methods used by the beneficiaries of the Nguni project**

Figure 8 showed that, Ear-notching was the mostly used cattle identification method, with 49 % beneficiaries, while 28 % and 23 % were using Branding and Ear-tagging, respectively. The current study is in contrast with the study by Hangara et al. (2011), who reported that branding was the mostly used cattle identification method than ear-notching and ear-tagging by famers in Omaheke Region in Namibia. The differences of the current study and previous studies may be due to the fact that, the previous studies had many farmers who owned land with high income to buy the machines, while the current study is dominated by poor-resource farmers without enough money to buy branding machines. Ear-notching is less recommended and needs to be reduced as it causes a lot of bleeding, which may lead to infections and more stress to the animal (Leslie et al., 2010). In addition, Hangara et al. (2011) reported that ear-notching is not scalable and can only identify a few animals; therefore, it is not suitable for large herds.

In the present result, Figure 9 showed that Amathole and Alfred Nzo municipalities had the majority of beneficiaries using ear-notching, with 73.4 % and 50 %, respectively. These municipalities are dominated by village owned enterprises, hence they mostly used ear-notching. This is true because Joe Gqabi municipality have only group owned enterprises (farms), hence there are no beneficiaries in this municipality using ear-notching. The beneficiaries in Joe Gqabi using branding and ear-tagging were tied at 50%. Chris Hani and Sarah Baartman had the majority of beneficiaries using branding with 61.6% and 58.3% respectively. According to Hangara et al. (2011), the branding method does not provide sufficient reliability and accuracy as it can be easily altered, removed and duplicated.

**Association between district, demographic information, livestock training, cattle ownership, marketing and traceability**

From the present result, Table 3 showed the association between district, demographic information, livestock training and traceability. The results showed that, district had a strong association with the record keeping and types of identification methods used, however district had no association with cattle buying. As shown in Figure 2, all the municipalities had the majority of beneficiaries who were not buying cattle during the study. The age had no association with cattle buying and type of identification methods used. However, the education level of farmers had a strong association with record keeping and the types of identification method used. According to Mudzielwana (2015), education helps famers to enhance understanding and policies, which help to develop their farming skills. The source of income was found to have no association with cattle buying and the type of identification method used. Formal livestock training had a strong association with record keeping and the type of identification method used. These results suggest that famers with formal livestock training are more likely to keep records than those who have no formal training.

**Conclusions**

Many beneficiaries of the Nguni Cattle Project are not buying cattle as they are satisfied with their cattle numbers, while the majority of those who buy cattle do not receive records from the sellers. This had negative effect on traceability, as there were no details of cattle health status and the location in which the cattle were reared. The majority of the beneficiaries were not keeping cattle records, however, famers who are land owners keep cattle records because of their participation in the formal market. Ear notching is the mostly used identification method by the Nguni beneficiaries, especially by the village-owned enterprises. High level of education and formal livestock training received by the beneficiaries of the Nguni project contributed towards record keeping, and proper farm management for traceability. It is therefore recommended that, policy makers of the Nguni Cattle Project must invest in training famers on traceability aspects as this may affect their participation in the formal market, and therefore affect their level of commercialisation.

**References**

Brester G, K Dhuyvetter, D Pendell, T Schroeder, G Tonsor (2011). *Economic impacts of evolving red meat export market access requirements for traceability of livestock and meat*. <http://www.agmanager.info/livestock/marketing/AnimalID/USMEFFinal-Project-Report-Tonsor_03-30-11.pdf>. [14 August 2020].

Canadian Food Inspection Agency (CFIA). (2018). *Livestock identification and traceability*. <http://www.inspection.gc.ca/animals/terrestrialanimals/traceability/eng/1300461751002/1300461804752>. [30 of July 2019].

Department of Agriculture, Forestry and Fisheries (DAFF). (2011). *Identification of animals in terms of Animal Identification Act* (Act No. 6 of 2002). <https://www.daff.gov.za/vetweb/Animal%20Identification/VPN%20AIDA%20Feb2009.pdf>. [30 of July 2019].

Department of Agriculture, Forestry and Fisheries (DAFF). 2016. Economic Review of the South African Agriculture. <http://www.daff.gov.za/Daffweb3/Portals/0/Statistics%20and%20Economic%20Analysis/Economic%20Analysis/Economic%20Review%202016.pdf>. [30 July 2019].

Fuller A (2006). The sacred hide of Nguni; the rise of an ancient breed of cattle is giving South Africa new opportunity. Miracles that are changing the Nation. Industrial Development Corporation (IDC) Newsletter. pp. 3-4.

Gwala L, N Monde, V Muchenje (2016). Effect of agricultural extension services on beneficiaries of the Nguni cattle project in the Eastern Cape Province, South Africa: A case study of two villages. *Appl. anim. husb. rural dev*  9: 31-40

Hangara G N, M Y Teweldemedhin, I B Groenewald (2011). Major constraints for cattle productivity and managerial efficiency in communal areas of Omaheke Region, Namibia. *Int J Agr Sustain* 9: 495-507

Mapiye C, M Chimonyo, V Muchenje, K Dzama, M C Marufu, J G Raats (2007). Potential for value-addition of Nguni cattle products in the communal areas of South Africa: a review. *Afr. J. Agric. Res* 2: 488-495

Mapiye C, M Chimonyo, K Dzama, J G Raats, M Mapekula (2009). Opportunities for Improving Nguni Cattle Production in the Smallholder farming system of South Africa. *Livest Sci* 124: 196-204.

Molefi S H (2015). Utilization and management of beef cattle farming as a contributor to income of households in communal areas of Chief Albert Luthuli Local Municipality in Mpumalanga Province. MSc. Thesis, Agriculture. University of South Africa, South Africa.

Muchenje V, K Dzama, M Chimonyo, J G Raats, P E Strydom (2008a). Meat quality of Nguni, Bonsmara and Angus steers raised on natural pasture in the Eastern Cape, South Africa. *Meat Sci* 79: 20-28

Muchenje V, K Dzama, M Chimonyo, J G Raats, P E Strydom (2008b). Tick susceptibility and its effects on growth performance and carcass characteristics of Nguni, Bonsmara and Angus steers raised on natural pasture. *Animal* 2: 298–304

Mucina L, M C Rutherford (2006). *The vegetation of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute*. <https://www.sanbi.org/wp-content/uploads/2018/05/Strelitzia-19.pdf>. [20 July 2020]

Mudzielwana G. (2015). *Determinants of cattle ownership and herd size in Vhembe district of South Africa: A Tobit approach*. Master of Agricultural Economics Thesis. University of Limpopo, South Africa.

Musemwa L, A Mushunje, M Chimonyo, G Fraser, C Mapiye, V Muchenje (2008). Nguni cattle marketing constraints and opportunities in the communal areas of South Africa: Review. *Afr. J. Agric. Res* 3: 239-245

Raats J G, A M Magadlela, G C G Fraser, A Hugo (2004). ‘Re-introducing Nguni Nucleus Herds in 100 Communal Villages of the Eastern Cape Province’. A proposed co-operative project between the University of Fort Hare, Agricultural and Development Research Institute (ARDRI) and the Eastern Cape Department of Agriculture and the Kellogg Foundation.

Van Schalkwyk H D, J A Groenewald, G C Fraser, A Obi, A Van Tilburg (2012). *Unlocking markets to smallholders: Lessons from South Africa*. Springer Science & Business Media. <https://www.springer.com/la/book/9789086861682>. [30 July 2020].

Zhao J, C Zhu, Z Xu, X Jiang, S Yang, A Chen (2017). Microsatellite markers for animal identification and meat traceability of six beef cattle breeds in the Chinese market. *Food Control*. 78: 469-475

Table 1: The geographical coordinates and pedo-climatic conditions of the study areas

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **District** | **Geographical coordinates** | **Rangeland Type** | **Annual rainfall (mm)** | **Mean annual temperature ()** | **Altitude (m)** |
| **Alfred Nzo** | 30.54°S, 28.85°E | Sour | 600-950 | 14-15 | 600-1400 |
| **Amathole** | 32.58°S, 27.36°E | Sweet | 400-700 | 15-20 | 400-700 |
| **Joe Gqabi** | 30.98°S, 26.98°E | Sweet-Sour | 400-700 | 12-16 | 1100-1600 |
| **O R Tambo** | 31.46°S, 29.23°E | Sweet-Sour | 450-750 | 17-18 | 600-850 |
| **Chris Hani** | 31.87°S, 26.79°E | Sweet-Sour | 400-700 | 12-16 | 400-1450 |
| **Sarah Baartman** | 33.57°S, 25.36°E | Sour | 600-945 | 12-14 | 800-1350 |

Source: Mucina and Rutherford (2006)

Table 2. Cattle buying by the beneficiaries of the Nguni Cattle Project in Eastern Cape (n=120)

|  |  |  |
| --- | --- | --- |
| **Cattle buying** | **No** | **%** |
| Buying | 24 | 20 |
| Not-buying | 96 | 80 |

Table 3. Association between district, demographic information, livestock training, cattle ownership, marketing and traceability

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Record keeping** | **Cattle buying** | **Type of identification method** |
| District | \*\* | NS | \*\*\* |
| Age | \*\*\* | NS | NS |
| Education level | \*\*\* | NS | \* |
| Source of income | \*\*\* | NS | NS |
| Livestock training | \*\*\* | NS | \*\*\* |

\*\*\*p<0.0001; \*\*p<0.01; \*p<0.05

Figure 1. Demographic characteristics of the Nguni cattle project beneficiaries (No = 120)

Figure 2. Representation of Nguni cattle beneficiaries who buy cattle and those who do not buy cattle across six districts

Figure 3. Cattle records received by the beneficiaries of the Nguni cattle project when buying cattle

Figure 4. Livestock formal training for the Nguni cattle beneficiaries

Figure 5. The Livestock formal training for the Nguni cattle beneficiaries across six districts

Figure 6. Keeping of cattle record by the beneficiaries of the Nguni cattle project

Figure 7. Keeping of cattle records by the beneficiaries of the Nguni Cattle project across six districts

Figure 8. Types of identification methods used by the beneficiaries of the Nguni cattle project

Figure 9. Types of identification methods used by the beneficiaries of the Nguni Cattle Project across six districts