Dairy investment options for poverty reduction for small-scale dairy farmers in Tanzania

Eliamoni Titus Lyatuu[1]; Mwai Okeyo[1]; Daniel Komwihangilo[2]; Amos Omore[1]; Gilbert Msuta[2]; Neema Kelya[2] Julie Ojango[1]; Gebregziabher Gebreyohanes [1]

[1] International Livestock Research Institute (ILRI)

[2] Tanzania Livestock Research Institute (TALIRI)

Abstract

The effect of an unproductive investment could be detrimental to the investor, especially when is a dairy farmer investor who depend on earnings and may distort the productivity effort if is not approached with caution. Anyone who wish to invest in dairy farming has to choose wisely, think independently to avoid follow the crowd. Ideal investment decisions in dairy would starts by best choice of breeds, feeds availability, affordability and accessibility, knowledge in proper animal husbandry and proper handling and marketing of animal products. Most farmers in Tanzania who are in dairy farming invested with different objectives, such as for prestige, for family nutrition, for manure and sale of live calves, to mention a few. This study investigating dairy cow investment and how it affects poverty situation in the families. The results show that investment in the dairy sector is the key to reliable income and leaning pole to poverty reduction in the family. Therefore, choice in investment may affect income and reduce poverty in two folds if it is done in ideal situation.

Keywords: *Tanzania, small scale Dairy farmers, poverty*

Introduction

Investing in dairy farming needs to be done in a cautious manner in order to optimize efficiency of available farm resources, or, simply put, to help farmer do more with less. The effect of an unproductive investment could be severely detrimental to a dairy farm and, accordingly, investments are approached with caution(Winsten, Parsons, and Hanson 2000). To determine capital of investment required land, infrastructures (such as building, equipment), human resource and knowledge in dairy farming. Anyone who wish to invest in dairy farming must choose wisely, think independently to avoid follow the crowd. Trainings and knowledge in dairy husbandry is enough to know when to make a decision so that farmers will not do anything with

which they aren't comfortable. This is the initial step and the most vital player in getting dairy farming right.

Producing and sustaining high quality milk in today's competitive dairy farming is complex(Peden *et al*. 2006), allowing no room for mistakes, thus more time should be spent for informed decision making when setting up plans for investment in dairy farming business. Investment decisions in smallholder milk production in Tanzania would likely concern investments in proper breeds, feeds, proper animal husbandry practices and animal products handling(Twine, Omore, and Githinji 2017). A dairy investment plan outlines the finances required for cow house design, land required and feeding plans, without forgetting all the logistics for future expansion.

Most farmers who are in dairy farming invested in traditional ways with different objectives. Some farmer wants to get manure for their garden and farms, other aim to get calves and sell them, other aim at getting milk and other owning cattle because is the influence from their tradition originated from their ancestor by keeping animal (prestige of having dairy cattle). Based on the above mixed objectives it is obvious that farmers are having high cost of production which affect their income, but they are living happily with the investment.

Therefore, this study investigating the influence of dairy cow investment on poverty reduction within their families and investigates the effect of assets endowment to support dairy farmers on income and its impact in poverty reduction. The major and basic question that will be answered is whether dairy sector is responding to the development challenges of economic growth and poverty reduction.

2. Tanzanian Livestock, Poverty and Economic situation

2.1 Livestock Situation

Tanzania cattle is 1.4% of the world total cattle population and 11% of African total cattle population (FAO 2014). It has about 35.3 million cattle[1] which produces 3.13 billion litres of milk[2] annually (NBS 2021c, 2021a). The livestock sector employs about 50% of the population, which is equivalent to 4.6 million households whose income depends on livestock(MLF 2017). The increase in number of livestock and human population made land to be competitive which created changes in land tenure, conflicts, and new settlement have undermined traditional land use practices and exacerbated land chaos (FAO 2014). However, commitment is made in the national land plan to ensure land allocation and ownership, policies have to change in favour of the investments required to increase productivity (MLF 2017).

2.2 Poverty Situation

The number of poor people increased from 11.5 million (2001) to 12.8million (2007) (Policy Forum, 2010) and increase more to 14 million in 2018 (WB, 2022), which was contributed by increase in population from 34 million in 2000 to 56.83 million in 2018 (Worldometer, 2022). In 2021, the national poverty rate is estimated to have declined marginally from 27.1 percent in 2020 to 27.0 percent in 2021, driven by the recovery of employment and nonfarm business revenue (WB, 2021).

Tanzania has experienced over 20 years of sustained economic growth, culminating in its transition from low-income to lower-middle-income status in 2020. Between 2007 and 2018, the national poverty rate fell from 34.4 to 26.4 percent, while the extreme poverty rate dropped from 12 to 8 percent (WB, 2021). However, individual people reduce poverty through shift from agriculture to nonagricultural with the hope to increase their income, which cause majority of farmer to migrate into much better cities. It was reported that, for the past 20 years (1992-2012), poverty dropped from 28.1% to 4.2% for Dar es Salaam and from 28.7% to 21.7% for other urban

[1] Tanzania has 35.3 million cattle, whereby 35.2 million cattle owned by smallholder farmers and 148,874 cattle by large scale farms.

[2] Tanzania cattle produce 3.13 billion litres of milk annually of which 3.11 billion litres (99.4 percent) are from mallholder farmers and 17.8 million litres (0.6 percent) from large scale farms.

areas and a slim drop from 40.8% to 33.3% in rural area. This indicate that huge drop in urban area is contributed by labour force shift from rural to urban (Lyatuu, Nie, and Fang 2015b). “It is shocking to have a poverty line as low as $1.25 per day with 1/7th of the world's population lives below this line. The levels of inequality and poverty that prevail in the world today are totally unacceptable” Said Kaushik Basu, a Senior Vice President and Chief Economist, World Bank Group (2014).

2.3 Economic Situation and Fiscal Position

Structural changes and several economic reforms that Tanzania experienced recently did not significantly benefitted the most labour-intensive sectors like agriculture among other production sectors. It is estimated that 36 percent of the people employed live below the nationally defined poverty line, including agriculture sector that employs 68.0 percent of total population, where by 76.4% are in rural area and 26.4% are in urban area. However, is surprising that about 62.4 percent of youth in Tanzania are employed in agriculture, forestry and fishing industry (NBS, 2021b). The average monthly incomes in agricultural activities estimated as TZS 169,377, however, the income is highest in Dar es Salaam TZS 410,337 and lowest in rural areas TZS 158,704 (NBS, 2021b).

The performance of Tanzania economy has a long history, looking at its progress of growth across years from 4.2% (1995) to 7.4% (2013) drop to 4.8 (2020) but had slight increase to 4.9 (2021). The inflation rate dropped from 27% in 1995 to 3.3% (2020) but increase to 3.7% (2021)(AFDB 2022; NBS 2014).

However, the economy is vulnerable to external shocks; pandemic disease (covid 19); low domestic saving; a heavy external debt burden; and high poverty incidence and is continues to face a number of challenges. The history tells us that the socialist and “self-reliance” policies which was implemented after independence in 1961 lead to improving social indicators but proved to be unsustainable, whereby, per capita economic growth rates turned negative in the late 1970s and early 1980s(Lyatuu, Nie, and Fang 2015a). Supported by the IMF, World Bank, and bilateral donors, the first comprehensive structural adjustment program was embarked in

1986, with the aim of dismantling the system of state controls and promoting the private sector (Kyejo, 2000).

After the Government shift from self-reliance and government control of production mechanism to market- based economy, changes have been noticed through transformation in each production sector. This also happened in livestock as well where establishment of database (ADGG, ARDS and M-Kilimo) and effort in identifying and digital registration of all cattle, goat and sheep is making the livestock sector digital which may attract youth to be part of the process in all stages of value chain of livestock. Moreover, there several plans underway guided by roadmap and policies development such as Tanzania Livestock Master Plan (TLMP) in 2017 and review of livestock policy. However, increase in production and productivity is expected to emanate from farmer adoption to the new production technology and improvement in the livestock management.

3. Methodological Research Approach

3.1. Data Sources and Analysis Techniques

The study is based on a quantitative research approach, represented on exploratory, explanatory, and descriptive, based on livestock data and development trend over a period of 2016 - 2022. The study used data from African dairy genetic gains (ADGG) project database that were captured in a period mentioned above. The data and information gathered were used in triangulating the facts that relate dairy sector development and growth, have rational relation with the poverty reduction among dairy farmers.

Techniques were employed based on the relevant research reports and origin of the data, such as World Bank indicators, NBS statistic guideline, FAO and International Monetary Fund (IMF) suggestions. The study used STATA to run multivariate analysis.

3.2. The Conceptual Model

The conceptual framework is based on research contribution by ADGG data gathered from 24 local Government Authorities (LGAs). The model is composed of one dependent variable poverty and considered important measurement of dairy sector development to understand how poverty reduction is impacted by development and transformation of dairy sector. Regarding conceptual model, the study used policy and strategies/programme developed as one of the moderating variables which relates to poverty but also connected to the dairy sector growth and economic growth of a farmer.

3.3. Conceptual equation and Empirical Model

Increase in agriculture growth decrease poverty and has positive effect in the economic growth and vice versa. The statement can be proved by relating poverty and economic development equations as shown below.

The Economic growth (GDP) equation is GDP= C + G + I + (E-M)…….Q1

C is consumption, G is government spending, I is investment, E is exportation and M is importation. Assume balance of export and import are equal then (E-M) =0 and (C + G) is income denoted by Y and I is investment in livestock denoted by L then,

GDP=Y+L……..Q2

based on Poverty equation

$$P = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Gn}{z}\right);\ Gn = (Z - Y_1).\ I(Y_1 \le Z)$$

$$= (Z - Y1) * I(Y1 - Z)(Z - Y1)$$
$$= ZIY1 - ZIZ - Y1IY1 + Y1IZ$$

but investment by small scale farmers is infinitesimal then equation deduced to

$$P = Z(IY_1 - IZ)$$

Assume poverty level definition cut off is $1 and IY_1 is farmer income denoted by Y and IZ is livestock investment denoted by L, then

$$P = Y - L \ldots\ldots\ldots\ldots\ldots\ldots Q3$$

(1) Then take Q2-Q3 whereby GDP-P = Y-Y +L+L

$$GDP - P = 2L$$

(2) Assume Livestock investment contribution to the GDP by 1/2, then,

$$GDP \propto L+P \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Q3$$

This means increasing livestock growth will direct reduce poverty at the same time increase economic growth.

To avoid omission of the parameter due to the collinearity in Praise-winsten model, the suppression of the constant term was observed. Then livestock investment used as independent variable while the rest were dependent. The model developed is

$$L = \alpha + \beta 0_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots Q4$$

where L is livestock investment, α is constant and β is correlation coefficient and 0_i is the other variables contributing factor to the investment.

In the modeling of the investment option versus poverty reduction used in the study relation with constant suppression the relation developed as follows:

$$Log\ (Poverty) = \alpha + \beta log(Income)$$
$$lnP = \alpha + lnI + E_i \text{ ; then factor cause poverty is denoted by the equation}$$
$$P = \alpha + \beta \sum F_i + E_i$$

Where *P* is poverty and *F* is Investment factors and i^{th} is parameters that contribute to income.

4. **Results and Discussion**

4.1 Results

The ADGG database was established in 2016 with the registration of dairy cattle preceded with farmer registration and documentation of farmer assets. Therefore, the animal monitoring was

followed which capture animal performances by farmer being visited each month. Since database established registration of animal have been increasing tremendously from initial registration of six thousand to 34 thousand now (Figure 1). There was lagging in new registration for past two

Table 1: number of animals owned by farmers and their percentage in total

Number of animals per farmer	Animals	Percent
1	20,148	39.9
2≤10	29,844	59
11≤	536	1.1
Grand total	50,528	100

year which was caused by lack of ear tags. The data were run to see milk production and the results show that farmers with one cattle are 39.9% while farmers with two or more cattle but less or equal to ten were more than 59% and farmer with more than 10 cattle are less than 1.1% (Table 1). Furthermore, as number of animals increased in a farm amount of milk produced in a farm decreases. The result indicates that farmer with more cattle find it difficult to manage them compare with farmer with less cattle (Figure 2).

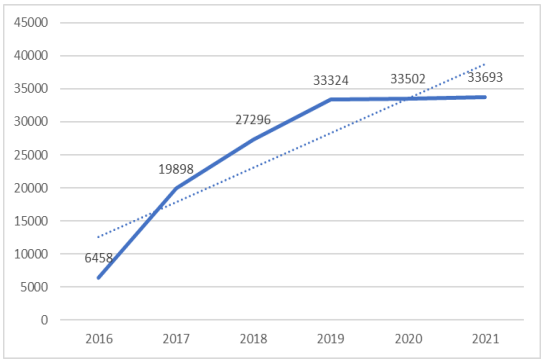

Figure 1: Number of Animal Registered each year

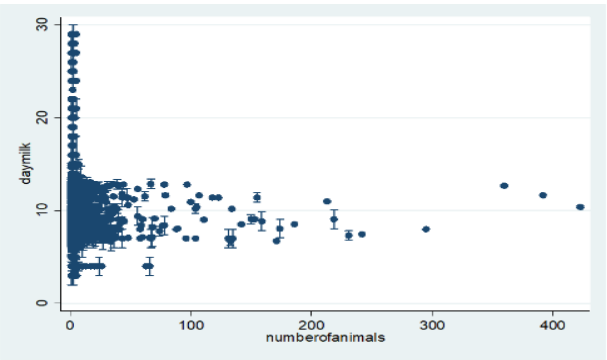

Figure 2.: Comparison of number of cattle having with amount of milk (liters) in a day

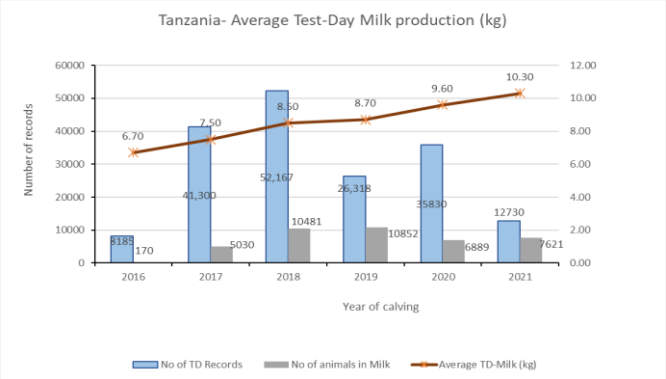

Figure 3. Average test day milk production from 2016 to 2021

The results show general milk production trend in the project area has been increased after intervention in 2016 to 2021. The figure shows records for amount of milk produced each year being increase due to an increase in the number of cows recorded. The average milk production has

increased from 6.7 liters to 10.3 liters in 2021. The increase of milk is contributed by improvement in management attributed by the improvement in extension services that farmer gets each

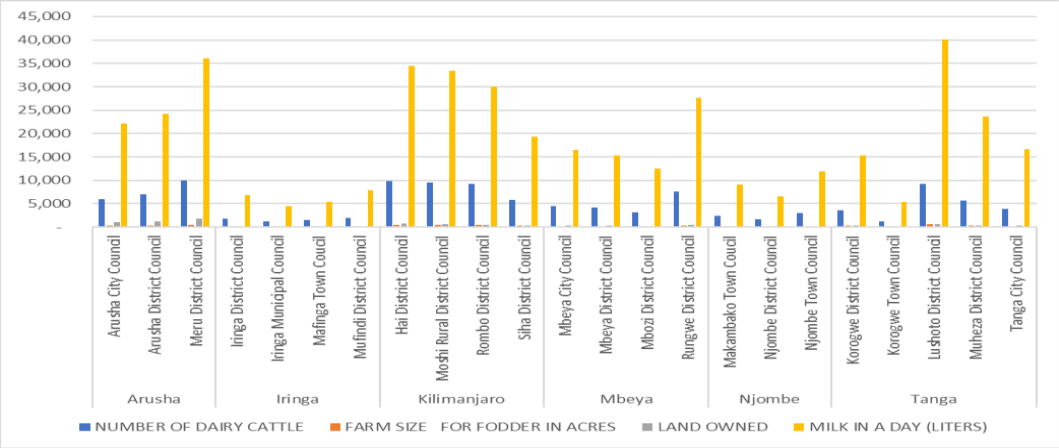

Figure 4: ownership in a region and LGAs and amount of milk produced in a day by farm

month and training message[3] that farmer receives each week.

when comparison was made on investment by geographical location results shows that the investment done by a farmer in terms of land owned does not correlate to the number of animals the farmer has but have high contribution to the increase in productivity and ensure availability of fodders throughout the year. The analysis realized that farmers in Arusha own more land than any other regions, but allocation of land for pasture is less than any other regions (25% of its total land located for pasture production). However, Njombe's farmer recorded to have small land owned but fodder land allocation is higher (91% of its total land located for pasture production) than other regions.

[3] Short messages sent to farmers in a period of 2018to 2021 through ADGG programme were 13.3 million (training messages 12.6 million, cow calendar or events happens in farms 0.6 million and feedback messages based on farmer request or necessary for changes 0.08million)

Table 1 multivariate analysis day milk produced against other parameters

Equation	Obs	Parms	RMSE	"R-sq"	F	P
daymilk	50403	12	3.233861	0.8883	9.579845	0.0000

daymilk	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
numberofanimals	.04458	.0026292	16.96	0.000	.0394268	.0497332
costconcentrates	7.79e-06	8.69e-08	89.60	0.000	7.61e-06	7.96e-06
growfoodcrops	.1068136	.0060917	17.53	0.000	.0948738	.1187534
naturalizedgrassland	-.1839866	.0088888	-20.70	0.000	-.2014088	-.1665644
costpasture	8.14e-08	4.32e-08	1.89	0.059	-3.19e-09	1.66e-07
transportcost	.0003223	2.68e-06	120.41	0.000	.0003171	.0003276
landlocateddairycattle	.056689	.0159628	3.55	0.000	.0254018	.0879762
structures	.1098315	.0018958	57.93	0.000	.1061157	.1135474
landowned	.6263866	.0392771	15.95	0.000	.5494031	.7033702
cattlehousingstructure	.1095599	.0017575	62.34	0.000	.1061151	.1130047
foddertypearea	.1701492	.0104562	16.27	0.000	.149655	.1906434
location	.00043	.0001491	2.88	0.004	.0001377	.0007223

This result was expected as farmers in Tanga depends on natural land for grazing or fetching fodders while other regions grow pasture on their own land in different style (some have special land for pasture, others grow pasture close to borders while other pasture are grown in the ridges). However, depending on natural land might not be good sign for sustainability as the so-called natural land is owned by somebody who may not necessarily be the farmer who depend on that land for feeding his cattle, therefore if owner of land change land use may cause farmers to struggle for fodder.

The empirical analysis shows that all parameters were significantly different and have positive correlation with milk production, with exception of natural land for grazing which show negative correlation with milk production.

Bearing in mind that ADGG programme goals is to increase resilience and productivity per cow, using the data to assess investment nexus poverty reduction is a milestone to sustainability and adoption by young generation, where all variables show to do well in supporting productivity increase but only if they are well managed. The ADGG breeding program which employs ICT and genomic technology is meant to select high yielding adaptable heifers, cows and bulls for herd replacement is geared to increase milk production and profitability smallholder dairy farming. Thus, the allocation of land for forage production should be equivalent to number of cows owned.

The model used to run the data and results show that investment in dairy cattle increase the productivity but only if the animal is kept in right location (Table 2). Which indicate that proper

investment of the best heifer and choices made for proper bull increases production not only in the current but also in the subsequent years. Its was also noted that number of animal that farmers have should be manageable. It is important to mention that as more land is allocated for fodder production it increases milk production and the productivity per cow also increase when other cost variables are constant (Table 2).

Table 2: Average Milk production versus average cost per region and productivity per region in a period of 2016 to 2022 calculated in a day.

Regions	milk per cow	Price of litre (tshs)	Total amount (tshs)	Concentrate cost	Pasture cost	Transport cost	Labour charges	Health Cost	Other costs	Total Factor productivity
Arusha	8.3	800	2,895	324.34	120.16	11.32	1315.8	200	500	2.69
Njombe	9.1	800	3,162	334.75	134.07	12.15	1315.8	200	500	2.91
Iringa	8.7	800	3,025	330.72	126.25	11.76	1315.8	200	500	2.80
Kilimanjaro	7.9	800	2,731	307.97	114.08	10.76	1315.8	200	500	**2.57**
Mbeya	8.6	800	2,982	317.95	121.31	11.64	1315.8	200	500	2.78
Tanga	9.9	800	3,438	368.34	138.19	13.40	1315.8	200	500	**3.12**
Total	**8.6**	**800**	**3,000**	**330.68**	**125.68**	**11.84**	**1315.8**	**200**	**500**	**2.78**

Data source: ADGG database, author own calculations.

Table 2 depicted the Total factor of productivity for each region with the assumption that labour, health and other minor costs were the same and price of milk is the same in region. Dairy business is mostly a family owned whereby major source labour is done by family, but additional hired labour was required in some farms especially those with higher number of cattle, therefore the cost of labour was quantified based on real market price. Generally, the result suggests that there is low productivity per dairy cow in Tanzania as most farmers are practicing intensive farming system. Low productivity is considered to be caused by combination of several factors which including genetic, feeding, management and environmental as was also reported by Nkya et al., (1997).

Productivity growth in livestock is crucial to economic growth, poverty reduction and food security for family and a nation. The analysis shows that, Tanga recorded high productivity while Kilimanjaro recorded low productivity compared with other regions. There is potential to invest in Tanga than other regions where there is larger natural land to feed cattle and also farmers can fetch or graze their cow. But the question remains if the natural land will be sustainable. This study found that, to make investment counts, adoption to the new technology, and improvement in management proved to increase milk production and farmer income. The results show that

for dairy farmer to increase its production by one shilling they have to decrease cost of production by 0.83 shillings, which means poverty can be reduce in the same way of reducing cost of production and increase milk output. This study has proved by what was reported by previous studies that have concluded that productivity growth has positive effects to the poverty three areas: ensure food availability; increase incomes for producers; and have multiplier effects to the rest of the economy as demand for other goods and services increases.

4.2 Conclusion

Relating poverty eradication effort and dairy investment, this study considers the government effort in strengthen policy and programme. Therefore, assume government tempted to increasing funding to livestock which address rural poverty and food security, but injection of fund could be distorting if farmer adoption to technology does not match the injection of fund. Therefore, for sustainability approach would have been better to improve genetics that adhere to proper dairy management with proper recoding which accelerate transformation of dairy industry in Tanzania. Generally, looking at trend in production and income increase, there is clear indication that income for dairy farmers increase tremendously hence poverty reduction among community. The results show that for dairy farmer to increase its production by one shilling they have to decrease cost of production by 0.83 shillings, which means poverty can be reduce in the same way of reducing cost of production and increase milk output. Poverty may be exuberated among dairy farmers only if they have invested the cow that produce less than the cost injected. However, its important that any investment made in the family be shared by all family members. The study realized that productivity is low when cows are poorly managed, compromising milk production potential, hence impair family income that affect the ability to lift themselves out of poverty.

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