

Analysis of Daily Production and Development Status in Rwanda

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Abstract: This study aimed to assess the status of dairy production and development with focus on Rwanda Diary Development Project (RDDP) in Nyagatare district, Eastern Rwanda. The authors employed 82 respondents selected among owners and managers of milk centers. The structure questionnaire helped to collect data which were analyzed by the Statistical Package for Social Sciences (SPSS) software. The results indicated that 60 percent of respondents were male and 42.7 percent were aged between 30 and 39 years old with 51.2 % holding bachelor's degrees. As by the results, 34% strongly agreed that dairy products increase due to breed quality while 32 percent strongly agreed that breed quality increases dairy products availability. Also, 42% strongly agreed that artificial insemination increases dairy products; 50% strongly agreed that the quality of dairy products increase due to artificial insemination. Accordingly, 36 percent of respondents strongly agreed that training of staff and farmers increases dairy product availability. With regard to correlation analysis, breed quality is significantly correlated to dairy production ($r=0.002$, $p<0.01$) and artificial insemination is significantly correlated to dairy production ($r=0.038$, $p<0.01$). Based on the study's findings, it is concluded that adequate institutional management skill, positive government policies and institutional management practice contribute the performance of the dairy industries. Finally, adoption of the same procedure would help to achieve development objective by other similar projects.

Keywords: Daily production, Daily development, Nyagatare district, Rwanda

I. INTRODUCTION

Livestock systems in general went through a period of unprecedented change and dairy systems are no exception [1]. The rapidly evolving scene is a response to a series of drivers including population growth and urbanization, both of which contribute to increased demand for livestock products [2].

The Rwandan dairy subsector is crucial for rural development, poverty reduction and food and nutrition security for the country. It offers a pathway out of poverty for the large number of households keeping livestock, and for those who provide services and value addition throughout the supply chain [3]. The current "farm gate" value of annual milk production is approximately Rwf 117.0 billion (USD 162.4 million). The dairy subsector is the largest segment of the livestock which accounts for 10.5% of agricultural GDP and is the fastest growing subsector within agriculture [3, 4].

The Government has over the past decade made significant investments in the industry to transform it from subsistence to a business-oriented, modern sector capable of meeting the country's demand [5, 6]. This led to rebuilding the national cattle herd from an insignificant level after the 1994 genocide during which over 80% of cattle were

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decimated to a herd of 1.35 million in 2015, where more than half (54%) are improved dairy breeds [7, 8]. In addition, annual milk production increased from 50,000 MT to 731,000 MT in 2000 and 2015, respectively, and the per capita milk consumption steadily increased from below 20 liters/year in the 1990s to 64 liters/year in 2015 [4, 5].

The Rwanda Dairy Development Project (RDDP) was initiated to build on the strengths and lessons learned in the dairy sector by developing cattle productivity, milk quality and processing capacity, and strengthening the policy and institutional framework for the sector [9]. The project begun with 12 districts of the East (Nyagatare, Rwamagana and Kayonza), North (Gicumbi, Burera and Musanze), West (Nyabihu, Rubavu and Rutsiro) and South provinces of Rwanda (Nyanza, Huye and Ruhango) [10].

Despite the remarkable progress in dairy sector development in Rwanda, significant challenges still remain and little systematic research has been conducted on dairy development products and dairy products performance [11, 12]. The current research aims to contribute to filling this gap. Nyagatare is selected as a case since many livestock keepers are engaged in dairy production and in 2014, the milk production averaged 10,578 liters per month but dropped to 647,821 liters per month in 2015 [13]. The falling trends are attributed to; low number of improved dairy cattle and compounded by inadequate forage base, animal feeding practices and seasonal fluctuations in water availability, limited support services (artificial insemination, veterinary extension, inputs), inadequate knowledge to manage dairy cattle, limited organization of farmers for effective collective action in marketing of milk and access to inputs/services, inadequate development and management of milk collection [14, 15].

There is also, processing and marketing infrastructure for supply of good quality milk to domestic and regional markets, limited access to finance for dairy value chain actors, especially women and youth and nascent policy and institutional framework with the need for specific laws, regulations and capacity development of key institutions to encourage the growth of the industry [5, 16, 17]. The current study therefore aims at establishing the relationship between dairy development and dairy production as a result of the RDDP initiatives in the district of Nyagatare, Eastern Rwanda.

II. METHODOLOGY

A. Description of study area

This study was conducted in Nyagatare district of the Eastern province of Rwanda. Nyagatare is the largest and second most populous district in Rwanda. The district is localized in the Eastern Province and occupies the

northeastern extremity of Rwanda. The district borders Uganda in the North, Tanzania in the East, Gatsibo District of the (Eastern Province) in the South, and Gicumbi District of the Northern Province in the West. Nyagatare has an area of 1741 km², what makes it the largest district in Rwanda [18].

As per the National Household Survey conducted in 2012, Nyagatare district has a total population of 466,944. This

makes Nyagatare to be the second most populated district of Rwanda only after Gasabo District of Kigali City with 530,907 inhabitants. This is an 83% increase from 2002 when the population was only 255,104. This sharp rise in the population is due to the major movement of the population from other parts of the country in search of land [19].

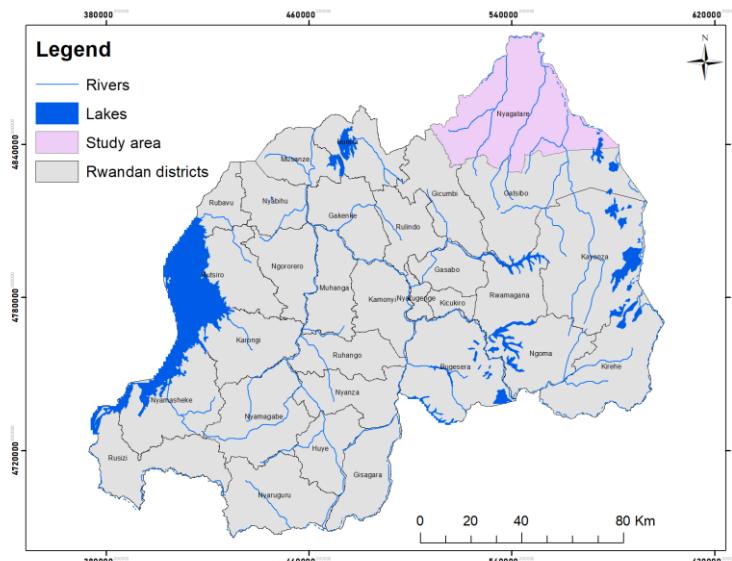


Fig. 1: Map locating Nyagatare district and its neighboring districts of Rwanda

B. Data collection

The study was a descriptive research design, combining correlation and survey designs. Both quantitative and qualitative approaches were employed so that through quantitative approach, data in form of numbers will be collected from respondents.

Target population

The authors considered 85 milk collection centers located in Nyagatare with an estimate of 100 members. Some were cooperatives while others were individually owned. In order to determine the sample among the above members, the authors employed the following Slovin's formula as follows:

$$n = \frac{N}{(1+Ne^2)} \quad (1)$$

Where n = sample size, N = population size, e = Margin error. A confidence level of 95% (0.95) was assumed which resulted into $e = 1 - 0.95 = 0.05$.

Therefore, the sample employed by the study was as follows and was distributed in Table 1.

$$n = \frac{100}{1 + (100 * 0.05^2)} = 82 \quad (2)$$

TABLE 1. SAMPLE SIZE

| Department | Total | Sample | Sampling Technique |
|---------------------|------------|-----------|--------------------|
| Individuals | 20 | 17 | Simple random |
| Cooperative members | 80 | 65 | Simple random |
| Total | 100 | 82 | |

Source: Primary data

C. Data collection tools

In order to get the needed information among the respondents, the authors employed a structure questionnaire which was written in Kinyarwanda (local language) for the respondent to feel free while answering. Furthermore, the authors used the interview to respondents who could not easily have sufficient time of filling in the questionnaire.

Data Analysis

The data collected were processed and analyzed by using the Statistical Package for Social Sciences (SPSS). This involved data coding, editing and tabulation especially

quantitative data. The collected data were analyzed showing demographic characteristics of the sample, descriptive statistics including frequency distribution and illustrative presentations and finally inferential statistics mainly the correlation analysis was performed. The following section presented the obtained results.

III. RESULTS

Demographic characteristics of respondents

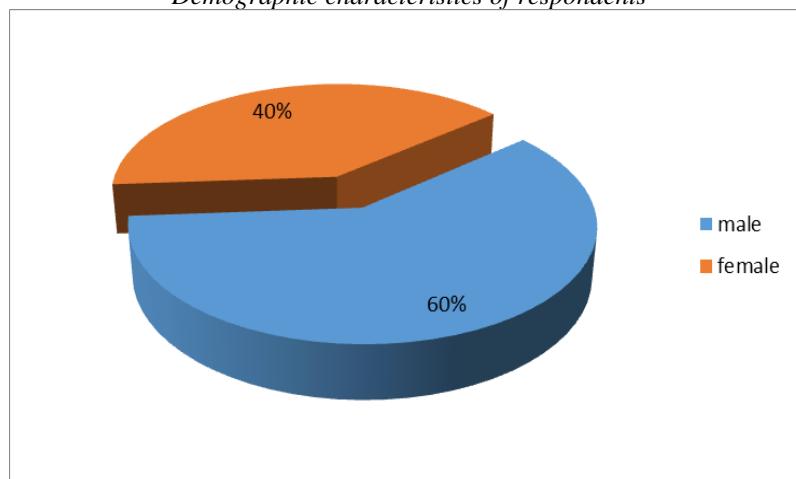


Fig. 2: Gender of respondents

From the data shown in Figure 2, the results showed that majority of the respondents (60%) were male while 40 percent of them were female. This implies that both men

and women had a greater impact of knowledge about dairy development and dairy production in Rwanda.

TABLE 2. AGE OF RESPONDENTS

| Age | Frequency | Percent | Valid Percent |
|----------------|-----------|---------|---------------|
| Below 20 years | 14 | 17.1 | 17.1 |
| 21-29 years | 24 | 29.3 | 29.3 |
| 30-39 years | 35 | 42.7 | 42.7 |
| 40-49 years | 9 | 11.0 | 11.0 |
| Total | 82 | 100.0 | 100.0 |

The results in Table 2 indicated that 43% of respondents were aged between 30 and 39 years, 29% of respondents were aged between 21 and 29 years. In addition, 17% of

respondents were aged below 20 years and 11% were aged between 40 and 45 years.

TABLE 3. EDUCATION OF RESPONDENTS

| Education | Frequency | Percent | Valid Percent |
|-----------------|-----------|---------|---------------|
| Certificate | 13 | 15.9 | 15.9 |
| Diploma | 19 | 23.2 | 23.2 |
| Bachelor Degree | 42 | 51.2 | 51.2 |
| Masters | 8 | 9.8 | 9.8 |
| Total | 82 | 100.0 | 100.0 |

The results, as shown in Table 4.3 revealed that 51% of respondents had acquired a Bachelor's or undergraduate degrees level of education, while 23% of them indicated

that they had acquired diploma' level. Other respondents of the study had masters level of education with 10%, while those with certificate level ranked 15 percent.

TABLE 4. AGE IN DAIRY INDUSTRY

| Age | Frequency | Percent | Valid Percent |
|--------------|-----------|---------|---------------|
| Below 1 year | 7 | 8.5 | 8.5 |
| 1-2 yrs | 16 | 19.5 | 19.5 |
| 2-3 yrs | 11 | 13.4 | 13.4 |
| 3-4 | 6 | 7.3 | 7.3 |
| 4-5 | 11 | 13.4 | 13.4 |
| Above 5 | 31 | 37.8 | 37.8 |
| Total | 82 | 100.0 | 100.0 |

As shown in Table 4, most (38%) of the respondents had been rearing cows for five years, 19% indicated that their company had stayed for 1to 2 years, 13% indicated that their company had stayed for 2 – 3 years, and those below 1 year were 9 percent.

Factors associated to dairy production and development

Effect of quality of breeds on dairy production

For this section, the authors requested respondents to provide their answers by using the ranks Strongly Agree=5;

Agree=4; Undecided=3; Disagree=2 and Strongly Disagree=1.

The results in table 5 indicated that 26 out of 82 respondents (32%) strongly agreed that the quality of breeds increases availability of dairy products while 12

TABLE 5. BREED QUALITY AND DAIRY PRODUCTION

| Statement | Ranking | | | | |
|---|---------|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 |
| Quality of breeds increase dairy products availability | 12 | 14 | 16 | 25 | 32 |
| Quality of breeds reduces the cost of dairy products | 18 | 12 | 17 | 26 | 27 |
| Amount of dairy products increase due to quality breeds | 11 | 11 | 18 | 25 | 34 |

Impact of artificial insemination on dairy production

Similar to the above subsection, the authors answered this point by ranking the contribution of artificial insemination on dairy production by using ranks of Strongly Agree=5; Agree=4; Undecided=3; Disagree=2 and Strongly Disagree=1.

The results provided in Table 6 revealed that 42% strongly agreed that artificial insemination contributes to increasing the availability of dairy products; only 9% disagreed with

percent strongly disagreed with the statement. The same Table 5 showed that 27% strongly agreed that quality of breeds reduces the cost of dairy products and 34% strongly agreed on the statement that amount of dairy products increase due to quality breeds.

TABLE 6. IMPACT OF ARTIFICAL INSEMINATIONA ON DAIRY PRODUCTION

| | Ranking | | | | |
|--|---------|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 |
| Artificial insemination increases dairy products availability | 9 | 7 | 11 | 32 | 42 |
| Cost of dairy products was reduced by artificial insemination | 10 | 15 | 13 | 23 | 39 |
| Quality dairy products increase due to artificial insemination | 7 | 7 | 11 | 24 | 50 |

Contribution of staff training on dairy production

The respondents also ranked this contribution by using the Strongly Agree=5; Agree=4; Undecided=3; Disagree=2 and Strongly Disagree=1.

The results in Table 7 showed that 36 percent of respondents strongly agreed that training of staff and farmers contributes to increasing their skills and knowledge which in turn, helped to increase the availability of dairy

product. This statement was strongly disagreed by 12 percent of the informants.

However, it was noted that 29 percent strongly agreed that cost of dairy products has been reduced by of training of staff while 49 percent of respondents strongly agreed that the quality of dairy products increased due to providing training to the staff and farmers (Table 7).

TABLE 7. CONTRIBUTION OF STAFF TRAINING TO DAIRY PRODUCTION

| | Percentages | | | | |
|---|-------------|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 |
| Training of staff and farmers increase dairy product availability | 12 | 13 | 15 | 22 | 36 |
| Dairy products cost reduced due to training of staffs | 9 | 16 | 28 | 13 | 29 |
| Dairy products quality increase due to staff and farmers training | 7 | 10 | 10 | 24 | 49 |

• Correlation analysis

In order to make sure that the study was more significant, the authors utilized the correlation analysis which proved to which extent the considered factors contribute to dairy production and development in then study area. The related results were presented in Table 8, 9 and 10, respectively.

The correlation analysis of quality of breed and dairy production was done in Table 8 and indicated that the quality breed is significantly correlated to dairy production ($r=0.002$, $p<0.01$).

TABLE 8. CORRELATION BETWEEN BREED QUALITY AND DAIRY PRODUCTION

| | | Quality breed | Dairy production |
|------------------|---------------------|---------------|------------------|
| Quality breed | Pearson Correlation | 1 | |
| | Sig. (2-tailed) | | |
| Dairy production | N | 82 | |
| | Pearson Correlation | .332** | 1 |
| | Sig. (2-tailed) | .002 | |
| | N | 82 | 82 |

**. Correlation is significant at the 0.01 level (2-tailed).

The results in Table 9 showed that the correlation between artificial insemination is significantly correlated to dairy production ($r=0.038$, $p<0.01$). The maximum coefficient between artificial insemination and dairy production (0.734) indicated a positive correlation and the correlation

coefficient was significant at the 0.05 level of significant level. Therefore, as indicated in Table 9, it was noted that artificial insemination phase had the strongest relationship with the dairy production since it had the highest positive coefficient of ($r=0.734$).

TABLE 9. CORRELATION BETWEEN ARTIFICIAL INSEMINATION AND DAIRY PRODUCTION

| | | Artificial insemination | Dairy production |
|-------------------------|---------------------|-------------------------|------------------|
| Artificial Insemination | Pearson Correlation | 1 | |
| | Sig. (2-tailed) | | |
| | N | 82 | |
| Dairy production | Pearson Correlation | .038** | 1 |
| | Sig. (2-tailed) | .734 | |
| | N | 82 | 82 |

**. Correlation is significant at the 0.01 level (2-tailed).

Finally, the results in Table 10 indicated that training of staff phase had the strongest relationship with the dairy production since it had the highest positive coefficient of ($r=0.43$). Thus, it can be mentioned that training of staff is

positively correlated with dairy production ($r = 0.43$, $p<0.001$; $r = 0.702$, $p < 0.001$; respectively at 0.05 level of significance (Table 10).

TABLE 10. CORRELATION BETWEEN STAFF TRAINING AND DAIRY PRODUCTION

| | | Training of staffs | Dairy production |
|--------------------|---------------------|--------------------|------------------|
| Training of staffs | Pearson Correlation | 1 | |
| | Sig. (2-tailed) | | |
| | N | 82 | |
| Dairy production | Pearson Correlation | .043** | 1 |
| | Sig. (2-tailed) | .702 | |
| | N | 82 | 82 |

**. Correlation is significant at the 0.01 level (2-tailed).

IV. CONCLUSION

This study considered the Diary Development Project (RDDP) in Nyagatare district, Eastern Rwanda to assess the status of dairy production and development. The 82 respondents selected among owners and managers of milk centers were approached through questionnaire and interviews. The results indicated that 60 percent of respondents were male and 42.7 percent were aged between 30 and 39 years old. It was noted that 34% strongly agreed that dairy products increase due to breed quality and 42% strongly agreed that artificial insemination increases dairy products. In addition, 50% strongly agreed that the quality of dairy products increase due to artificial insemination, and 36 percent of respondents strongly agreed that training of staff and farmers increases dairy product availability. The results on Pearson correlation analysis indicated that breed quality is significantly correlated to dairy production ($r=0.002$, $p<0.01$) and artificial insemination is significantly correlated to dairy production ($r=0.038$, $p<0.01$). Finally, with reference to the study's findings, the authors recommend further study on the influence of other factors on dairy development not only in Rwanda but also in other areas with similar conditions.

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