

# Technology Adoption Capabilities of Small Farm Dairy Cattle Holders in Gwagwalada, Abuja: Effects of Asymmetric Information and Extension Approaches

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**Abstract:** The study examined technology adoption capabilities of small farm dairy cattle holders in Gwagwalada, Abuja: effects of asymmetric information and extension approaches. The study was conducted in Gwagwalada Area Council in FCT. Three objectives guided the study. Structured questionnaires were adopted to evaluate the impact of asymmetric information and extension approaches on small farm dairy cattle holders in the study area. The study adopted a descriptive research design. Purposeful random sampling technique was employed in the choice of the study area and simple random sampling of 123 small farm dairy cattle holders. Primary data were generated for this study through a cross-sectional personal interview survey that was carried out randomly among small farm dairy cattle holders in Pikon Kore Grazing Reserves, Gwagwalada Area Council. Pikon Kore Grazing Reserves was purposefully selected because it is the most developed of the four Grazing Reserves in FCT with a large number of sedentary and non-sedentary pastoralist households and clusters with livestock rearing and dairy as the principal source of livelihood. Google Platform purposefully created for the study was analyzed with descriptive statistical tools. The descriptive statistical tools comprised frequency counts and percentages presented in pie and bar charts generated by google platforms. Results from the finding of the study revealed that Information Asymmetry is glaringly reflected in the huge gap between stakeholders with awareness of new technologies (96.7%) and utilization or adoption (3.3%) as well as those engaging indigenous methods (96.7%). Therefore, the following recommendations were made: multi-stakeholder backstopping mechanism may have to be evolved to address current levels of information asymmetry in smallholder dairy ventures and allied setups. Similarly, improved access to symmetric information and use of specialized bespoke extension approaches for livestock farmers should be encouraged to adequately translate awareness of technologies to utilization and adoption capabilities of small farm dairy cattle holders and indeed livestock farmers.

**Keywords:** Asymmetric Information, Technology Adoption, Extension Approaches, Small Farm Dairy Cattle Holders

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## 1. Introduction

Availability and affordability of milk and dairy products are directly linked with health and juvenile mental capacity development indices in a community [4]. Consumption of milk and products is a cost-effective way of getting animal proteins and a wide array of essential minerals and vitamins to people especially at the lower socioeconomic strata. Similarly, affordability is a function of a community's ability to produce a

substantial chunk of her dairy needs [2] in the most cost-effective manner leveraging on techniques and reliable hand-holding services. Despite its rudimentary status, the Nigerian dairy value chain represents an important component of the agricultural sector of the economy with great economic, nutritional and social implications [14], providing a means of livelihood for a significant proportion of rural pastoral families in the sub-humid and semi-arid ecological zones of Nigeria.

Nigeria's milk production at about 526,000 litres per annum

is far short of her demand estimated to be in the region of 1.2 million litres per annum. A whopping sum of US\$1.3 billion is spent annually on imports to bridge the gap [1]. Empirical facts and figures have indicated that suboptimal genetic grade, low and fluctuating plane of nutrition, substandard animal husbandry practices and post-milking operations are bane of Nigeria's smallholder dairy operation.

Asymmetric information succinctly put refers to a situation in which a segment of the Key Actors has less information than the rest of Stakeholders. Information asymmetries in the context of the smallholders' dairy agriculture aligns with the model of monopolies of knowledge [17, 11], where the ignorant party has limited or no access to key information about a situation for decision making. A prominent example is the retention of research outcome on shelf without appropriate communication and delivery to key actors, most often too, research needs of key actors are not efficiently conveyed to extension or research institutions for appropriate follow-up actions, in many instances leading to short circuit of information and knowledge about relevant policies, inputs, global best practices, market and remote contemporary issues and emergencies that may have effects on some nodes or the whole length of the value chain. Asymmetric information most often negatively affects value chain functioning and relationships [9] with drastic consequences such as defect of value chain functions and market failure due to lack of enabling information required to make important decisions. Tweaking extant channels of information, even at a cost, putting up robust coordination by contracts or vertical integration and institutionalization of regulatory frameworks to promote compliance are possible solutions to addressing asymmetric information challenges [10]. Nigeria's cattle population is put at about 20.6 million head, out of which 2.3 million are producing milk [3]. About 95% of these are owned by individuals and managed by indigenous nomadic herdsman while the remaining 5% are owned by medium and large-scale farmers in managed pastures. The pastoralists with about 12 million population are further divided into three sub-groups and keep their cattle with different motivations in rearing with different breeding practices.

Traditional Nigerian dairy industry is dominated by the pastoralists who produce at a subsistence level with little emphasis on the economic considerations of their business. Adoption of improved and modern techniques and practices are rare and far between leaving the setup at a rudimentary subsistence level with low productivity and resilience scores. On-farm milk production in Nigeria has remained low due to poor animal husbandry practices, low quality feeds, inadequate feeding regimen, a declining genetic base, animal diseases, effects of climate change, diminishing land sizes in high potential areas and limited access to water especially during dry season among others. Besides, in primary marketing, small farm dairy cattle holders also face asymmetric information and infrastructure bottlenecks caused by poor road networks, lack of cooling and storage facilities and information and knowledge gaps [15]. This study therefore, explored the effects asymmetric information

and extension approaches have on technology adoption capabilities of small farm dairy cattle holders. Specifically, the study identified the socio-economic characteristics of small farm dairy cattle holders in study area, technologies known and adopted by them, determined if present extension approaches meet their knowledge and information needs, and if asymmetric information had any effect on their technology adoption capabilities. Therefore, the purpose of this study is to find out the technology adoption capabilities of small farm dairy cattle holders in Gwagwalada, Abuja - effects of asymmetric information and extension approaches. The specific objectives are to:

- i. describe the socio-economic characteristics of small farm dairy cattle holders in study area;
- ii. identify technologies in small farm dairy cattle holdings in study area;
- iii. determine if present extension approaches meet the knowledge and information needs of small farm dairy cattle holders.

## 2. Materials and Methods

### 2.1. Study Area's Profile

The study was carried out among small farm dairy cattle holders in Gwagwalada Area Council in FCT. Gwagwalada is also the name of the main city in the Area Council, which has an area of 1,043 km<sup>2</sup> and a population of 157,770 at the 2006 census [13]. It is projected to have a 6.26% growth between 2020 and 2025 and adjudged the largest increase on the African continent. The respondents were interviewed using semi-structured questionnaires in google forms and the data analysed using google platforms.

### 2.2. Sample Techniques

The Google Form Interview instruments were applied online and real-time among randomly selected small farm dairy cattle holders domiciled in the study area. Women participation was encouraged in order to ensure coverage of gender and other cross cutting issues of asymmetric information occurrence and incidences.

### 2.3. Sample Size

Purposeful random sampling technique was employed in the choice of the study area and simple random sampling of 123 small farm dairy cattle holders. The gender profile of the sample population indicated that 74.8% male and 25.2% female were interviewed.

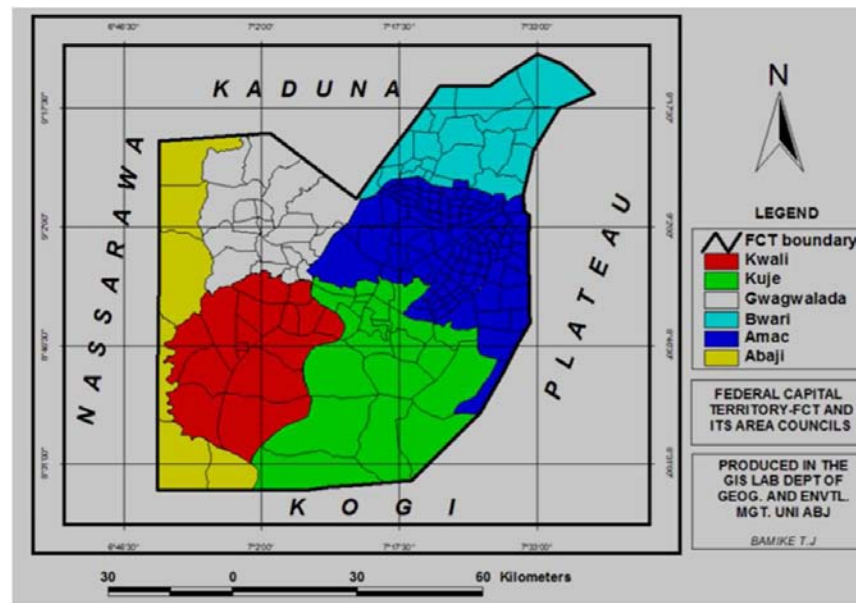
### 2.4. Data Collection

Data was generated for this study through a cross-sectional personal interview survey that was carried out randomly among small farm dairy cattle holders in Pikon Kore Grazing Reserves, Gwagwalada Area Council. Pikon Kore Grazing Reserves was purposefully selected because it is the most developed of the four [4] Grazing Reserves in FCT with a

large number of sedentary and non-sedentary pastoralist households and clusters with livestock rearing and dairy as the principal source of livelihood. In addition to obtaining information regarding farmers' awareness on advisory and extension services, information about socio-economic attributes, such as age, education, household size, herd size, milk production levels, approach to productivity and value addition and challenges, were collected. These were based on the study objectives.

## 2.5. Data Analysis

The Back-End data of the Google Platform purposefully created for the study was analysed with descriptive statistical tools. The descriptive statistical tools comprised frequency counts and percentages presented in pie and bar charts generated by google platforms.



Federal Capital Territory and its Area Councils  
Source: Hassan S.M. (2014)

Figure 1. Map of Federal Capital Territory.

## 3. Results and Discussion

### 3.1. Socio-economic Characteristics of Small Farm Dairy Cattle Holders in Study Area

Gender

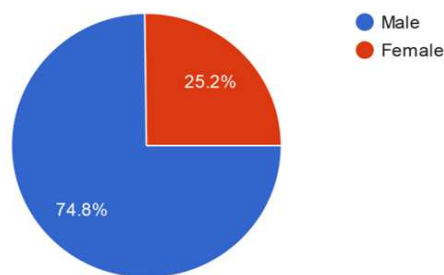


Figure 2. Distribution of Gender.

The study area gender profile aligns with the submission of [6] that female pastoralists tend to prefer small ruminants ventures than large ones with higher dairy potential.

Age distribution among respondents conforms to findings of [8] where he posited that Dairy value chain actors often

fall within the productive age bracket of 26-65 years. Although this is similar to the most productive age bracket of most farmers in Nigeria, businesses along the dairy value chain often attract younger farmers due to nutritional benefits as deduced in [15].

Level and type of education

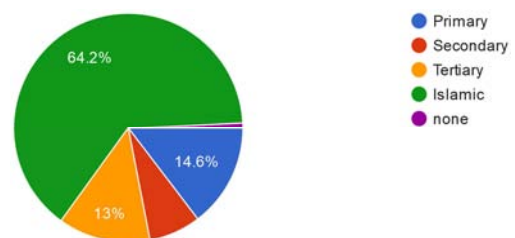


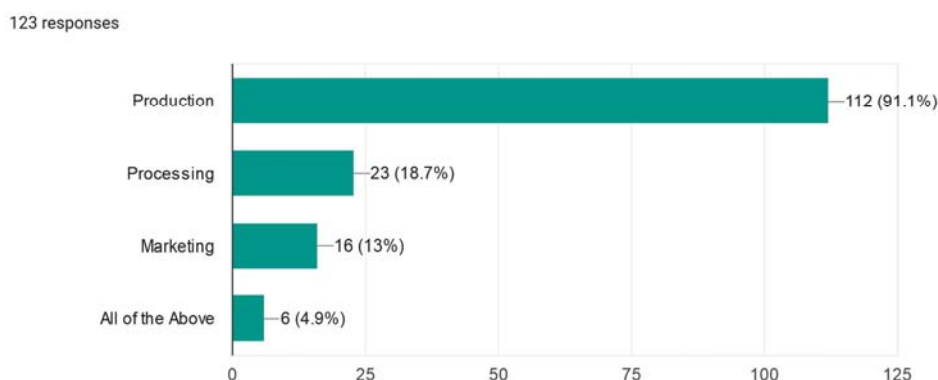
Figure 3. Distribution of Education.

The study showed that only a negligible number of respondents had no form of education. Although the majority (64%) had only Islamic education, others had varying forms of education be it primary, secondary and tertiary. Education can thus be a key influencing factor in technology adoption of dairy farmers as stressed in Quddus 2021 p133 "the level of technology adoption by small farm

dairy cattle holders is unsatisfactory and is highly dependent on farmer's education, farming experiences, financial status and extension services". This also may impact on their ability to assimilate and use extension materials that are majorly produced in English and local

languages. To address information asymmetry that may arise from this background, there may be the need to consider the use of Arabic or local languages in extension services delivery to small farm cattle holders.

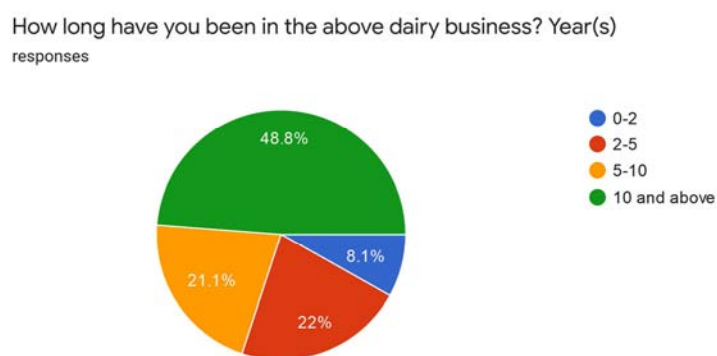
*What kind of business are you engaged in?*



**Figure 4.** Distribution of Business in the Area.

The profile of levels and nodes of engagement in the dairy value chain (91.1%, production; 18.7%, Processing; 13%, marketing) of respondents aligns with the basic economic

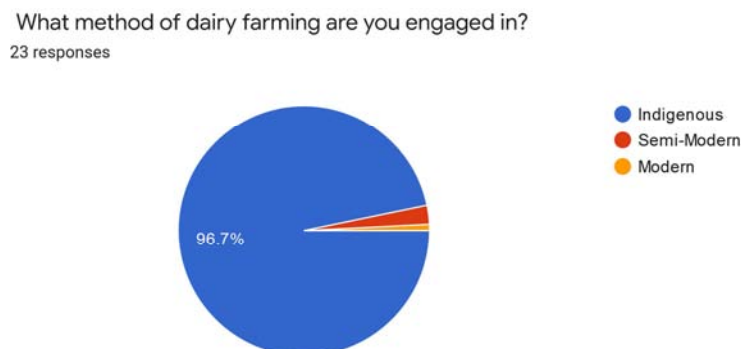
principles and empirical value chain pyramid where the producers constitute the base and marketers are found at the apex as succinctly presented in [16].



**Figure 5.** Years in Dairy Business.

Close to 50% of the respondents have been in the dairy business for more than 10 years, while another 21.1% have been for above 5 years indicating that they were not only

firmly rooted in the business, they also have good understanding of strength, weakness, opportunities and threats of their vocation.

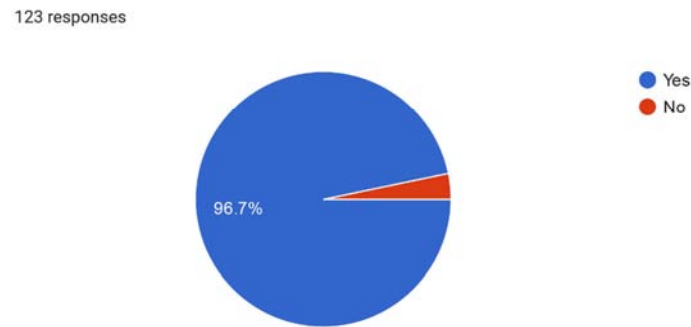


**Figure 6.** Method of Dairy Farming.

Majority of Paikon Kore Small farm dairy cattle holders still engage the indigenous methods in their vocation conforming with the submissions of [7, 13].

### 3.2. Objective II: Technologies in Small Farm Dairy Cattle Holdings in Study Area

*Are you aware of new technology in dairy farm*

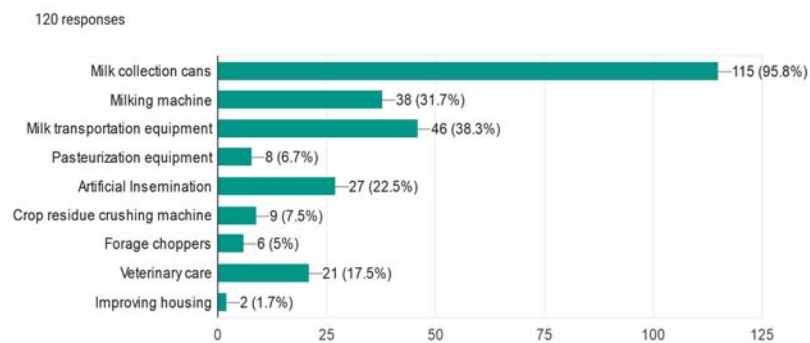


**Figure 7.** Technologies in Dairy Farming.

Information Asymmetry is glaringly reflected in the huge gap between stakeholders with awareness of new technologies (96.7%) and utilization or adoption (3.3%) as well as those engaging indigenous methods (96.7%). As a matter of fact, the study shows that 96.7% are aware of new technologies and 96.7% still utilize indigenous methods. This

means that awareness of technologies alone does not translate to utilization. Other factors like knowledge on how to use the technologies, access, finance and hand-holding particularly in livestock value chains are even more critical for technology adoption as argued in [15, 12].

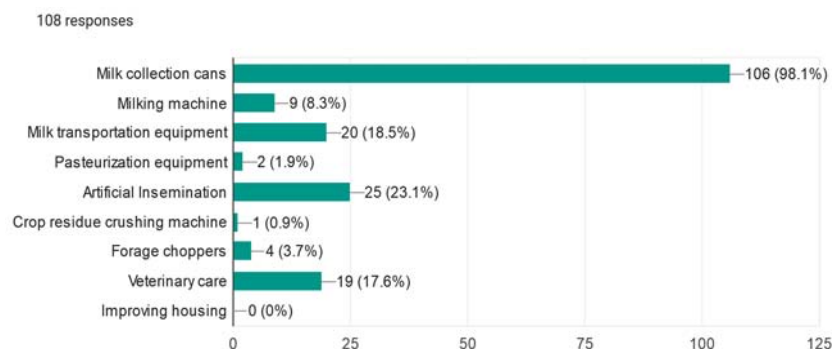
*Which of the technology are you adapted to?*



**Figure 8.** Technologies in Dairy Farming.

The levels of awareness about post-milking operations' new technologies (Milking Cans, 95.8%; Milking machine, 31.7%; Milking transportation equipment, 38.3%) and Artificial insemination (22.5%) indicate that respondents were aware of the need to upscale productivity and hygiene.

*Which of them are you currently using in operation?*



**Figure 9.** Technologies currently in operations.

The wide gaps among the scores for engaging modern techniques such as Milk Collection cans, Pasteurization equipment, Forage processing and improved housing is another strong indicator to the fact of information symmetry.

Seamless delivery would have indicated with emphasis the nexus between the use of all the technologies and improved productivity and profitability.

*Where did you get your information from?*

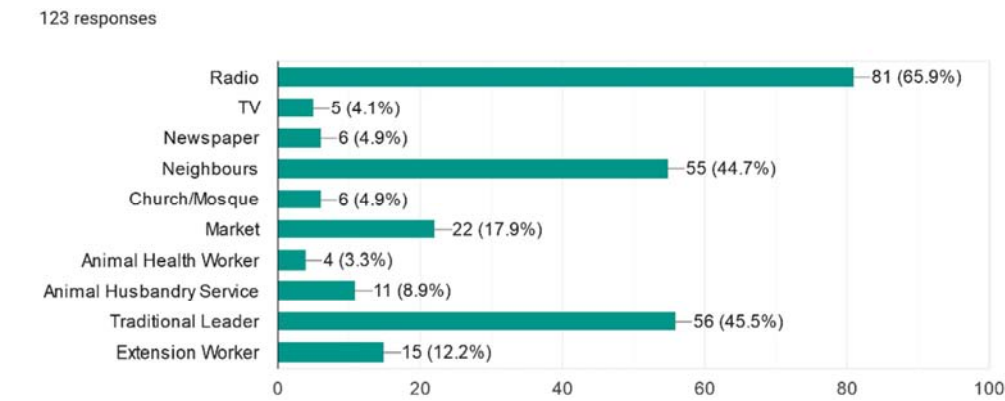


Figure 10. Sources of Information.

The rampant level of information asymmetry is confirmed by the percentage (65.9%) of respondents getting the bulk of their information from radio with its traditional low levels of contact with audience and poor feedback mechanism. The impacts of other major sources: Neighbours (44.7%)

and Traditional Rulers (45.5%) may not be too different due to high probability of quality of contents issues and delivery techniques appropriateness. *How long have you been using the technology?*

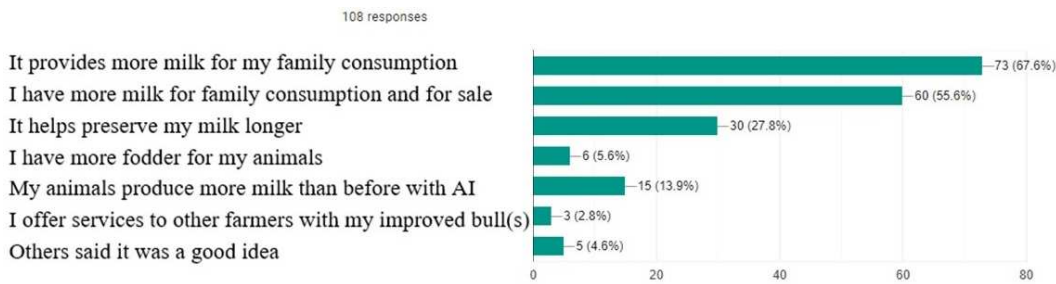


Figure 11. Technologies in Dairy Farming.

The various reasons given for adoption of new technology indicate that respondents were aware of the need to upscale productivity and livelihood but needed more effective information delivery and hand-holding services for effective adoption and sustainability. *How effective is the new technology?*

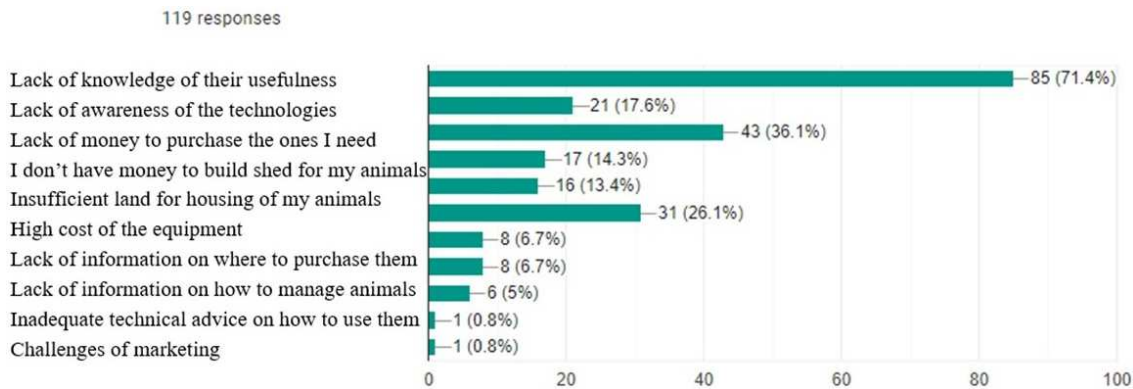
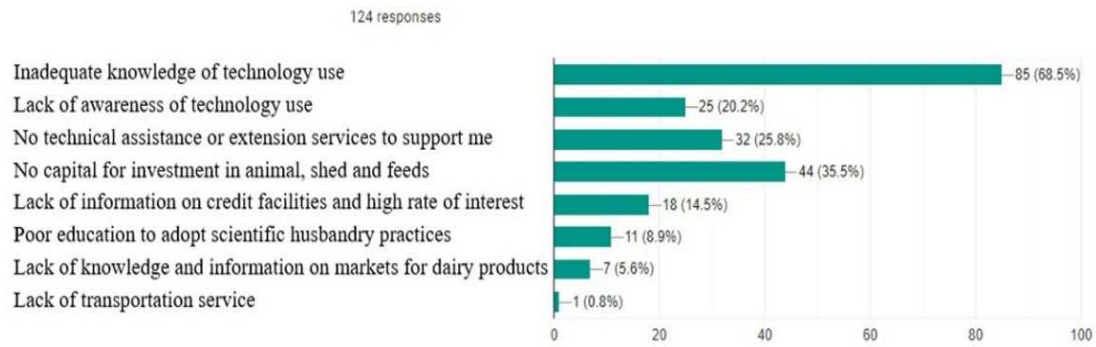


Figure 12. Technologies in Dairy Farming.

The overwhelming submission of lack of knowledge of use (72%) and lack of awareness of technology (17.8%) are indications of asymmetric information. The lack of money to purchase (36.4%) and High costs of equipment submissions also are symptoms of poor levels of hand-holding services

which are in themselves a reflection of information asymmetry as succinctly put in Montes de Oca Munguia et al, [18]. *Has an extension worker visited your area?*

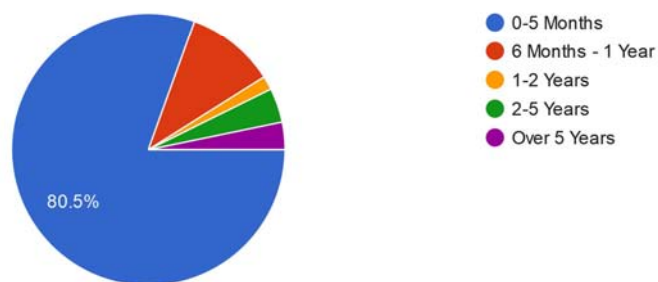




**Figure 13.** Constraints in Adoption Technologies.

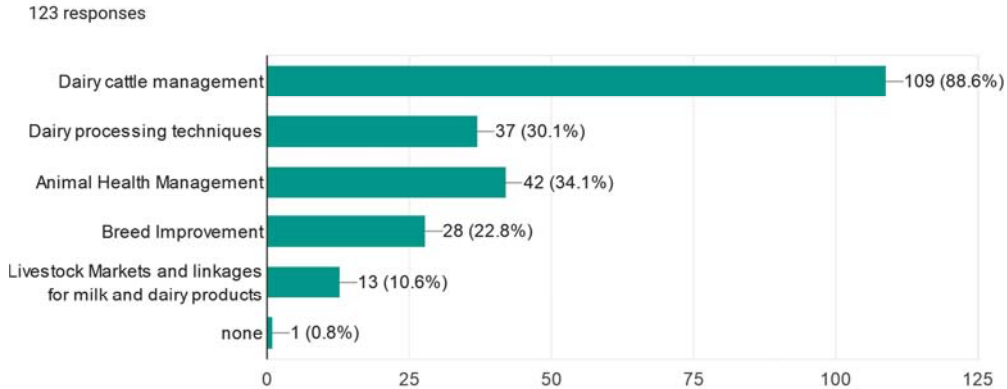
When last did an extension worker visit your community?

23 responses



**Figure 14.** Extension worker visit.

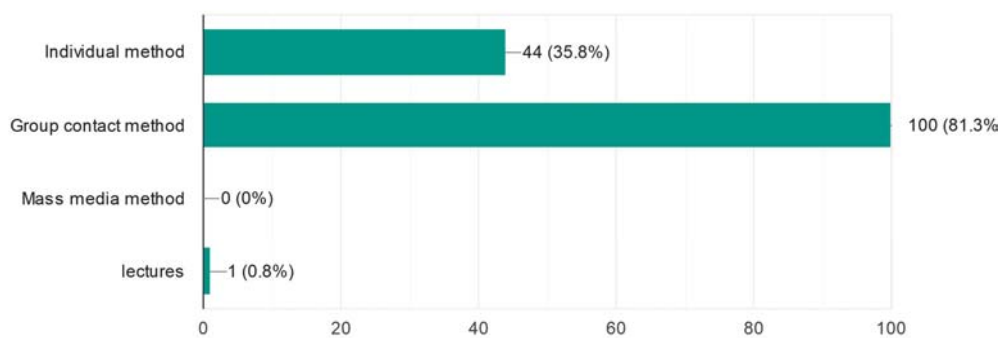
If within the above period, what topic or message on livestock did you discuss?



**Figure 15.** Messages on livestock.

If within the above period, how were the messages delivered?

1 responses

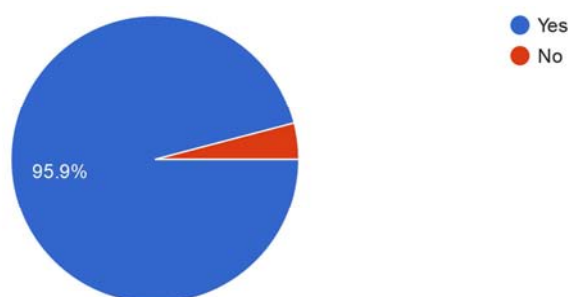


**Figure 16.** Messages delivered.

It is shown from the study that the respondents have benefited from extension services which could be attributed to the fact that the Abuja Agricultural Development Programme (ADP) and the Picon Kore Grazing Reserves are in the same catchment area. However, the method most applied for message delivery

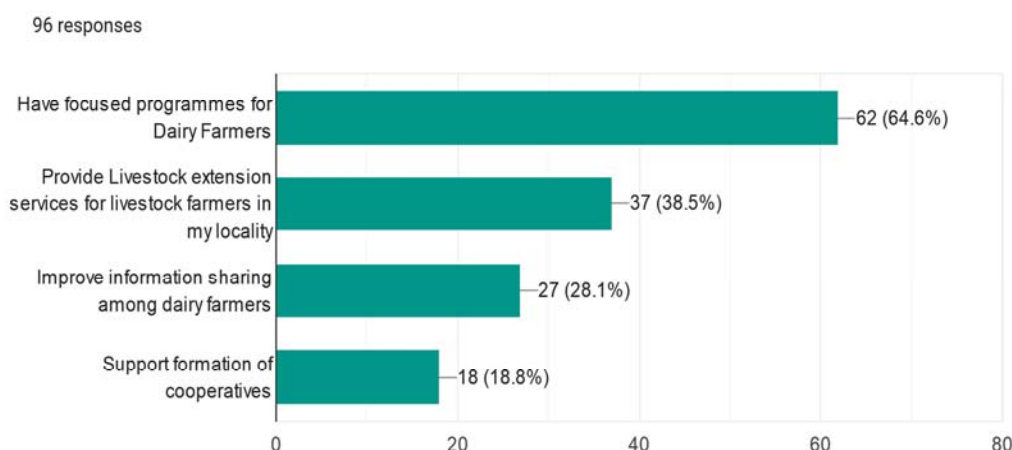
(Group Contact method 81.3%) while being efficient for awareness creation might be inadequate for in-depth knowledge of how to utilize technology and eventual adoption. Thus the reason for the majority of respondents being aware of new technologies but not utilizing them as is the case in questions i and ii.

Did the messages delivered meet your information needs on dairy farming?  
responses



**Figure 17.** Information needs on dairy farming. If no (4) above, what did the effect make.

If no in (4) above, what do you suggest should be done to meet your knowledge and information needs?



**Figure 18.** Knowledge and Information needs on dairy farming.

The quest for dairy focused knowledge and information system (64.4%) and a dedicated livestock extension services (38.8%) indicate that the respondents were in the know that a gap may exist in the current setup of extension services where an array of generic agricultural information are provided by Extension Agents from crop-based qualification background.

## 4. Conclusion

The study has revealed that despite the fact that small farm dairy cattle holders in the study area were aware of new and improved technology and the potential positive impacts they may have on their productivity and livelihood, they are being barred from adoption and buy-in due to gaps in information deliveries and hand-holding services.

The rampart generic extension services platform may

never fulfil the technical needs of small farm dairy cattle holders and indeed livestock.

Dedicated information design, packaging and delivery systems must be prioritized in interventions and budgetary programmes in order to optimize impacts and outcomes.

## 5. Recommendation

- i. A multi-stakeholder backstopping mechanism may have to be evolved to address current levels of information asymmetry in smallholder dairy ventures and allied setups.
- ii. Improved access to symmetric information and use of specialised bespoke extension approaches for livestock farmers should be encouraged to adequately translate awareness of technologies to utilization and adoption capabilities of small farm dairy cattle holders and indeed livestock farmers.



iii. Further studies are recommended to further x-ray information asymmetry, extension approaches and other causative factors hindering the use of new technologies despite appreciable levels of awareness.

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