
# Farmers' preference for bundled input-output markets and implications for adapted dairy hubs in Tanzania – a choice experiment

Rao, E.J.O., N. Mtimet, E. Twine, I. Baltenweck, and A. Omore

***Invited paper presented at the 5th International Conference of the African Association of Agricultural Economists, September 23-26, 2016, Addis Ababa, Ethiopia***

# Farmers' preference for bundled input-output markets and implications for adapted dairy hubs in Tanzania – a choice experiment

Rao, E.J.O. [1], N. Mtimet[1], E. Twine[1], I. Baltenweck[1], and A. Omore[1]

[1] International Livestock Research Institute (ILRI)
P. O. Box 30709
Nairobi 00100, Kenya

Corresponding author:
Elizaphan J.O. Rao
Phone: +254-20-422-3452; Fax: +254-20-422-3001
Email: J.rao@cgiar.org

**Farmers' preference for bundled input-output markets and implications for adapted dairy hubs in Tanzania – a choice experiment**


## Abstract

Dairy business hubs present opportunities for efficiently linking farmers to input and output markets. Yet participation by smallholder dairy farmers in these hubs will only be realized if the hub options are adapted to fit the needs of farmers. In this study we have analyzed preference for dairy business hubs in Tanzania where ILRI is currently implementing adapted hub options. Using survey data from smallholder dairy producers from Tanga and Morogoro and applying the choice experiment method we find significant preference for hub options with higher milk prices and payment for milk on a fortnight rather than cash basis. Farmers also prefer hub options that bundle milk marketing with input provision. For bundled inputs, smallholder dairy farmers prefer hub options that allow payment for such inputs via credit or check-off rather than cash. Our analyses also reveal significant heterogeneity in preference among farmers hence the need for advanced analytical approaches that can handle such heterogeneity. Emerging dairy hubs in Tanzania should be supported to either establish in-house input provision arrangements or to enter into contracts with major agro-input dealers in their environs.


## 1. Introduction

Tanzania dairy value chain has been characterized by stagnation in dairy output and supply of milk, which has over the years led to low milk consumption per capita (FAO, 2012). The growth rate in dairy output of 4.4% per annum has been recorded against a population growth rate of 4.5% leading to consumption rate of 24 kg per capita over the last two decades. Recent trends, however, indicate growth in demand for milk with consumption reaching about 39 litres per capita annually in the last decade (TNBS, 2003). Nevertheless, the consumption growth has been recorded against modest growth in milk productivity of 1.1% per annum (FAO, 2012). The slow growth in productivity is largely driven by animal health and reproductive challenges, limited access to quality and affordable feeds and unreliable access to technical information among other factors (Swai and Karimuribo, 2011; Ulicky et al., 2013). Remote and scattered location of smallholder households engaged in dairy production presents further challenges in terms of access to input and output markets.

In order to address some of these challenges, there is need for improved organizational models that would enhance economies of scale and minimize transaction costs associated with production and marketing of dairy products (Fischer and Qaim, 2012; Markelova and Mwangi, 2010; Wambugu et al., 2011). This is specially so in the face of smallholder predominance of the dairy sector in Tanzania. Appropriately designed collective approaches are likely to enhance access to inputs, services and improved dairy technologies, which would in turn allow for increases in cow productivity and hence production of surpluses at farm level. With improved

production, there will be further incentives for bulking of milk and upgrading of the value chain thus enabling farmers to access more profitable buyers.

Yet traditional approaches to collective action involving cooperatives are compromised by a heavy social orientation that limit economic viability of such entities (Mujawamariya et al., 2013). In response to these limitations, the International Livestock Research Institute (ILRI) has been collaborating with development partners to promote an alternative approach to collective action known as the dairy business hub (DBH). A dairy business hub is a mechanism to upgrade the value chain by clustering dairy services around a milk buyer under some form of contractual agreements that enable farmers to access milk markets as well as inputs and services (Jaleta et al., 2013; Puskur et al., 2011). In situation where smallholder producers are scattered and produce low volumes, it is uneconomical for traders/ processors as well as input and business service providers to provide services to these farmers. The hub approach is therefore aimed at addressing the underlying causes of productivity constraints faced by smallholder dairy farmers, much of which arise from inadequate access to essential inputs and services as well disincentives emanating from unreliable access to output markets.

After successful roll out of DBHs in Kenya, Uganda and Rwanda, ILRI together in collaboration with other development partners are currently implementing adapted dairy business hubs in Tanzania. However, the success of this adaptation hinges crucially on the fit of the proposed hub solution to the constraints faced by smallholder dairy farmers in respective areas. Hub models with attributes that address farmers' needs are more likely to be adopted by smallholder dairy households. Indeed, it is these attributes that farmers consider in making a choice between alternative marketing arrangements. Currently, contracts imposed by milk processors, cooperatives or chilling plants may involve requirements such as lagged payments (monthly or fortnightly) or other quality standards, which may not be attractive to some smallholder dairy farmers. Some farmers may also prefer milk marketing arrangement that is accompanied by input and/or service provision to alleviate the operating capital constraints often faced by smallholders. The current study therefore seeks to investigate smallholder dairy farmers' preference for attributes of dairy business hubs in order to recommend development of hub models that address the needs of smallholder dairy farmers in Tanzania.

The article proceeds as follows. In the next section we describe the study area and elaborate on the data collection protocol followed in this research, including the experimental design applied. This is followed by the description of the analytical approach. Finally we present and discuss results before making some concluding remarks.

## 2. Study area and data collection

Data used in this study was collected from 461 cattle keeping households located in two regions in Tanzania: Tanga region covering Lushoto and Handeni districts and; Morogoro region encompassing Mvomero and Kilosa districts. Both regions are characterized by extensive, pre-

commercial rural producers selling milk predominantly to rural consumers (Kilosa and Handeni) and intensive commercially-oriented rural producers selling milk to urban consumers directly or via traders (Mvomero and Lushoto). Compared to hub approaches implemented elsewhere in East Africa, interventions in Tanzania are targeted at pre-commercial marginalized smallholder cattle keepers whose participation in the dairy value chain has been minimal. The aim is to extend the benefits of commercial dairying; hence the focus on DBHs around small-scale milk traders instead of larger bulking units. Households were sampled from project villages proportional to the population of cattle keeping households in each district. Project villages in each district were grouped by possible hub model - either a chilling plant-based hub or a milk trader-based hub, depending on existing conditions for emergence of respective hub types. For each hub type a sampling frame was constructed from a list of all cattle keepers in all the project villages. The household lists for each hub type was then stratified into two: one list of group members and one for non-members of project groups. Finally, the required number of households was randomly selected from each list.

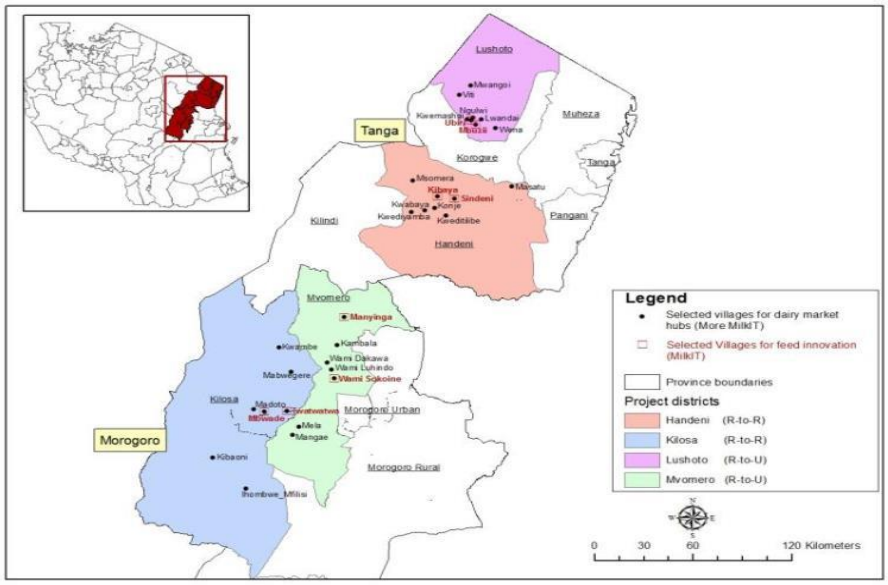


**Figure 1.** Study area Source: Omore (2012)

A structured questionnaire was used to collect data on dairy productivity, animal husbandry, input access and milk marketing alongside other socioeconomic variables. At the onset of interviews, every household was subjected to a section of the questionnaire where respondents were presented with a set of 12 choice cards. Each card included a set of 3 alternatives and each alternative had a mix of attributes that define a dairy business hub. These attributes included milk purchase price, frequency of milk payments (cash, fortnightly, monthly), bundled inputs or services and, mode of payment for the bundled inputs/services (cash, credit or check-off). The selection of attributes was based on existing hub models that have been introduced in Kenya Uganda and Rwanda. This was also augmented by key informant interviews with various actors

in the dairy value chain and a review of relevant literature. Table 1 summarizes the selected attributes describing the dairy hub options and their corresponding levels.

**Table 1.** Selected attributes for the dairy hub options and their corresponding levels

| Attributes | Levels |
|---|---|
| Price (Tsh/l) | 600<br>800<br>1000 |
| Payment for milk | Cash on delivery<br>Fortnightly<br>Monthly |
| Input and service provision | Inputs (feeds, drugs etc.)<br>Services (AI, Animal health)<br>Credit<br>Extension/training |
| Payment for services and/or input | Cash<br>Credit without check-off<br>Check-off |

The combination of the four attributes with their corresponding levels led to a total of 108 (3x3x3x4) hypothetical products. As the questionnaire was supposed to be completed in a reasonable time, the number of choice cards needed to be reduced, and this task employed an orthogonal design procedure. Considering efficiency and orthogonality requirements, without reducing variability, 12 choice cards was the minimum feasible number. Each card contained three choices of hypothetical dairy hub types. For each card respondents were asked to state their most, as well as their least preferred choice of milk sales and services provision arrangements (hub). The resulting choice experiment fulfils the properties of orthogonality, and exhibits high D-efficiency (98.3%), A-efficiency (96.5%) and G-efficiency (100%) levels. This type of experiment is better known as a Best-Worst, or sometimes a Most-Least, experiment. Figure 2 shows an example of a choice card that was presented to respondents in each household.

**Please indicate the most and least preferred milk sales and services provision arrangements**
(Tick only one case in each line)

| Attribute | Choice 1 | Choice 2 | Choice 3 |
|---|---|---|---|
| Milk price | 1000 TSH/L | 800 TSH/L | 600 TSH/L |

| Payment of milk | Fortnightly | Cash on delivery | Monthly |
|---|---|---|---|
| Input/service provision | Inputs | Services | Credit |
| Payment for inputs/services | Credit without check-off | Cash | Check-off |
| *Most preferred* | ☐ | ☐ | ☐ |
| *Least preferred* | ☐ | ☐ | ☐ |

**Figure 2.** An example of a choice card

## 3. Analytical approach

The first step of the analysis was to calculate standardized Most-Least scores (generally known as Best-Worst scores) to assess respondents' stated importance of the various attributes, and the importance of their respective levels (Marley and Louviere, 2005). The standardized scores are calculated as follows:

$$Standardized\ Most - Least\ Score = (M - L)/(m \cdot n) \quad (1)$$

Where:

*M: Number of times the attribute level appeared in the hub option was chosen as most important*

*L: Number of times the attribute level appeared in the hub option was chosen as least important*

*m: Number of respondents*

*n: Number of times the attribute was presented to the respondent*

As a second step in the analysis we consider the selection process as a choice experiment/conjoint analysis where the first ranked option (best option) is the preferred (chosen) one. Conjoint analysis arises from the theory of Lancaster (1966), which stipulates that utility is derived from the properties or characteristics that goods possess (bundle of attributes) rather than the good per se. Since its first development during the 1970s (Green and Rao, 1971; Green and Srinivasan, 1978), conjoint analysis technique has grown in popularity and has been extended to many disciplines such as transportation, telecommunications, the environment, marketing, and human health. In the agri-food sector, various studies have used conjoint analysis (choice experiments) to explore consumer behavior.

Generally, conjoint experiments employ ordered logit (OL) and ordered probit (OP) models to study consumers' preferences in the case of ordered responses; that is, the dependent variable takes ordered discrete values: 1, 2, 3, and so on. In this study the OL model was selected, based on ease of interpretation of the parameter estimates, which are employed in the WTP calculation. In addition, in order to maximize the degrees of freedom, three alternative models were

estimated by considering product cards' ordering as a discrete choice experiment: that is, the first ranked alternative is considered the chosen product. These are the conditional logit (CL), the rank ordered logit (ROL), and the random parameters logit (RPL - also called the mixed logit). The rationale of using these three models is to obtain more robust and precise estimates, particularly the RPL model which allows for randomness in the attributes' measurement across respondents.

All the above mentioned models rely on the Lancaster assumption regarding overall utility decomposition as well as random utility theory (Manski, 1977). The latter states that overall utility $U_{ij}$ can be expressed as the sum of a systematic (deterministic) component $V_{ij}$, which is expressed as a function of the attributes presented (raw milk marketing characteristics in this example), and a random stochastic component $\varepsilon_{ij}$:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (2)$$

Lancaster theory leads to the following linear additive decomposition of $V_{ij}$:

$$V_{ij} = \beta_1 x_{ij1} + \beta_2 x_{ij2} + \ ... + \beta_n x_{ijn} \quad (3)$$

where $x_{ijn}$ is the $n^{th}$ attribute value for card j for consumer i, and $\beta_n$ represents the coefficients to be estimated. Finally, following additional assumptions about the distribution of the error term, the following probability models could be derived:

CL (McFadden, 1973):

$$\Pr(j) = \frac{e^{V_{ij}}}{\sum_{k \in C_n} e^{V_{ik}}} \quad (4)$$

RPL model (Train, 2009):

$$\Pr(i) = \int \left(\frac{e^{\beta' . x_{ni}}}{\sum_j e^{\beta' . x_{nj}}}\right) . f(\beta) . d\beta \quad (5)$$

where $f(\beta)$ is the density function of $\beta$

Based on the aforementioned models, the willingness to pay (for specific attributes) estimates (WTP) are obtained as follows (Haefele and Loomis, 2001):

$$WTP_i = -\frac{\beta_i}{\beta_{price}} \quad (6)$$

In the case of the RPL model, all parameters were supposed to be random following a normal distribution.

## 4. Results and discussion

Before discussing results of the choice experiment analyses, we present some summary statistics describing the effects of attributes on the choice of hub approaches. Table 2 and Figure 3 graphically display for each attribute level, a score that measures association between attribute level and preference for hub option. Positive scores indicate that higher preference for hub options is associated with respective attribute level. On the other hand, a negative score implies an association between low preference for hub alternative and respective attribute level.

**Table 2.** Attributes' levels scores

| **Attribute** | **Level** | **Most preferred (M)** | **Least preferred (L)** | **M-L** | **m*** | **n**** | **Score***** |
|---|---|---|---|---|---|---|---|
| Price (TSh/l) | 600 | 1199 | 2422 | -1223 | 12 | 461 | -0.221 |
| | 800 | 1641 | 1807 | -166 | 12 | 461 | -0.030 |
| | 1000 | 2692 | 1303 | 1389 | 12 | 461 | 0.251 |
| Payment for milk | Cash on delivery | 1486 | 2363 | -877 | 12 | 461 | -0.159 |
| | Fortnightly | 2351 | 1337 | 1014 | 12 | 461 | 0.183 |
| | Monthly | 1695 | 1832 | -137 | 12 | 461 | -0.025 |
| Input and service provision | Inputs (feeds, drugs etc.) | 1493 | 1388 | 105 | 9 | 461 | 0.025 |
| | Services (AI, Animal health) | 1313 | 1322 | -9 | 9 | 461 | -0.002 |
| | Credit | 1418 | 1361 | 57 | 9 | 461 | 0.014 |
| | Extension/training | 1308 | 1506 | -198 | 9 | 461 | -0.048 |
| Payment for services and/or input | Cash | 1386 | 2409 | -1023 | 12 | 461 | -0.185 |
| | Credit without check-off | 2041 | 1583 | 458 | 12 | 461 | 0.083 |
| | Check-off | 2105 | 1540 | 565 | 12 | 461 | 0.102 |

* m is the number of times the level was present in the choice cards for each respondent
* n is the number of respondents
*** The Score is calculated as M-L / (m x n)

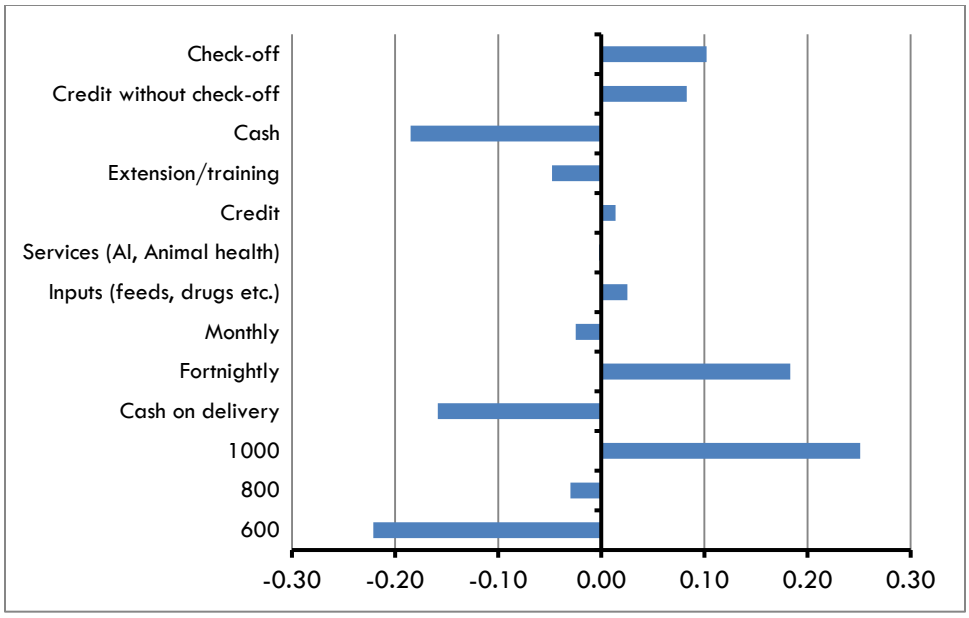


**Figure 3.** Attributes' levels scores

Table 2 and Figure 3 shows the relative association between different attribute levels and the choice of alternatives as most or least preferred. Positive values indicate that the respective attribute level are associated with increased preference for hub options while a negative score implies that the respective attribute levels are associated with lower preference for a given alternative. As expected the choice of alternatives is positively associated with higher prices for milk; the price of Tshs. 1,000 per liter of milk had the highest score while the other two lower prices were actually associated with lower preference for alternatives. As for mode of payment as an attribute of hub models, fortnightly payment for milk seemed to be associated with higher preference for alternatives, albeit by a lower score relative to higher pricing for milk. Monthly and cash payments on the other hand were associated with lower preference for. With regards to tied inputs and service provision, bundling milk marketing to provision of inputs and credit appears to be associated with higher preference for hub options as compared to tying inputs and extension. Finally, payment for bundled inputs and services in credit or via check-off are also associated with increased preference for alternatives.

*Determinants of milk producers' preference for dairy business hubs*

The above summary discussion reveals preference patterns which we further explore econometrically. Results of the regression analyses based on mixed logit estimation are shown in Table 3. These results describe which of the discussed attributes determines preference for hub options.

**Table 3.** Simulated Maximum likelihood estimates from mixed logit model

| | **Mean effects** | **Variance** |
|---|---|---|

| Variables | Coefficient | SE | Coefficient | SE |
|---|---|---|---|---|
| Price of milk per litre (Tshs) | 0.003*** | 0.000 | 0.003*** | 0.000 |
| Fortnightly [a] | 0.531*** | 0.053 | -0.812*** | 0.060 |
| Monthly [a] | 0.051 | 0.062 | 1.049*** | 0.068 |
| Services [b] | -0.142*** | 0.049 | 0.064 | 0.094 |
| Credit [b] | -0.042 | 0.051 | -0.240*** | 0.086 |
| Extension [b] | -0.178*** | 0.049 | 0.075 | 0.092 |
| Credit without check-off [c] | 0.322*** | 0.044 | 0.264*** | 0.076 |
| Check-off [c] | 0.403*** | 0.057 | 0.984*** | 0.061 |
| Observations | 16,596 | | | |
| Log likelihood | -5144 | | | |

*, **, *** implies variable is significant at the 10%, 5%, and 1% level, respectively.
[a] The reference frequency of payment for milk is cash on delivery.
[b] The reference service is input provision.
[c] The reference mode of payment for services and/inputs is cash on purchase.

Our findings are in tandem with the summary statistics discussed previously. Smallholder dairy producer do actually prefer milk marketing arrangements that offer higher prices. Indeed as the summary statistics revealed, the higher prices had the highest score of all the attribute levels. This underscore the need to establish efficient market linkages that will ensure farmers receive higher prices per liter of milk sold. With regards to mode of payment for milk, farmers can be paid cash on delivery or payment can be delayed. Our analyses reveal that farmers prefer delayed payment but the duration should not be too long. Payment on a fortnight basis seems to be the most preferred option. Preference for delayed payment may be due to the need by farmers to accumulate funds for substantial investments, which would be a challenge if they had to receive payment on a daily basis. We also analyze farmers' preference for tied input-output markets. As previously discussed, the hub approach is promoted as a mechanism for improving farmer access to inputs and services. By tying inputs and services provision to milk marketing, dairy business hubs ensure that farmers can access inputs and services on the account of milk delivered for sale even if they are not endowed with cash. Our findings reveal that if milk marketing has to be bundled with input and/or service provision, farmers would prefer arrangements that tie input provision rather than ones that tie services or extension. This could be an indication of limitations that farmers face in accessing inputs relative to access to extension or other services. Finally, for the bundled inputs and services, farmers would prefer payment via either credit or check-off. These last two results are interesting since a critical defining characteristic of the hub model is the flexibility that it offers for farmers to access inputs and services on check-off.

While these findings are interesting, the results assume homogeneity among the sample respondents that were interviewed. Yet there could be individual and contextual differences that could belie the homogeneous preference that we have so far assumed. The mixed logit analyses allow us to determine if there is some underlying heterogeneity worth further consideration. The

last two columns of Table 2 show the variance of mean effects of respective attributes on farmer preference for hub options. All the attributes reveal significant heterogeneity in effect, at least for one level for each attribute. This confirms existence of individual heterogeneity among respondents that will require more advanced models in our future analyses.

*Understanding the utility of hub attributes to farmers*

Additional to preference analyses discussed so far, we undertook a willingness to pay estimation. The estimates, which are displayed in Table 4, reveal how much in terms of money the respondents are willing to pay/forego in order to have hubs with respective characteristics.

**Table 4.** Willingness to pay estimates

| **Attribute levels** | **Tshs/liter of milk** | **95% confidence interval** |
|---|---|---|
| Fortnight payment for milk | -194.17*** | [-237.83, -150.51] |
| Monthly payment for milk | -18.75 | [-63.47, 25.97] |
| Bundled service provision | 51.94*** | [16.24, 87.63] |
| Bundled extension services | 64.87*** | [28.87, 100.87] |
| Bundled credit services | 15.19 | [-21.46, 51.85] |
| Payment for services/inputs via credit | -117.64*** | [-152.90, -82.38] |
| Payment for services/inputs via check-off | -147.44*** | [-192.04, -102.83] |

Results show that respondents are willing to forego an equivalent of Tshs. 194 per liter of milk sold in order to have hubs that pay for milk on a fortnight rather than cash basis. On the other hand, they would only be willing to forego an equivalent of Tshs. 18 per liter of milk to have hubs that pay for milk on a monthly rather than cash basis. For milk marketing arrangement that could be paying on a monthly basis, respondents are willing to forego approximately Tshs. 176 per liter of milk to switch to a fortnightly payment regime. We also see from Table 4 that respondents were willing to forego Tshs. 52 per liter of milk to have market coordinating mechanisms that bundle supply of inputs (feeds drugs etc.) rather services (animal health, breeding etc.) with milk marketing. Respondents would be willing to forego more (Tshs. 65 per liter of milk) to mechanisms that bundle inputs supply rather than extension services. Finally, for coordinating mechanisms with bundled inputs and services, respondents would be willing to forego Tshs. 118 per liter of milk to have payment for these inputs done on credit. Similarly, respondents would be willing to forego Tshs. 147 to pay for respective bundled goods and services via check-off. However, respondents would be willing to part with much less (Tshs. 29 per liter of milk) to switch from credit payment to check-off system.

## 5. Conclusion

This study sought to understand preference among dairy farmers for attributes of dairy business hubs currently being implemented by ILRI and other partners in the Tanzania dairy value chain. Our findings reveal attribute preference that should inform the on-going adaptation of dairy business hubs to the Tanzania dairy value chain.

First and as expected, higher price remains top in the priority of smallholder dairy farming households. Second, smallholder producer prefer bulk payment for milk done on fortnight rather than on a monthly basis. Cash payment does not seem to be popular with producers. Preference for bulk payment may be driven by the desire to accumulate funds for substantial investment. This could be an indication that dairy farming among these smallholders is an economic rather than a subsistence enterprise. Third, we find that smallholder dairy producers prefer hub arrangements that bundle milk markets with inputs and/or services provision. In particular producer prefers arrangements that bundle input provision rather than other services such as animal health or extension. This could be a pointer to input access limitations that households are facing. While services such as animal health or extension remain under the domain of the public sector, input provision is largely private with businesses located in market centers that are far from most farms. This makes input access relatively inaccessible and producers would thus be looking out for arrangements that would alleviate such limitations. Finally for the bundled inputs and/or services producers tend to prefer payment options that do not involve cash payment, probably due to liquidity constraints. Indeed, producers prefer both credit and check-off options but check-off is preferred more.

We however find significant heterogeneity among respondents indicating that these conclusions may not apply across board. Further analyses that account for such heterogeneity will be needed to offer refined recommendations that can aid more targeted hub adaptation to the Tanzania dairy value chain.

These findings provide substantial opportunities for existing or emerging dairy cooperatives to move beyond the traditional role of just bulking milk and build business around bundled input and/or service provision. Such services could endear more farmers who are often attracted to milk outlets that offer higher prices for milk but do not have organizational capability to offer services that increase farmer loyalty. By offering bundled input services and thus attracting more farmers, dairy hubs will increase the volume of milk that they handle, thus lowering the cost of milk marketing per liter of milk sold. In the same breath, bundled input provision will improve farmer access to inputs with possible positive effect on milk productivity and the amount supplied to the hubs. This will similarly reduce the associated milk marketing cost per liter and the ensuing cost saved can then be passed on to farmers in form of higher milk prices. This will in turn attract more farmers, further driving down associated costs for hubs. Cooperatives can either develop such input provision arrangements in-house or enter into some contractual arrangement with major agro-input dealers in their locality. However, developing and sustaining such business linkages will require business development support that government and non-governmental bodies should provide.

**References**


FAO (2012). Fao Statistical Database.

Fischer, E. and M. Qaim (2012). Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya. World Development 40(6): 1255-1268.

Green, P.E. and V.R. Rao, (1971). Conjoint Measurement for Quantifying Judgmental Data. Journal of Marketing Research 8(3): 355-363.

Green, P.E. and V. Srinivasan (1978). Conjoint Analysis in Consumer Research: Issues and Outlook. Journal of Consumer Research 5(2): 103-123.

Haefele, M. and J. Loomis (2001). Using the Conjoint Analysis Technique for the Estimation of Passive Use Values of Forest Health. Journal of Forest Economics 7(1): 9–24.

Jaleta, M., B. Gebremedhin, A. Tegegne, S. Jemaneh, T. Lemma and D. Hoekstra (2013). Evolution of Input Supply and Service Hubs in Dairy Development at Ada'a Milk Shed in Ethiopia. Development in Practice 23(2): 249-263.

Lancaster, K. (1966). A New Approach to Consumer Theory. Journal of Political Economy 74(2): 132-157.

Manski, C.F. (1977). The Structure of Random Utility Models. In Theory and Decision 8(3): 229-254.

Markelova, H. and E. Mwangi (2010). Collective Action for Smallholder Market Access: Evidence and Implications for Africa. Review of policy research 27(5): 621-640.

Marley, A.A.J. and J. Louviere (2005). Some Probabilistic Models of Best, Worst, and Best Worst Choices. Journal of Mathematical Psychology 49: 464-480.

McFadden, D. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In P. Zarembka (ed.), Frontiers in Econometrics, 105-142, Academic Press: New York.

Mujawamariya, G., M. D'Haese and S. Speelman (2013). Exploring Double Side-Selling in Cooperatives, Case Study of Four Coffee Cooperatives in Rwanda. Food Policy 39: 72-83.

Omore, A. (2012). More Milk by and for the Poor: Adapting Dairy Market Hubs for Pro-Poor Smallholder Value Chains in Tanzania.

Puskur, R., D. Baker, A. Omore and S. Staal (2011). Changing Approaches to Pro-Poor Livestock Market Development: Innovation and Upgrading in the Value Chain. ILRI Issue Brief.

Swai, E. S. and E. D. Karimuribo (2011). Smallholder Dairy Farming in Tanzania Current Profiles and Prospects for Development. Outlook on AGRICULTURE 40(1): 21-27.

TNBS (2003). Country Statistics, Tanzania National Bureau of Statistics.

Train, K. (2009). Discrete Choice Methods With Simulation, Second Edition. Cambridge University Press: Cambridge.

Ulicky, E., J. Magoma, H. Usiri and A. Edward (2013). Improving Smallholder Livelihoods: Dairy Production in Tanzania. Tropical Grasslands-Forrajes Tropicales 1(2): 244-248.

Wambugu, C., F. Place and S. Franzel (2011). Research, Development and Scaling-up the Adoption of Fodder Shrub Innovations in East Africa. International journal of agricultural sustainability 9(1): 100-109.