3R Kenya Project Practice Brief 001

Calculating on-farm cost of milk production in Kenya

Assessing the suitability of five methods being used in Kenya

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High on-farm production costs and high supply chain transaction costs are a key bottleneck in the development of Kenya's dairy sector. Solid evidence on cost of production and transaction costs along the chain is missing due to lack of consistent approaches for cost calculation. Also, previous studies were carried out in different years, which makes it even more difficult to compare their results. This practice brief assesses the suitability of various methods which are currently being used in calculating the cost of production in Kenya. This will be followed by a detailed analysis of cost of production using one or more of these methods and the outcome will be presented in the next practice brief.

A study by Staal (2003) showed average costs of production per litre of milk to be 17.20, 11.90 and 13.30 Ksh in Kiambu, Nyandarua and Nakuru respectively. Meanwhile, Ojango *et al.* (2011) reported average production costs ranging from 10.3 Ksh to 21.0 Ksh per litre for extensive systems and from 8.1 to 14.9 for semi-extensive dairy systems in Kenya. Baltenweck *et al.* (2012) further indicated that these differences were driven by the geographical location and the production intensity. The International Farm Comparison Network (IFCN) estimated the cost of milk production from typical farms in Kenya to range between 26.2 and 34.0 Ksh per litre of milk in 2015. In 2016, the costs increased by 7 Ksh per litre of milk, mainly due to drought conditions (Hemme *et al.* 2016, 2017). Tegemeo Institute's study on cost of production from typical farms in twenty Kenyan counties reported costs ranging from 15.1 – 36.2 Kshs per litre of milk, with Kakamega and Taita Taveta counties having the highest costs while Narok and Baringo counties had the lowest costs (Tegemeo 2015).

Because of differences in cost calculation methods, chain actors lack consistent evidence to adequately address farm and chain inefficiencies. Farm advisors in particular lack a tool that aids them in advising farmers on better farm management, in order to improve farm efficiency by addressing cost of production. Policy makers also lack a tool that can support them in setting regional priorities on dairy production based on competitiveness. Although various cost calculation methods are available, their accuracy and user-friendliness are yet undetermined. Furthermore, estimates from a local processor in Kenya show that the farm gate milk price accounts for 34% of the final value of typical dairy products in Kenya. Meanwhile, the costs of cooperatives and milk transportation to the processor account for 11%, processing costs 17%, distribution, marketing and retailing 23%, leaving the processor with a margin of about 15%. Improving the efficiency at farm level would therefore have the highest effect on the price of the final product. Of course, improving the efficiency in other areas along the supply chain could also significantly reduce costs and increase overall profit share for all and competitiveness of the country's dairy sector.

Key messages:

- Evidence that financial record keeping and use of these data by the farm manager offers great opportunities to increase profits in the Kenyan dairy sector.
- The cost approaches have been designed to meet one or more of three major goals:
  - Supporting farmers to improve farm management and economic performance.
  - Supporting researchers and policy makers to identify interventions to improve on farm profitability.
  - Supporting processors and policy makers in setting milk prices and in identifying adequate farmer support interventions.
- DairyNomics, ILRI and nKCC methods have a stronger potential to support farmers in making on-farm decisions while Tegemeo and IFCN have more focus on the support for sectorial and regional decision making.
- The absence of farm records is a major hindrance to obtaining accurate cost of milk production at farm level.

In March, 2017, the 3R (Resilient, Robust, Reliable - from aid to trade) Kenya project, which aims to contribute to the sector's development, convened a workshop to review a range of methods and tools used to support dairy production and enterprise management in Kenya. Of special interest were methods of assessing cost of milk production under different farming systems and supply chain arrangements. Five different methods for cost calculations were identified and discussed: (i) DairyNomics (ii) International Livestock Research Institute (ILRI) approach (iii) the International Farm Comparison Network (IFCN) typical farm approach; (iv) the nKCC approach and (v) the Tegemeo approach. Meanwhile, other support tools for evaluating farm economics and enabling farm decision making were also presented, including Dairy Farm Benchmark (DFB), iCow smart tool and the Uniform Agri herd management software.

The workshop compared the five methods in order to select some methods for comparative use in cross-sectional and longitudinal analysis of costs of dairy production in Kenya. This practice brief reports on the characteristics of these five methods.

Five methods in brief

DairyNomics (SNV/KMDP)

Dairynomics was first developed in 2016 through the SNV's Kenya Market-led Dairy Program (KMDP) as a comprehensive dairy farm-economics tool. The method integrates manual record keeping by DairyNomics Recording Modules with an ICT application and advisory services for improved farm management. It is available in a web-based form and as a mobile phone application. The Farm Recording Modules are also available in hard copy and can be used as a stand-alone product. The developers are preparing further marketing and route to market of the tool. It involves monthly data collection and recording, coupled with provision of advisory and decision support to farmers by a consultant. It incorporates a "farm walk" to check consistency between data collected and observations on the farm. This also aids the consultant and farmer in identifying areas requiring immediate and long-term improvements. The method's record keeping system is designed to generate data useful in computing costs of farm inputs and per litre of milk, and to generate information for comprehensive advice on how to reduce costs and increase yield and profitability (Van der Brink, 2016).

ILRI method

The International Livestock Research Institute (ILRI) generates knowledge to promote sustainable use of livestock in smallholder systems for better lives in developing countries. A recent partnership project, the East African Dairy Development (EADD), triggered the need for understanding the cost of milk production in the region. The ILRI approach was used for calculating and comparing the cost of producing a litre of milk in three countries (Kenya, Tanzania and Uganda) and to identify cost components that can be targeted in order to enhance profitability. The costing approach enables a fragmentation of costs into: labour, feed, animal health, breeding, extension, fixed costs, given out milk, calf milk and mortality. This approach facilitates the comparison of milk production systems based on their production intensity and scale of production. For example, it was seen that, while feed had a high contribution to the total costs in all three countries, Uganda had an extremely high proportion of costs (63% in extensive systems) from animal mortalities compared to 29% in Kenya and 5% in Rwanda (Baltenweck *et al*. 2012). The same study also showed that the intensity of production system, farm size, cattle sales, animal mortality and cost of purchased feed strongly influence the costs of milk production.

IFCN method

The IFCN method has been used since 2000 for annual comparison of costs and profitability of dairy farms worldwide. Its first versions were mainly suited for comparison of dairy farms from industrialised countries, but since 2004, it has been adapted to suit smallholder dairy farms in developing countries. The main goals of this method are: 1) to compare and identify drivers for competitiveness between farms in different countries and within the same country; 2) to carry out normative analysis that shows how various management strategies and policies could affect specific dairy farms; and 3) to support in determining suitable milk pricing systems for various farms and identify various breakeven points that affect major decisions at farm level. It applies a typical farm approach, where farm data is collected annually in a country and validated for a few typical farms by a panel of experts.- A typical farm is a common farm type with a large share in the national milk production, representing a predominant dairy farming and management system in a country or region. Data collected from typical farms are analysed using the Technology Impact Policy Impact Calculation (TIPICAL) model which considers full cash and non-cash costs of the dairy enterprise.

nKCC method

nKCC is the second largest milk processor in Kenya in terms of milk intake and dates its operations as far back as 1908. In a bid to strengthen the dairy industry in Kenya, the company, as a quasi-government entity provides extension services to dairy farmers. Part of this approach is to calculate the costs of milk production at farm gate, as well as the costs along the dairy chain. These costs are shared with farmers to discuss milk cost pricing and to unravel areas of inefficiencies along the supply chain. The tool for calculating farm gate costs is simple and only considers operational costs. The costs categories cover labour, feed (dairy meal, mineral salts, hay, silage, lucerne), artificial insemination, veterinary costs, insurance, calf rearing, transportation, loans, management etc.
Recently, nKCC has designed a cluster extension system, where advisers are assigned to a number of farmers (clusters), to provide individualized support that includes linkages to input suppliers and tracking of production costs, to determine potential areas of improvement. There is an on-going process of integration of an Information and Communications Technology (ICT) tool which will track/capture such farm data.

Tegemeo method

Tegemeo research institute's method applies a similar typical farm approach as the IFCN approach. One difference between the two methods is the standardisation of milk when calculating costs. Tegemeo calculations are done without milk standardisation, whereas the IFCN standardises milk by converting it to a protein content of 3.3% and fat content of 4%. In the past, Tegemeo applied a longitudinal household survey approach where individual households were interviewed to provide costs incurred and revenues earned. To come up with overall cost of production, these individual households were averaged and therefore costs were the mean of all farmers interviewed.

Tegemeo changed to the typical farm approach as it is less complex and takes considerably less time and money for data collection. Tegemeo now has 22 "Typical Farms", representing different counties in Kenya, from which it collects data annually. The Tegemeo approach also considers the fluctuations in milk production caused by seasonality in calculating the cost of milk production.

The differences between these methods are further explained in Tables 1 and 2 below:

Table 1: General comparison of cost price calculation methods

	Method	Method goals (as reported by owners)	Definition of cost price and profit indicators	Data collection method	Assumptions used (mainly to reduce data collection costs)
1	DairyNomics	1. Increase individual farm profitability 2. Support farmer with financial data needed to take operational decisions 3. Track farm progress and advise farmers to reach their targets 4. To aid monitoring cost of production of different farms in Kenya	Result per litre: Earnings Before Interest, Taxes, Depreciation and Amortisation (EBITDA): (total revenue minus operational cost). Result per litre: EBIT: (total revenue minus operational cost and depreciation/amortization) Result per litre: EBT	Farmer collects data in DairyNomics record keeping book. Consultants analyses the data during their monthly farm visits and discusses and advises on areas of improvement.	All cash flows are considered
2	ILRI	1. Monitoring cost of production and profitability in Kenya and compare with other countries in the region 2. Identify key factors that influence cost of production in smallholder farms 3. Identify interventions to reduce costs	Profit = Total revenues minus total costs, including depreciation, excluding family labour & non-marketed benefits (draught power, manure used on farm & benefits of cattle as form of savings & insurance)	Data collected by ILRI researchers from 90 sampled farms over a few years; including milk consumed by household and milk given to labourers and calves	Annual milk yield estimated by using actual milk production and lactation stage; milk price estimated from various market outlets in region
3	IFCN	1. Monitoring revenues and costs of milk production in participating countries 2. Benchmark different farms and determine the areas where each has a competitive advantage compared to the others 3. Support in determining a suitable pricing system for milk	"Entrepreneur's" profit = Total revenues – total expenses – depreciation – opportunity costs (on own capital, quota, land and labour)	Typical farm approach: A panel collects data that represent the situation on a typical farm for the country/region; data and results are subject to continuous feedback from dairy stakeholders	Reduced sample size – use of typical farms; full costs approach; typical farm is good indicator for dairy sector in country/region
4	nKCC	1. Determine/set farm gate milk price based on actual cost of production on farm 2. Determine effects of production system, feed rations, opportunity costs, cow productivity and number of cows on production cost.	Enterprise profit = value of all sales minus costs, including variable costs, transport, depreciation, cow loan and management costs	Extension workers collect the data during farm visits; calculations are made seasonally and annually	Assumptions on feed costs based on market value, veterinary costs, insurance, calf rearing, etc.
5	Tegemeo	1. Monitoring cost of production in Kenya 2. Estimate profitability across different production systems 3. Identify key factors that influence costs and interventions to reduce costs	Enterprise profit = total revenues minus total costs (incl. depreciation and opportunity costs)	Alignment with IFCN approach. Use of typical farms established in areas reflecting most important production structures; panels collect farm data from 22 typical farms annually	Reduced sample size; full cost approach

Table 2: Methodological considerations for various cost parameters as applied in the Kenyan context

	Parameter	DairyNomics method	ILRI method	IFCN method	nKCC method	Tegemeo method
1	Fixed costs	Considered in EBIT calculations	Considered	Considered	Not considered	Considered
2	Milk yield	Monthly yield based on actual milk sales; total milk production is recorded	Deducted from the production against time	Annual yield including milk fed to calves and consumed at household, estimated from lactation yield	Annual yield estimated from the average daily milk yield	Annual yield estimated from the lactation yield
3	Concentrate cost	Based on actual farm expenses	Based on farm expenses	Based on farm expenses	Based on feed market prices	Based on farm expenses
4	Roughage cost	Calculated monthly using real costs based on actual production cost of roughage per kg.	costs based on farm expenses	Real costs calculated based on farm expenses; land and labour costs for home grown feed are allocated to the dairy enterprise	Estimates based on feed market prices	Real costs calculated based on farm expenses; land & labour costs for home grown feed are allocated to the dairy enterprise
5	Land cost	Actual cost for rented land is considered; Does not consider any opportunity costs	Only costs for rented land are considered	Paid rents for rented land; rent price considered as opportunity cost for owned land	Considered in the feed costs	Paid rents for rented land; rent price considered as opportunity cost for owned land
6	Labour cost	Only hired labour is considered	Only hired labour is considered	Wages for hired labour + opportunity cost for family labour are calculated from local wages	Only hired labour is considered	Wages for hired labour + opportunity cost for family labour calculated from local wages
7	Depreciation	Straight line depreciation calculated for machinery and buildings	Calculated for buildings and machinery	Book value if available; straight line depreciation	Considered at a minimal rate	Book value if available; straight line depreciation
8	Calf rearing	Included in cost calculations; separate young stock feeding cost	Included in the cost calculations	Male calves are sold to beef enterprise at 2 weeks. Calf/heifer rearing costs allocated to the dairy enterprise	Considered as a fixed rate per calf	Costs for rearing female calves/heifers are allocated to the dairy enterprise
9	Standardi-sation of milk	No standardisation; milk is used in its natural composition	No standardisation of milk	Milk is standardised to 3.3% protein and 4% fat content	No standardisation; milk is used in its natural contents	No standardisation; milk is used in its natural contents
10	Returns except milk	Returns from cattle, manure and trainings are considered	Sales of cattle is considered. Manure & draft power are seen as non-market benefits.	Returns from cattle, manure, subsidies and other possible returns from the dairy enterprise are considered	Returns from cattle and manure are considered	Returns from cattle and manure are considered

Observations

Purpose of tools

By comparing the five methods we came to the following findings:

1. Differences in the goals of the methods are a major driver behind the differences in calculation approaches, although the output indicators used were similar in most of these methods.
2. The main goals for calculating cost price for milk production are:
   a. Supporting farmers to improve farm management and economic performance.
   b. Supporting researchers, practitioners and policy makers to study economic farm performance, to analyse reasons for variation (i.e. differences between farm types or regions), to prioritise regional interventions on the dairy sector and to identify strategies to reduce cost of production.
   c. Supporting processors and policy makers and farmers in setting or negotiating for the price of milk and in identifying adequate farmer support interventions.
3. The absence of farm records is a major hindrance to obtaining accurate cost of milk production at farm level. For any method to be sustainable in cost calculations in Kenya, it should include a component on data collection and needs to be designed in such a way that it motivates dairy farmers to participate in consistent data collection as a means of improving their farm management and economic performance.

Comparing the five methods

Notably, Dairynomics and nKCC methods have been designed for use in an extension system, where farm advisers support data collection and guide continuous decision making by farmers in order to improve their farming enterprises. Such approaches would likely be more attractive to farmers.

The DairyNomics approach entails data collection for a large number of variables which might be time consuming and on the other hand, the use of real farm data might guarantee more accurate results. The nKCC method on its part requires fewer data entries, which together with a number of estimates, are used for cost calculations. It is therefore easier to use, especially by persons with only a very basic knowledge in farm economics. However, the many estimates used might affect the accuracy of the results and will be less challenging to adapt purchase decisions for cost items that are only based on assumptions.

Tegemeo and IFCN methods both use the typical farm approach and could be cheap and fast in generating results. However, their results are more steered towards assessing regional differences, rather than to support decision support on individual farms. The advantage of these approaches is that they can identify aspects of regional competitiveness which can be improved upon or utilized in other regions where possible.

The ILRI approach combines the possibility to support in farm decision making and also in identifying regional differences. However, costs related to the use of family resources and non-marketed benefits of the dairy enterprise are not considered in the ILRI calculations.

Differences in cost price within Kenya

The results of Tegemeo, ILRI and nKCC show significant differences in cost price and profitability between farms. Based on studies done by the users of these methods, these differences are influenced by: the study region, herd size, production system (including available land for fodder production, share of lactating animals in the herd, and livestock units per acre). It is recommended that the Kenyan dairy sector should pay more attention to financial record keeping and data analysis, considering the relationships between farm characteristics, cost price and farm profit. This can contribute to enhancing the competitiveness of the Kenyan dairy sector; profitability can be improved through reduction of costs as well as through increase in revenues on milk and cattle sales.

Methodology behind this Practice Brief

This Practice Brief is based on presentations and discussions from a workshop on methodology for Cost of Production held in Nairobi Kenya in March 2017. Further discussions were held with the developers of five different method providers to deeply understand the methods.

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3R Cost of production workshop participants, March 2017

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