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CALCULATION OF PRODUCT COST IN DAIRY FARMING: EXAMPLES FROM ESTONIA

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Abstract. In order to ensure sustainable milk production and comparison of results, it is important to be able to calculate the unit cost of milk production (unit price). As there is no uniform methodology for calculating milk production and full unit cost, companies themselves have tried to develop suitable methodologies which unfortunately have given incomparable results. This uncertainty prevails in the use of topical concepts. This article investigates dairy output unit cost calculation principles in use in Estonia within the framework of a case study, and offers possible solutions for their harmonisation. This issue has become important in Estonia due to the fall in purchase prices on the dairy market.

Key words: dairy farming, cost accounting, production costs, unit cost.

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Introduction

The structure and level of production costs are determined by the global food product market and food safety (Bengtsson, 2011; Isermeyer, 2011). Production costs are characterized by production systems and production technology, investments in their development, and ultimately the production potential. Production costs are economic indicators with which the economic results of production are assessed (Värnik, 2008). In evaluating the competitiveness, the calculation and accuracy of production costs are of significant importance in making necessary changes to the selection of inputs and in their usage (Viira, et al., 2015). A production cost can be defined as the value of production factors/inputs in the final output. Therefore, the challenge for agricultural enterprises remains in how and with what methodologies to carry out accurate cost accounting and evaluation (Cesaro, 2008; FACEPA, 2011). One way of assessing the cost of production is the analysis of all costs in the production process (Shadbolt, et al., 2011).

The main goal of cost accounting is to provide management with important information at the right time for different managerial decisions. In a situation where one of the prerequisites for ensuring sustainable milk production is management's knowledge on the composition of the production unit cost of milk, it is especially deplorable that there is a lack of a unified calculation methodology that would ensure the comparability of costs per unit of output (cost object). So far, it has been sufficient in most agricultural companies to know how to take costs into account fairly and correctly but nowadays cost management, forecasting, and budgeting have become increasingly important, which makes it necessary to go beyond cost accounting to cost management. The goal of cost management is to ensure the safeguarding of interest groups with information necessary for their interests in costs of cost objects. The aim of the current paper is to investigate possible means of calculating production costs in dairy farming, presenting theoretical opinions and comparing different production cost calculation schemes, spread in practice in Estonian dairy companies. The authors hope to start a discussion on this topic. Observation and a case study have been used as this article's research methodology. The primary data were gathered in five interviews conducted in October and November 2015. Production costs are trade secrets, and thus in order to ensure the anonymity of the sources, the identities of those interviewed had not been disclosed.

Research results and discussion

1. Overview of the principles of output cost calculation

The output unit cost price of livestock farming is calculated after the determination of the crop production costs and the adjustment of the actual costs of animal nutrition produced and used by the company (Accountancy Guideline Materials…, 1987). A dairy herd's primary product is milk, while calves born to the herd are counted as supplementary products, and manure is a by-product (Soe, et al., 1984).

According to the Estonian Accounting Board guidelines ASBG 7 *Biological Assets*, agricultural products, including by-products, are recorded at an estimated fair value less sales costs. To this end, it is necessary to know the production quantity and the market price of the respective unit. Both figures are estimates, and their value on the basis of various estimates is inaccurate. By-products may be calculated in terms of the costs involved in obtaining by-products (Musallyamova and Antonova, 2014). According to the

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same authors, accounting and assessment of a by-product becomes important if it is used in the production of biogas. Several variants are offered for the calculation of supplementary products:

- after the deduction of the production costs of by-products from the costs of the dairy herd, the remaining costs of feed stuff exchange energy are divided accordingly: milk 90%, calf births 10% (ASBG 7 (2011), Musallyamova and Antonova, 2014, Product Cost Planning …, 1987). Musallyamova and Antonova (2014) believe it would be more correct to calculate 10% of the feed cost for the value of the births;
- calves are recorded at their actual birth weight and budgeted value for one kilogram of body weight (Musallyamova and Antonova, 2014).

One of the goals of cost management is the providing of necessary information on the cost of cost objects (Karu, 2008). In agriculture, a cost object may be defined as any product for which we wish to measure and calculate costs. Dairy farming activities do not result only in the production of the primary product (milk) but additionally in the production of by-products and supplementary products (e.g. manure, calves). The manner of dividing cost objects involves dividing them between direct costs and indirect costs (Ryzhova et al., 2015; Vooro, 2011). Besides information for the choice of necessary cost objects, it is important to focus on specifying points of consumption, which provides information on which part of a company's structure or process costs arise (Karu, 2008). In addition to accurate cost centre cost accounting, a key issue here is the establishment of necessary overhead rates (distribution bases) for the distribution of overheads to cost objects (Musallyamova and Antonova, 2014). For example, the report of the Ontario Dairy Farm Accounting Project (2015) recommends a detailed breakdown of cost bases for dairy enterprises. In ASBG 4 *Stocks*, clause 10, an overhead distribution method is given which should be described in the company's internal accounting regulations. Such a procedure is suitable for a production company with a determined normal production volume but not for an agricultural producer.

Following the guidelines on the calculation of production cost prices in the 1980s (Product Cost Planning …, 1987), certain costs are excluded, such as:

- costs which derive from state budgetary appropriations;
- losses from natural disasters;
- costs recovered from responsible persons for dying or dead animals;
- interest on short- and long-term bank loans.

In light of the foregoing, government grants to offset the cost of dairy cattle should be calculated to reduce costs. In the opinion of Vooro (2011), costs can be reduced by the amount of the subsidies on the decision of management when calculating production costs, keeping the aim of the subsidies in mind.

Belloin (1988) recommends that profits and losses from cattle sales and deaths be reflected not as reductions in costs but as adjustments of dairy revenues (revenue from sales of milk and manure).

As it is not possible give a reliable estimate on the fair value of biological assets, pursuant to ASBG 7 Biological Assets such assets may be recorded in acquisition cost if (a) the asset has not significantly changed biologically after acquisition; or (b) the effects of the biological change to the cost of the asset are not important. Depreciation is calculated from the acquisition cost of biological assets. Herd depreciation is the spreading out of the cow' acquisition cost over the estimated useful life of the animals (Converting the Farm's …, 2006).

Sustainable Food Trust started a new true cost accounting project in 2013. Smith (2015) argues that parts of the production costs (costs related to the environment, e.g. costs related to the disposal of antibiotic residue introduced into the environment through milk sludge; social costs) are hidden. However, there are also positive effects (e.g. job creation in rural areas, maintenance of agricultural land) that should be taken into account. The project proposes the development of a model that takes into account all the costs related to food production, rendering different systems of food production costs comparable (Smith, 2015).

2. Dairy production cost accounting principles in Estonian dairy companies

In order to study the calculations of unit costs in Estonian dairy companies, five interviews were conducted. Table 1 presents the principles and examples in use for calculating production costs in three Estonian dairy companies.

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Table 1

Details on characteristics of calculation of dairy production costs in three Estonian companies

Item	Company 1	Company 2	Company 3
Costs	Production costs and production overheads	Remunerations, feed, direct expenses, interest from loans and leases for specific purposes, depreciation, real operating costs affecting milk price	Production costs and interest costs
By-products as expense reduction	In final sales price	Value determined by board	Unit price set years ago
Supplementary production as expense reduction	(dairy herd costs – by-product) * 10%	0 value	Budgeted price increase per kilogram
Primary production calculation unit	One ton produced milk	One ton produced milk	One ton sold milk
Economic content upon which calculation is based	Production cost per ton of milk produced	Company's total cost per ton of milk produced	Production and financial cost per ton of milk sold
Term used by enterprise	Production cost of milk	Full production cost of milk production	Production cost of milk output

Source: authors' compilation based on interviews

It is always important to clarify what is understood by the term "production cost," and to differentiate between different production cost levels. Table 1 shows (Company 2, Company 3) that production cost entails indicators from many different economic aspects. The data collected for research show the problems of classifying costs as direct and indirect costs (production overheads) or fixed and variable costs. Proper cost accounting management and division of costs between cost centres, cost objects, and cost types is necessary. The distribution of indirect costs (production overheads) was unclear, with no guidelines in the internal accounting rules for cost allocation. In one company, the allocation of costs between dairy and young cattle, housed in one farm complex, was done according to a decision of the management which had no basis in reason. Recognition of the consumption of milk fed to calves and milk waste (own output) in expenses is unregulated and unclear. The interviews revealed the need for training on the topics of the organization of cost accounting and the calculation of output production unit cost.

When calculating unit production cost, these examples of Estonian practice have taken into account interest costs connected with the financing of the acquired assets for the purpose of milk production. It is the opinion of the authors that interest costs may be taken into account in calculations of the full production unit cost of milk. In the examples given in Table 1, the companies have left unresolved the question of incorporating the gain or loss of biological assets (cows) into the calculations. In one case, the company in question presented costs of environmental charges related to the use of the environment (water abstraction permit fee, pollution charges related to pollution over the established norm) which were taken into account in the calculation of the production costs. The future challenge will be to change the so-called true-cost accounting principles, or the calculation of hidden costs.

In evaluating the value of by-products, differences between the companies became clear: the last market price as well as the estimate values were used. The evaluation of the value of supplementary products, calves, in the calculation of the production cost was also different. The practice whereby the value of the by-product is deducted from the total costs of the dairy herd after a presumed 10% for births may distort the production cost. Since this ratio is assessed on the basis of energy exchange for animal nutrition, the authors believe it may be advantageous to consider the birth value at 10% of the cost of feed. In one company, the calf crop was indeed registered but calves were recorded as having 0 value.

A scheme for the calculation of milk unit production cost introduced by one Estonian dairy farmer is presented in Table 2. Using the calculation scheme set out in the table, it is not the milk production cost that is found but the economic indicator of "adjusted costs per ton of milk sold." The result does not reflect the costs incurred per unit of milk produced. The scheme leaves unanswered the deduction of costs from animal sales

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revenues; distribution of general administrative costs for production is unclear; and although milk fed to calves is indeed taken into account, the value of milk waste is not reflected in the scheme.

Changes in the organization of financial accounting on the basis of international standards have led to the need for other adjustments in costs and improvements in cost accounting, where regulations for this are missing. One solution would require cattle deaths, sales revenue and gains or losses from biological assets (cattle), costs of reevaluation of biological assets, and others to be reflected in the calculations of the production unit costs.

The case study shows that one Estonian company has attempted to implement EBITDA-based calculations, whose outcomes reflect margins (i.e. interest costs, asset depreciation and income tax expenses covering the margins) per ton of milk sold but not the production cost of milk. Calculations are based on a company's residual income-based profit and loss account, taking into account both sales revenues as well as state subsidies and support to offset costs to the producer.

Table 2

Company X milk production cost calculation

Item	Unit	Quantity	EUR
Milk production	Ton	3720	
Milk sales	Ton	3380	
Direct expenses:			
Self-produced fodder	'000 EUR	X	520
Milk for calves	'000 EUR	X	32
Purchased feed	'000 EUR	X	92
Other variable expenses (medicine, performance testing, semen, bedding, services etc.)	'000 EUR	X	80
Total fixed expenses (salaries, fuel, depreciation, equipment maintenance, other)	'000 EUR	X	542
Total direct expenses	'000 EUR	X	1266
Sales revenue, cows	'000 EUR	X	98
Milk production cost = (direct expenses – sales revenue) / quantity of milk sold	EUR/ton	X	345.56
Adjustments:		X	
Losses from sales and deaths of animals	'000 EUR	X	+225
Milk fed to calves	'000 EUR	X	-32
Reevaluation of biological assets	'000 EUR	X	0
Birth and growth	'000 EUR	X	-99
Milk production full cost price = direct expenses – sales revenue +/- adjustments / quantity of milk sold	EUR /ton	X	373.37

Source: authors' compilation based on interview

In one formula, EBITDA-based margins took into account agricultural output (e.g. silage, fodder grain, slurry and dry manure) and accounting and outcome evaluation of biological assets; and in the other formula, these were not included in the calculations.

In calculations of production costs, it is the authors' view that it is expedient not to reduce costs relative to government grants, state subsidies but to compare milk production and cost prices with (1) the sales price, and (2) the sales price and the amount of the grants, subsidies per ton of milk sold.

The collection of the data showed that Estonian self-employed persons who keep their accounts on a cash basis are also interested in milk production cost calculations. Unfortunately, there are no clear and simple methodological recommendations for cash-based accounting for carrying out milk production unit price calculations.

Conclusions, proposals, recommendations

1) It is always important to clarify what's the substance under the term of unit cost and to differentiate between different unit cost levels. If all

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costs are distributed to products, these may then be called full unit cost estimates (calculations) but if only production costs are distributed to cost objects, these may be called product production cost estimates.

2) In practice, many different dairy herd output production unit cost calculation methodologies have become prevalent, and as a result the milk unit production costs calculated by different companies are not comparable. In addition, there is confusion in the terminology, meaning that certain companies calculate milk unit production cost, some milk cost, and some cost price of sold milk or another economic indicator. These figures are not comparable.

3) There is a need to find a solution how to take into account gains or losses of biological assets in cost accounting and in the calculation of unit costs.

4) The authors' suggestions:

- state targeted grants and subsidies should not be included in production unit cost calculations but rather output production costs should be compared with sales revenue and subsidies per unit of product sold;
- there is a need to develop methodological guidelines for the calculation of production costs for milk producers, including self-employed persons, using cash-based accounting;
- financial costs relating to milk production should be taken into account in the calculation of the full unit cost of milk;
- companies' knowledge about dairy cost accounting and the principles of calculation of production unit costs should be improved and the results should be more use in managerial decision-making process.

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