Macedonian dairy farmers and their choice of buyers

-A transaction cost approach

Ana Krstevska

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Val av köpare för mjölkproducenter i Macedonien

- En transaktionskostnadsekonomisk ansats

Која е одлуката на Македонските млекопроизводители во изборот на продажен канал

- Анализа на трошоци на трансакција

Ana Krstevska

Supervisor: Jerker Nilsson
Co-supervisor: Nenad Georgiev

Sveriges lantbruksuniversitet
Institutionen för ekonomi
Box 7013
750 07 UPPSALA

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Abstract

The dairy farming in the Republic of Macedonia operates under high uncertainties, where the not well regulated institutional environment creates unsuccessful governance structures. The study aims to indentify the transaction cost factors and household characteristics that influence the farmers' choice of milk marketing channel. The prime focus is to present a theoretically structured framework of the contractual arrangements between milk producers and dairy processors based on Transaction Costs Economics' predictions.

The empirical approach consists in surveying the farmers from three regions within the country. The collected data is presented by using descriptive statistics, but also by applying complex analytical tools, such as ANOVA, correlation and regression analyses (specifically, the general linear and the logit model). The analysis of the transaction costs in the dairy farming, aided to detect the different factors which influence the farmers' choice between types of dairy. Generally, the entrance costs are high for farmers engaged with large dairy processors. These farmers also face difficulties in negotiation process and enforcement of contracts. Whereby, farmers who have chosen to sell to a small dairy, experience high costs of coordination and maintenance of contracts. The monitoring and control costs are high for all farmers involved in arrangements with either small or large dairy. Nonetheless, the transaction cost levels in both channels differ fairly much regarding the farms' sizes mainly due to the specific investments employed on the farm.

Assessing the milk marketing in this manner is considered to have a good potential for contribution to the process of development of the dairy industry.

Key terms: dairy farming, institutional environment, institutional arrangements, transaction costs, choice of marketing channel.

Sammanfattning

Mejerubranschen i Republiken Makedonien arbetar under stora osäkerheter. De dåligt utvecklade institutionella strukturerna gör det svårt att styra verksamheterna i mejeirbranschen. Denna studie syftar till att identifiera hur mjölkböndernas transaktionskostnader och hur deras egenskaper påverkar deras val av avsättningskanal för sin mjölk. Fokus ligger på att presentera en transaktionskostnadsteoretisk föreställningsram avseende kontraktsförhållandena mellan mjölkbönderna och mejeriföretagen.

Den empiriska basen för studien består av en undersökning bland mjölkbönder i tre regioner av Makedonien. De insamlade data redovisas med hjälp av deskriptiv statistik med också genom komplexa analytiska redskap såsom ANOVA, korrelationer och regressionsanalyser (särskilt generell lineär och logitmodellen).

En analys genomförs av mjölkböndernas transaktionskostnader, som påverkar böndernas val mellan olika slags mejerier. Överlag har bönder, som levererar till stora mejerier, höga inträdeskostnader. Dessa bönder har också svårigheter vid förhandlingar samt vid samordningen med mejeriet och vid efterföljandet av kontrakten. Styrnings- och kontrollkostnaderna är högre för bönder, som säljer till antingen de största eller de minsta mejerierna. Transaktionskostnaderna vid försäljning till såväl stora som små mejerier skiljer sig tämligen mycket mellan stora och små bönder, eftersom dessa har olika mycket av transaktionsspecifika investeringar på sina gårdar.

En utvärdering av mjölkmarknaden enligt den här använda teorin måste anses ha en god potential för att stödja utvecklingen av mejeribranschen.

Nyckelord: mjölkproduktion, institutionell miljö, transaktionskostnadsekonomi, val av marknadskanal

Апстракт

Примарното производство на млеко во Република Македонија е соочено со голема неизвесност поради не регулираната институционална средина која придонесува неуспешно уредување на продажните канали. Поради тоа, оваа студија е наменета да ги идентификува факторите кои влијаат на нивото на трошоците на трансакција, како и карактеристиките на домаќинствата, кои заедно влијаат врз изборот на фармерот за продажен канал. Главниот интерес е насочен кон презентирање на начинот на договор помеѓу фармерите и преработувачите во теоретски структуирана рамка користејќи ги предлозите на теоријата за трошоци на трансакција.

Емпириските метод се состои во анкетирање на фармерите од три региони во земјата. Собраните податоци се презентирани со употреба на дескриптивни статистички методи, како и со аплицирање на комплексни аналитички средства, како ANOVA, корелација и регресија (поточно, линеарна регресија и logit моделот). Со анализа на трошоците на трансакција во млекопроизводството детектирани се разни фактори кои влијаат во изборот на фармерот на кој тип на млекара да го продава произведеното млеко. Генерално, влезните трошоци се високи за фармерите кои соработуваат со големите преработувачки капацитети. Овие фармери исто така се соочени со неприлики во процесот на преговарање и стапување на договорот. Додека, фармерите кои се одлучиле да продаваат на малите млекари, се соочуваат со високи трошоци за координација, како и за одржување на договорот. Трошоците за мониторинг и контрола се подеднакво високи за сите фармери, независно од типот на купувачот. Но, треба да се земе во предвид дека нивото на трошоците на трансакција е силно зависно од големината на фармата како последица од специфичноста на инвестициите расположливи на одредена фарма.

Проценувањето на маркетингот на млекото на ваков начин се смета дека има добар потенцијал за придонес во процесот на развој на млечната индустрија.

Клучни термини: Примарно производство на млеко, институционална средина и уредување, трошоци на трансакција, избор на маркетинг канали

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1 Introduction

'Market oriented dairy is considered to have a good potential for contribution to the process of economic development, through increased domestic production of dairy products to meet increased demand and reduce dependence on imports, and through increased employment, income generation and food security among the rural population. Realization of this potential will require an adequate understanding of the history and processes of dairy development in the country, as well as identification of facilitating factors where development occurred and constraints or inhibiting factors where it did not occur or occurred inadequately, ...' (www, FAO, 2007).

1.1 Problem background

The Macedonian dairy farming, as the rest of the holdings, went through dramatic structural changes during the economic transition period, started with gaining the country's independency since 1991 (Agriculture Sector Study, 1999). Even after the commencement of the independency, the agricultural sector remains characterised by missing and incomplete markets (www, World Bank, 2007). The brake-up of the former Federation and the ensuing regional conflicts meant a loss of a large and protected traditional market (DG-Agri, 2006), so farmers were left vulnerable to the competition. The privatisation of agricultural cooperatives and the withdrawal of the state organisation of the agriculture therefore led to disruption of many marketing channels (www, FAO, 2007), so the producers had very little exposure to outside markets and limited contacts in potentially interesting markets (Agriculture Sector Study, 1999). However, the situation is so far improving, with an abrupt halt in 2001 because of the ethnical conflict within the country, but henceforward 2002 the country has made considerable progress (www, World Bank, 2007).

The dairy sub-sector, nowadays, is embodied by a large number of small, subsistence oriented farm households and a decreasing number of large, specialised dairy enterprises that originate from the former socially owned large-scale agricultural enterprises, so-called agro-combinats[1] (MAASP, 2006). The conditions for milk production are improving, but still are not at a satisfactory level. Even though many new dairies have been incepted and new relationships between farmers and processors were developed to organise the milk supply, the weaknesses in marketing links between them, moreover the not well developed market intermediaries (Agriculture Sector Study, 1999), are still considered as major constraints to dairy farming development in the country.

Furthermore, dairy farming has a number of specific features which distinguish it from others agricultural farming, thus there are particular implications for marketing. First, milk is highly perishable product and produced daily, consequently transportation costs are high (www, FAO, 2007). The marketing aspects for this commodity require organisational and technical

[1] Agro-combinats operated during the period before the independence of the country. They were large farms in public ownership, who managed 20% of the total agricultural land, being in property of the state. These were given a massive budgetary support and were seen as pillars of agriculture development. Agro-combinats operated in different segments of the primary production, such as having a role in agriculture inputs supply, possessing and managing specific machinery for the production itself, and also were purchasers of agricultural production as well. Particularly, they had high accumulation of assets and power (The European Commission's Delegation to the Former Yugoslav Republic of Macedonia, 3/353, 2005).

skills and an understanding of quality and safety issues. The quality of milk depends on farm management practices which are not fully developed among the Macedonian farmers.

Second, milk can be used to make a wide range of high quality and nutritious products which requires enhancing the quality of the raw milk. Third, the vast majority of the dairy farmers are smallholders who produce milk as a regular cash income (EU Framework Contract, 2006).

The preceding arguments are closely related to the understanding of the importance of dairy marketing in the country. Hence, it is important to analyse the transaction costs derived when supplying raw milk so as to explain their importance for the farmers' choice of marketing channel.

1.2 Problem formulation

An inadequate infrastructure as regards the fragmented production units and inefficient marketing at farm are disadvantages for the Macedonian dairy farmers that lead to increased transaction costs and create an organizational failure. For many dairy farmers, the costs of carrying out the exchange of input or/and output are high and the market performance is poor. The poorly structured dairy farming causes high costs for milk collection and bad raw milk quality. The bad quality hinders processors to develop new, modern and highly profitable products. Consequently, dairies' demand for good-quality input is not fully satisfied so they behave opportunistically by paying low prices to farmers. The costly contract enforcement through court is another cause for opportunistic behaviour by dairies contributing for delays in payments to farmers and low prices. Due to lack of communication and inequitable payment, the amount of trust is limited.

Faced with high uncertainty in markets, dairy farmers make resource allocation and production decisions which often result in low risk investments. In so doing, low specific investments are made in regard to physical assets, such as low-productive cows, milking machinery and cooling equipment, as well as low investment in human resources which results in inadequate hygienic, management and marketing knowledge.

Furthermore, market supporting institutions for disseminating market information, enforcing contracts and providing services are not yet performing well. Hence, the costs of searching trading partners and enforcing agreements are high. As a result, informal contracting is quite present so costs of switching to new contractors are low and thereby, the dependence of certain market participants, vertically as well as horizontally, is also low.

1.3 Research purposes

The study aims to provide insights into the characteristics of the dairy farming in the Republic of Macedonia, as well as the farmers' choices of marketing channel when selling their output. To accomplish the prime purposes, it is essential to examine *how the transaction costs affect the performance of the dairy farms* in the country and *how these costs influence the choice between alternative buyers*. By better understanding of these costs and identifying the ways of reducing their impact on the production and trade of farm output, the marketing performance of the dairy farm may be enhanced.

Based on the preceding, the following questions are composed to lead the research.

- *How is the dairy farming characterised?* (Size, structure and organisation of the dairy farms; products marketed; physical environment within the marketing, *etc.*).
- *How do the transaction costs affect the marketing performance of a dairy farm?*
- *What is the farmers' choice of buyers?*

The answers to these questions provide an analytical framework of the Macedonian dairy farming and dairy marketing so to comprehend what type of farm organisation could serve better for a dairy husbandry development in the country, and therefore, milk producers to choose the right contractual arrangement with the other involved party in the exchange process.

1.4 Demarcations

The study emphasises the attention onto *dairy cattle farming*, on both small and large-scale farms, and moreover, on the *transactional relations* between milk producers and dairy processors. However, interviews with representatives of the dairies were not conducted. The empirical data was not obtained from a random statistical sample, but the sample is one of convenience, still the findings have confirmed an expedient homogeneity for further statistical processing. A questionnaire for the empirical study was composed in order to give answers to the aim for the year 2007. However, since farmers have not implemented a farm accounting system yet, the answers covered past experiences as well, despite the targeted year.

The empirical data was collected from three important regions, which are important as concerns production of raw milk: *Pelagonia, Skopje and the Northeastern region.* But, the survey didn't cover the whole area of the research regions (see Table 5, Chapter 5).

Taken the Institutional economics as theoretical approach, the study focuses on Transaction Cost Economics, TCE. For that reason, all the questions were posed in order to give the dairy farm a theoretical framework, compounding factors that have an influence on the size of transaction costs, and therefore on the farmers' choices of buyers. Other factors, which affect the farmers' choice of buyer, such as cultural, traditional and social dimensions, were not considered in the analysis. The traditional factors, however, were attached with regard to the farmers' experience.

A few current and real surroundings in the country constrained the study development while explaining the reality in theoretical terms. These are results of the partial closure of the transition process in the country, still waiting for various features in different branches of the country's system to be implemented. One of them is the farm accounting implementation, which is a part of the wide issues in the agriculture that have to be performed. Another issue that constrains this research was that all the visited farms were not registered. Moving further for one node in the dairy chain, there were other inconveniences. As regards the institutional arrangements between farmers and processors, crucial problem for the analysis of the results was that the contractual arrangement between them was not operating under jurisdiction, so conclusions were hardly developed. The transaction cost theory, however, has given an apparent perception of those.

These constraints limit the validity of the data, therefore some results and discussions might require careful consideration. However, with all available tools, although in lack, decent conclusions were drawn conceptualising the reality as it is.

1.5 Structure of the study

The outline, illustrated in Figure 1, provides an outlook of the study. *Chapter 1* sets out the problem area which leads to formulation of the problem and the aim. The main characteristics are delineated. *Chapter 2* provides an insight into the characteristics of the Macedonian dairy cattle farming and processing industry. It is based on secondary data sources. *Chapter 3* comprises an account of theories which are used as analytical tools when the empirical data are analysed. *Chapter 4* describes the research methods used for collection of the data, conducting the survey and processing the obtained data. The empirical findings are presented in *Chapter 5*. This is altogether being analysed and discussed in *Chapter 6*, where after, in *Chapter 7* conclusions are drawn in regard to fulfill the aim.

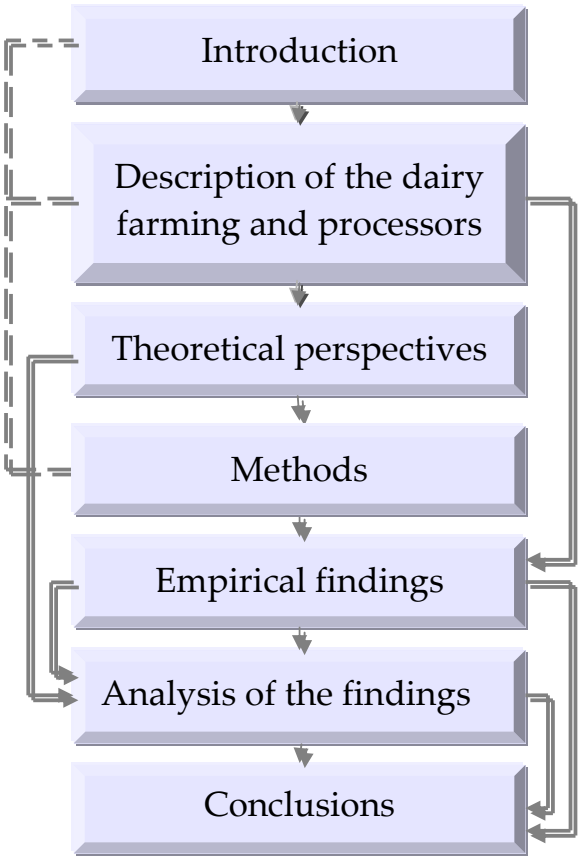


Figure 1 Illustration of the outline of the study

2 The dairy farming and the dairy processing industry

Since the fulfillment of the aim require a sufficient understanding of the history and processes of the dairy development in the country, and detection of the factors that influenced the transition of the dairy industry, it is necessary to capture some aspects of the dairy farming and the dairy processing industry.

2.1 Dairy cattle farming

2.1.1 Production of milk and cattle breed structure

Until 50 years ago in the Republic of Macedonia cattle was used for many purposes, but mainly as a working force in the agricultural production, as well as for production of milk and meat. During those years, dairy cattle was low productive. The most widespread breed was Busa up to the Second World War. Dairy farms in the country were created after the war and were equipped with appropriate mechanisation employed in the production process. Henceforth, farm production was developed including high productive cow breeds. Subsequently, the dairy industry started to develop causing an increase in the number of the employed people in the industry. As a result, a market for dairy products was created (Trajkovski & Bunevski, 2006).

Today, the composition of cattle breeds differ from the one in the past years. With well-developed selection and good production conditions, high-productive dairy cows were included in the production process (Trajkovski & Bunevski, 2006). However, productivity per cow is still low, especially at the family farms, and still cannot achieve the level of milk productivity that developed countries are attaining. Dairy production, nonetheless, is of great importance of the country's agriculture economy, because the local market for dairy products has a tendency to grow simultaneously with the increase of the payment abilities of the people and as regards the traditional habits of the Macedonian consumers to include dairy products in their diet (EU Framework Contract, 2006).

The dairy cattle in Republic of Macedonia comprise three breed categories (Trajkovski & Bunevski, 2006, 86; Annual Agricultural Report, 2006):

- Breeds with *emphasised milk production*, as black-white cattle, where Holstein-Friesian and Holland-Friesian are the most disposed;
- Breeds with *emphasised production of milk fat* (4.3 – 6%), as Jersey, Guernsey, Ayrshire, *etc.*
- Breeds with *average production of milk and milk fat* (Jaroslavka, etc).

However, mainly cross-breeds are bred. Pure breeds are very rare in the herds.

2.1.2 Structure of dairy farm households

The dairy milk production system differs on the degree of specialization on the farm. The average size of a farm is small and the milk productivity per cow is low (2,362 litres) (Annual Agricultural Report, 2006). A distinction between farmers is made according to the number of

cows and the intensity of the milk production (Trajkovski & Bunevski, 2006, 17; Annual Agricultural Report, 2006), so the categorisation falls into three groups (see Table 1):

- *Traditional cattle breeders of low productive cows and low input.* They usually own one or two dairy cows that produce 2,000 – 2,500 kg of milk annually.
- *Family farms* that own 10 – 15 cows and have production of 4,000 – 5,000 kg per year. The cows are of dual-purpose (milk and meat) breed, so the farmers receive income from several sources.
- *Specialised dairy farms* who poses larger herds (over 50 cows). The yearly productivity per cow is 7,000 – 8,000 kg of milk. The number of this type of farms is very small.

Milking cows in the country number around 90,000, accordingly, on average three cows per farmer (Trajkovski & Bunevski, 2006). In 2005, 91% of the cattle farms numbered less than 10 cattle, 6% less than 20, 2% less than 50, and only 1% of the farms had more than 50 cattle in the herd (Annual Agricultural Report, 2006). Today, as presented in Table 1, around 90% of the dairy cattle are reared on private farms in herds of one to five cows, with the consequence that the dairy cattle farming has its roots in the former private sector (MAFWE, 2006).

Table 1 Cattle farm structure

Farm category	Number of farms	% of farms	Number of cattle	% of cattle
1 – 5	42,098	86.4	100,521	54.0
6 – 10	4,669	9.6	34,367	18.5
11 – 30	1,634	3.4	27,163	14.6
> 30	340	0.6	23,956	12.9
Total	48,741	100	186,007	100

Source: Brandt, 2006, 40

In the period from 1999 to 2004 the total production of milk is 204,399 tonnes (SSO, 1999 – 2004) (see Table 2), but in 2006, there is a dramatic decline of the milk production to 93,984 tonnes (Annual Agricultural Report, 2006).

Table 2 Numbers of milking cow and production of milk in RM

	Year					
	1999	2000	2001	2002	2003	2004
Number of dairy cattle	94,056	94,001	95,851	94,762	89,501	90,135
Total production, 000 litres	202,387	220,244	200,904	198,431	191,533	212,898
Milk yield per cow, litres	2,152	2,343	2,096	2,094	2140	2,362
Production in agricultural enterprises, 000 litres	23,097	23,153	21,434	20,713	19,314	19,301
Milk yield per cow in agricultural enterprises, litres	2,618	4,855	4,622	4,833	4,,960	4,627

Source: SSO, Yearbook, 1999, 357; 200, 245; 2001, 429; 2002, 403; 2003, 396 & 2004, 406

One of the main constraints in the milk production is the expensive feed, generally imported if not produced by the farmer (NARDS 2007 – 2013, 2006). The bought feed is, however, more expensive than the feed produced at farm. The high expenditure is not the only drawback, as there are also poor feed management practices (Brandt, 2006).

2.1.3 Geographical distribution of dairy cattle farms and dairies

Dairy farms are spread all over the country except in the high mountainous regions where the costs of milk collection would be very high (EU Framework Contract, 2006) (See Figure 2). The major cow milk production areas are found around the perimeter of the northern, western and eastern boundaries of the country (www, FAO, 2007) near the cities in which neighbourhood are located focal dairy plants (Veterinary Department of the MAFWE, 2006). These production areas surround the field crop growing regions, which encourage interaction and use of arable by-products (www, FAO, 2007). In order of importance, the main raw milk production areas are the Pelagonia region in the south, Polog region in the north-west and the Northeastern region in the country (Invest Macedonia, 2007).

Figure 2 Distribution of cows and processing plants throughout the Republic of Macedonia
Source: Brandt, 2006, 29 & 42 - modified

2.2 Dairy processing industry

The production of milk and dairy products is one of the most developed agricultural sub-sectors in the country. Following independence in 1991, a significant decline of the large state-owned processing factories resulted in a rapidly growing food processing industry (DG-Agri, 2006). Over the past five years, the dairy processing industry went through substantial modernization and even the small and the medium sized dairy plants operate with good equipment and have developed a competitive product line (Invest Macedonia, 2007). Nevertheless, the dairies on average use only 50% of their total capacity (Annual Agricultural Report, 2006).

Today, there are 71 registered dairy plants in the country, though the total number is estimated to be between 50 and 120. Seven dairies export in the neighbouring countries, but just two of them have an EU export licence (Annual Agricultural Report, 2006; Swedmilk, 2007).

The dairies are divided into (EU Framework Contract, 2006):

- *Professional* (mostly medium sized, growing dairies, and large dairies) and
- *Semi-professional* (mostly small sized (*mini*) dairies that process 500 – 5,000 litres per day).

Nowadays, in the country is processed around 200 tonnes of cow milk per day. The largest two dairies amounting with 39.4% of the total market share (EU Framework Contract, 2006). From December 1, 2007 a new large dairy 'Swedmilk' started to operate, so the market share composition is expected to be changed.

The larger dairy plants operate simple laboratories to check the fat, protein and dry substance content. There are two independent laboratories (Survey data, 2007), and since the end of 2007 one more was incepted which is managed by the Swedmilk dairy and operates only for its purposes (Swedmilk, Macedonia, 2007).

In Macedonia, there is a regulation on a raw milk payment system (see Table 3), but the mini dairies have no laboratory facilities, and pay a flat rate to the raw milk producers.

Table 3 Raw milk price according to the bacteria content

Bacteria per ml raw milk	Change of raw milk price
< 100,000	+ 12%
100,000 – 500,000	+ 8%
500.000 – 2.500.000	Basis price
> 2,500,000	- 20%

Source: EU Framework Contract, 2006, 44

The large-scale dairy processors typically produce consumption milk (pasteurised and UHT) and traditional dairy products, such as yoghurt, sour milk, yellow cheese (kashkaval), white cheese, quark (urda), etc (Agriculture Sector Study, 1999). The small dairies tend to focus on yoghurt production. Neither of them has developed highly profitable dairy products, such as Gouda, Edamer, Camembert, sweet fruit yoghurt, etc (EU Framework Contract, 2006).

3 Theoretical perspectives

Milk production and marketing are costly ventures in an environment in which the firms face high transaction costs. The analysis of these costs could explain the institutional arrangement within which marketing of raw milk takes place and could serve as a commencement for potential development. In this study, the farm is viewed as a governance structure (as opposed to a production function) which is a Transaction Cost Economics, TCE, approach. Therefore, follows a review of literature regarding transaction costs theory, and in addition the agency theory, both giving a conceptual framework of the current eventualities that dairy farmers face during the sale.

3.1 Major concepts of Transaction Costs Economics

3.1.1. The development of Transaction Cost Economics

Commons (1934, 55) introduced the concept of transaction and considered it as fundamental unit of analysis. The concept *transaction* indicated that the exchange of ownership rights is a good approach instead of looking at it as the exchange of physical commodities (Commons, 1934). Accordingly, the basic assertion of TCE is that the costs of doing transactions could be too high under certain conditions, so organising economic transaction into a particular governance structure (farm specific related) could result in better marketing performance.

Williamson (1985, 1) described transaction differently: *'when a good or service is transferred across a technologically separable interface'*, focusing more on the exchange of physical goods and services and giving priority to corporeal form of property (Kaufman, 2003).

Coase (1937) identified that the existence of the firm is due to transaction costs. The market exchange is not costless, so the cost of a transaction has an important role on the organisation of firms and contracts. In addition, he described that the presence of transaction costs is associated with *information, negotiation, monitoring, coordination, and enforcement of contracts*, therefore firms emerge to economise on such costs. Information costs arise *ex ante* of exchange. Negotiation costs are the costs of physically carrying out the transaction, while monitoring costs occur *ex post* of the exchange and also include the costs of ensuring that the terms of the transaction are adhered to by the others parties involved in the exchange.

Williamson provides a cautiously crafted perspective on the nature of governance structures that can exist between organisations under various exogenous conditions. Williamson (2000) makes a distinction between institutional environment and institutional arrangement. Hence, he developed four levels of social analysis, where the transaction costs are framed with levels 2 and 3. The institutional environment, also referred to as the rule of the game (Williamson, 2000, 597), embraces formal rules such as laws, governmental regulations, court decisions, etc; and informal rules, for instance standard operating procedures, ideology, customs, etc (Schmid, 2004, 1-2). Institutional arrangements are supposed to economise on the transaction costs in a certain institutional environment. Williamson (2000) has described them as a play of the game as regards contracts. Williamson (1985) emphasises the importance of transaction costs in determining the governance of the firm by reference to key concepts of the behavioural assumptions and transaction dimensions.

3.1.2 Key behavioural assumptions of the Transaction Cost Theory

It is assumed that *bounded rationality* and *opportunism* characterise TCE. Bounded rationality indicates the cognitive limits of individuals. Even though human actors want to act rationally, they are limited in their ability to receive information to foresee all possible outcomes in a transaction relation or to formulate responses to all future eventualities. TCE observes limited rationality as a problem under conditions of uncertainty. This human specificity makes it difficult to fully specify the conditions surrounding an exchange and therefore gives rise to transaction costs (Williamson, 1975). Also, *'given cognitive limits, the complex contracts are unavoidably incomplete'* (Williamson, 2000, 601). Williamson also explains that contractual incompleteness creates added problems if combined with the condition of opportunism.

Opportunism specifies that individuals are guided by self-interest with guile, so they may sometimes behave in order to deceive the other party in the exchange process. TCE views opportunism as a threat which gives rise to transaction costs in the form of monitoring behaviour, safeguarding assets, and making sure that the other party does not engage in opportunistic behaviour (Williamson, 1975).

3.1.3 Key transaction attributes

According to the transaction cost theory (Williamson, 1985), transactions have three attributes: *the frequency* with which they occur; *the uncertainty* to which they are subject, and the degree of *asset specificity*. These variables determine whether transaction costs will be lowest in a market or in a hierarchy.

Transactions can be frequent or rare. If transaction has low frequency, the cost of carrying out the transaction will be too expensive to be protected, and vice versa. Frequency of the transaction, however, is the most easily to deal with, but it still has a strong effect on transaction costs. Regarding the frequency of the transaction together with the investment characteristics, the effective governance structure may be chosen (Williamson, 1985) with a right contractual agreement. A diagrammatic representation is illustrated in Figure 3.

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Investment characteristics</th></tr>
<tr><th>Nonspecific</th><th>Mixed</th><th>Idiosyncratic</th></tr>
<tr><td rowspan="2">Frequency</td><td>Occasional</td><td rowspan="2">Market governance</td><td colspan="2">Trilateral governance</td></tr>
<tr><td>Recurrent</td><td>Bilateral governance</td><td>Unified governance</td></tr>
</table>

Figure 3 Effective governance structures
Source: Williamson, 1985, 79

Uncertainty emerges from the unexpected changes in the circumstances which surround the transaction. Uncertainty can be founded by environmental and behavioural factors. The environmental uncertainty refers to the unpredictability of the environment, technology, and demand volume and variety (Grover & Malhotra, 2003). The behavioural uncertainty arises

because of the bounded rationality of human actors. It also includes information asymmetry problems, and it is affected by the opportunistic behaviour of individuals, as well.

Asset specificity is identified to have the supreme impact on transaction costs with regards to institutional arrangements (Williamson, 1996), that is why it is perhaps the most important element in Williamson's theory. Asset specificity refers to the transferability of assets that support a given transaction, or in other words, it refers to the degree to which an asset can be redeployed to alternative uses or by alternative users without losing value. Ollila & Nilsson (1997) explained: *'by transaction specific assets is meant such assets/investments whose value in every other purpose than in their intended use is much lower'*. Highly asset-specific investments represent costs that have little or no value outside the exchange relation (Grover & Malhotra, 2003).

The specificity of assets is assessed in terms of their: physical location *(site specific assets)*; physical value *(physical specific investments)*, such as infrastructure and facilitates, qualified labour *(specific human assets)*; and other specific investments typical for the production itself *(dedicated assets)* (Williamson, 1985).

3.2 Measuring transaction costs

Transaction costs have to be assessed in order to be reduced since good economic performance depends on low transaction costs (Benham & Benham, 2004). Measuring the absolute level of transaction costs is very difficult. Masten *et al.* (1991, 17) argue: *'Because of difficulties in observing and measuring transaction costs, analysts have had to rely on estimations of reduced-form relationships between observed characteristics and organisational forms'*.

As mentioned above, transaction costs are associated with *information, negotiation, monitoring, coordination,* and *enforcement of contracts.* Each transaction is treated by human and environmental factors. Williamson (1975), in addition, relates the occurrence of transaction costs to observable attributes of transactions. These core variables of TCE, herein, serve as theoretical tools. Thus, transaction costs can be presented as a function of the main attributes of the transaction, as follows:

$TC_i = f\ (F, U, AS)$, where

TC	transaction costs;
F	frequency;
U	uncertainty, and
AS	asset specificity.

These variables combined with the human factors, such as bounded rationality and opportunism, affect to transaction cost height. Grover & Malhotra (2003, 458), based on the Williamson's theory of TCE, stated three propositions of how the environmental and human factors influence the level of transaction costs:

Proposition 1 *Bounded rationality and opportunism give rise to transaction costs.*

Proposition 2 *Transaction costs are higher under conditions of high asset specificity and high uncertainty.*

Proposition 3 *The most efficient governance mechanism (markets or hierarchy) needs to be chosen to organise economic activity. In general, lower transaction costs favour markets, while higher transaction costs favour hierarchies.*

Many empirical researchers have attempted to analyse and test the predictions of the Williamson's TCE framework, but only few quantitative techniques have been developed for empirical study. Carter & Hodgson (2006) made a selection of studies that use the foregoing framework and evaluated criteria of how consistent they are with the Williamson's theory. According to their classification, this empirical research would be categorised as partly consistent, clarified as (Carter & Hodgson, 2006, 467): *'A study is classified as being partly consistent with Williamson's analysis where it tests only a part of his complete framework, has some dimensional results that are consistent, and no dimensional result that is inconsistent, with Williamson's predictions'*.

Among the other practices, TCE can be applied to the process of choosing between marketing channels. According to the TCE framework, the choice of buyers is decided via minimisation of the costs associated with the transaction occurrence, when given the transaction dimensions and the institutional environment. According to Boger *at al.* (2001), the choice of marketing channel is determined not only by the transaction cost level, but from the differences in prices between marketing nodes, socioeconomic characteristics, and transportation costs. Therefore, the function is composed as follows:

$M_i = f\ (TC, P, FC, TR)$, where

M_i	Choice of marketing channel;
TC	Transaction costs;
P	Farm-gate prices;
FC	Farm socioeconomic characteristics, and
TR	Transportation costs.

Additionally, regarding the TCE, an important issue in the choice of buyers is the institutional arrangement between suppliers and buyers, particularly the contract arrangement. In this manner, the key aspects of agency theory should be outlined.

Agency theory primarily examines the incentives, moreover, the way a principal can induce an agent to behave according to his interest. Although the relationships between suppliers and buyers are identified by contracts, it may be difficult for the involved parties to prevent one another from opportunistic behaviour, since contracts are imperfect due to bounded rationality of human actors (Nilsson, 2001). The theory argues that under conditions of incomplete information and uncertainty, the agency problems arise (Eisenhart, 1989).

3.3 Theoretical enclosure of the problem

> *'Markets and hierarchies approach attempts to identify a set of environmental factors which together with a related set of human factors explain the circumstances under which complex contingent claims contracts will be costly to write, execute and enforce'* (Williamson, 1975, 9).

All the issues formulating the problem (Chapter 1) suggest the organizational failure framework described by Williamson (1975, 40). Enclosing the problem in such a theoretical framework may help to better understand it (Figure 4).

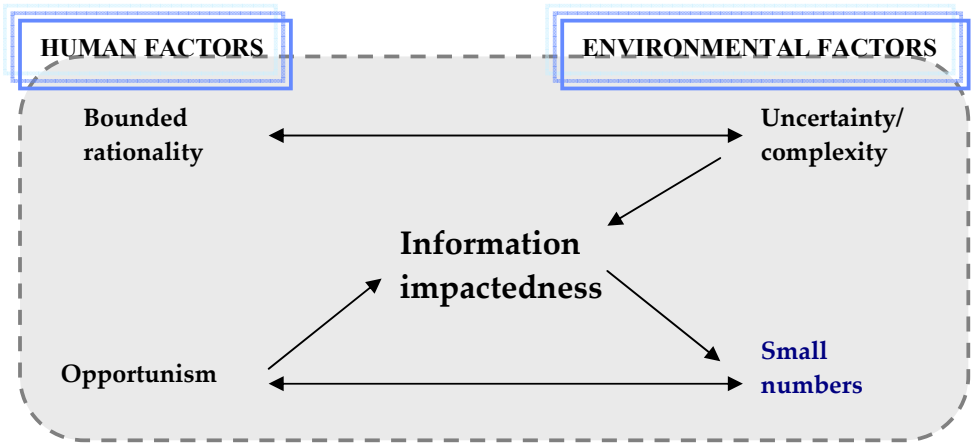


Figure 4 Organizational failures framework
Source: Williamson, 1975, 40

Figure 4 shows the main factors that cause organisational failure and their mutual dependence. In this manner, Williamson (1975) grouped these factors; bounded rationality of humans is interdependent with the uncertainty involved, whereas opportunistic behaviour of people is interlinked with the small numbers[2] relation during the exchange. Due to uncertainty and opportunism information asymmetry is derived, which in turn gives rise to small-numbers result. The core variables of the transaction cost theory, mentioned in Figure 1, serve as the theoretical tools of this study.

3.4 Outline of the theoretical model

The theoretical account is outlined with regard to depict and evaluate the problem. The deduction of the problem in such a theoretical framework, as presented in Figure 5, provides a presentation of the link between theory and problem. This figure serves as guidance for implementation of statistical models, which are used to test the influence of each variable to farmers' decision about the type of buyer.

[2] Small numbers are referring to the occasional frequency of transactions (not frequent transactions).

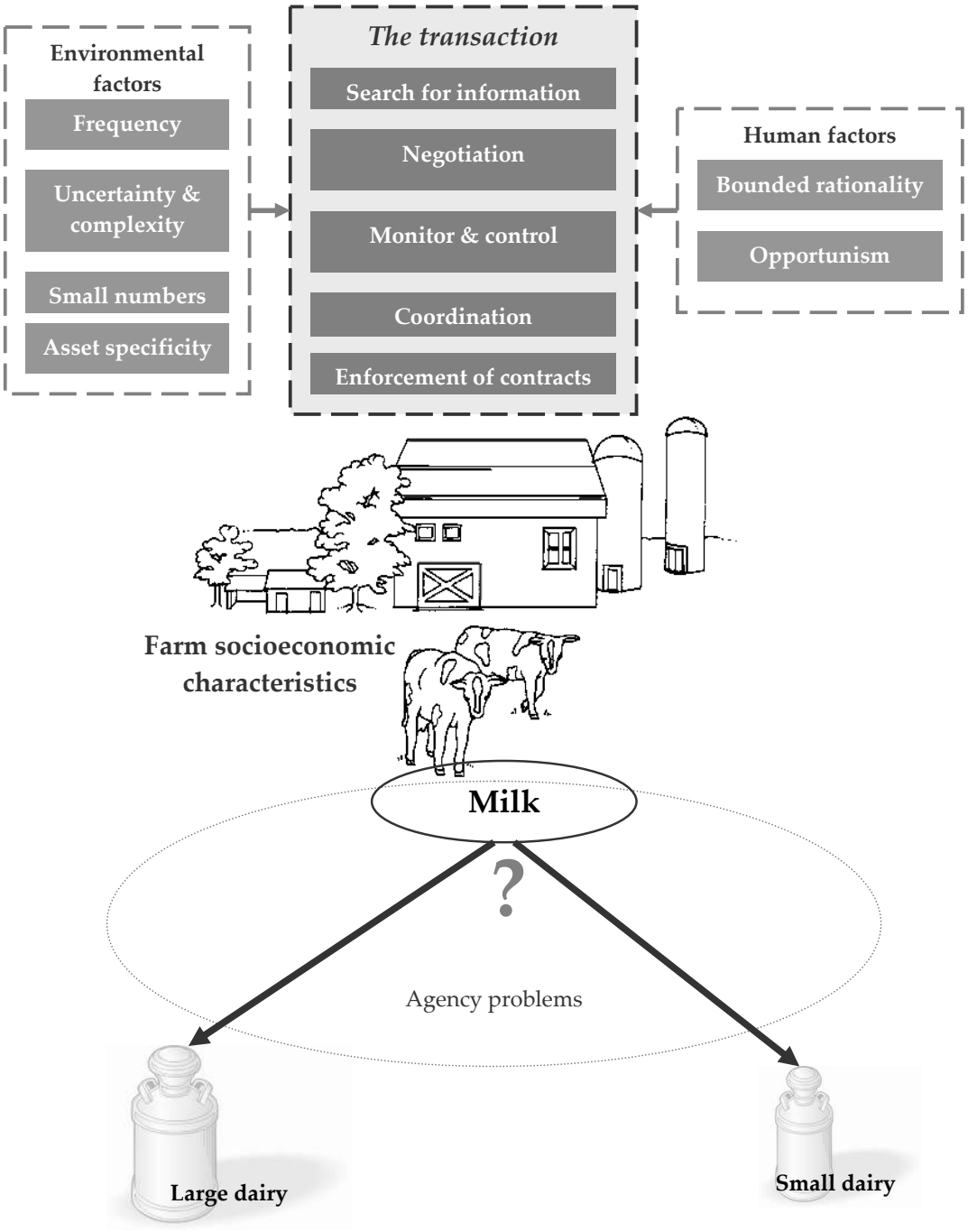


Figure 5 A framework of the theoretical approach

4 Method

This chapter comprises an account of methods used along the study, starting with explaining the methods of data collection, and continued presenting the questionnaire compilation. The description of the sampling approach is given, as well. At last, the statistical models that were used for the data processing are outlined.

4.1 Methods of collecting data

The primary data was collected by using a formal survey. The survey was conducted among small and large-scale dairy farmers in three regions within the country: *Pelagonia, Northeastern* and *Skopje region*. The farm visits were carried out during the period from September until November in 2007.

Supplementary discussions were accomplished with governmental representatives and experts in the field. A single survey format was not appropriate and adequate for all types of respondents, so separate questions were developed. All the information collected is relevant and useful in answering specific question regarding the aim of the study.

An interview with the dairy processors was not carried out, because the study is demarcated on raw milk producers (dairy farmers). But to comprehend the real marketing surroundings in the dairy sub-sector, it is appropriate to present the key indications of the dairies in the country (see Appendix 1 and 2).

4.2 Questionnaire design

For the field data collection, a questionnaire was composed in order to gather information for the study. The questionnaire consists of four parts: (1) general information of the respondents and households, (2) farm characteristics, (3) farm inputs and output and (4) collaboration. Each part provides explanations of dairy farming and marketing of raw milk in the country.

Both closed-ended and open-ended types of questions were used during the empirical study. Regarding the descriptive basis of the study, where the qualitative data was translated into quantitative for statistical analysis, closed-ended questions was mainly used. These are questions where the respondent is given a range of answers and has to make a choice of one or more (Schwab, 2006).

Principally, respondents were asked questions with a definite range of answers, from which to make a choice (*multiple choice questions*), because they give a clear answer, therefore the data was easy to be summarised (Creswell, 2002). These questions were mainly asked for finding out the marketing channels that farmers were using, and as well for respondents' identification. *Dichotomous questions* ('yes/no' questions) were composed, mainly to fulfill the preceding issues.

The respondents were asked to express their degree of agreement/disagreement on different statements using Likert scales (Kane & Trochim, 2006; Schwab, 2006). Principally, these questions were asked to obtain opinions about farmers enforcing contracts and negotiating

with the buyers of raw milk. Rating scale method was slightly used in order to provide a clear description of dairy cattle farm specific assets.

Additionally, farmers were posed completely unstructured questions, so were allowed to answer in their own words with a purpose to acquire more detailed information, especially regarding their opinion and view on a particular subject. This kind of questioning freed farmers to talk about the problems they face during the production and the marketing of their output.

4.3 Sampling approach

The sample of respondents is a homogeneous population (Creswell, 2002) in the sense that the units of the analysis are the Macedonian farmers who produce milk. The sample size between the units differs, including both small and large cattle holders. The defined survey units were geographically demarcated, thereby three study locations were chosen and therein, 30 dairy cattle farmers were interviewed. Although, a random sampling procedure was desired, the farmers were not randomly selected from a statistical database, but were chosen by the people employed in governmental and non-governmental organisations for agricultural development in the country. These persons have helped to conduct the survey. This approach was used since most of the farmers are not yet registered, so there was no statistical database available. Even though, the nature of the sample is not random, the interviewees provided lucid answers on the aim of the study that hold the descriptive values that are interesting from a research point of view. A summation of the method used along the research is offered in Table 4.

Table 4 Research methods used

Study location and period	Survey units and number of interviewed	Sampling approach	Source of sampling frame	Number of visits	Markets involved	Results/outputs
Bitola, Kumanovo and Skopje 09 – 11/2007	*Cow milk producers (30)*	*Not random sample*	*Exploratory survey*	*1 visit per farm*	*Informal*	*Characterisation of dairy cattle farming* *Marketing channels used*

Source: Survey data, 2007

4.4 Data analysis approach

The findings obtained through the research were summarised as a statistical outline by applying *pivot tables*. These were convenient and useful in creating cross tabulations of the data variability. The basic characteristics of the tabulated data were described using *descriptive statistics*, such as percentage, mean, mode, median and standard deviation.

The summarised data was graphically presented using charts as appropriate objects for the analysis. The use of the *box plots* (also called box-and-whisker plots) was in addition to assess and compare the sample distributions, by depicting their median location and the interquartile

range. Furthermore, the *individual value plot* presentation of the results was used, illustrating all the answers individually in a graph. For the same purpose *histograms* were constructed. *Dot plots* were also used to assess and compare distributions by plotting the values along the number line. And at last, *scatter plots* were used to compare the relationship between two variables by plotting one against the other.

To give an explanation of particular data the correlation coefficient (ρ) is used, defined as follows:

$$\rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

The covariance relationship between the sample variables were estimated by using the correlation coefficient, specifically the *Pearson product-moment correlation coefficient*[3], which indicates the strength and the direction of the linear relationship between two variables.

$$r_{xy} = \frac{\sum x_i y_i - n\overline{xy}}{(n-1)s_x s_y} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - \left(\sum x_i\right)^2}\sqrt{n\sum y_i^2 - \left(\sum y_i\right)^2}}$$, where

r_{xy} the Pearson's product-moment correlation coefficient;
x, y variables, written as x_i and y_i, where $i = 1, 2, \ldots\ldots n$;
$\bar{x}$, $\bar{y}$ means of the variables, and
sx, sy the standard deviation of the sample variables.

The statistical variability between groups of the same variables in the sample was measured by employing the *ANOVA*[4] (An Analysis of Variance) method. The statistical significance was displayed with the F-test, using the following equation:

$$F = \frac{MSTR}{MSE}$$, where

MSTR variance of the group means, and
MSE mean of the within-group variance.

Except for ANOVA, the *General Linear Model (GLM)*[5] was used. This regression analysis utilises the relation between two or more quantitative variables so that a response or outcome variable (the dependent variable) can be predicted from the others. Particularly, this linear model includes regression analysis, analysis of variance, and analysis of covariance. The method of estimation was used to describe the total daily milk production per farm influenced by a range of different independent variables.

The simple linear regression comprises the following function:

$y_i = a + bx_i + e_i$, in the statistics literature, while

[3] The Pearson's product-moment is calculated using the statistical package labelled as Gretl, as well as in Minitab 15.
[4] The analysis of the variance (ANOVA) is calculated in Excel's Add – Ins.
[5] The GLM was produced using the Minitab 15.

$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, in the econometrics literature. These equations are equivalent in their means, just the notation is different.

y_i	the value of the response variable in the i^{th} trial;
a and b (β_0 and β_1)	constants (parameters), the intercept;
x_i	the value of the predictor variable in the i^{th} trial, and
e_i (ε_i)	random error term with mean $E\{\varepsilon_i\} = 0$ and variance $\sigma^2\{\varepsilon_i\} = \sigma^2$; ε_i and ε_j are uncorrelated so their covariance is zero (i.e., $\sigma\{\varepsilon_i, \varepsilon_j\} = 0$ for all i, j; $i \neq j$), where $i = 1, \ldots\ldots$, n.

In the linear equation is assumed that the residuals (e_j) are independent, normally distributed with mean zero, and that they have the same variance for all x.

At the other hand, GLM is modelled as the following linear function (Olsson, 2008):

$y_i = \beta_0 + \beta_1 x_{i1} + \ldots + \beta_{p-1} x_{i(p-1)} + e_i$

The observed data were used for estimating the parameters of the regression function consist of observations on the explanatory (the predictor) variable x and the corresponding observations on the response variable y. For each trial, there was an x observation and a y observation, and so on for the next trials, denoted as (x_1, y_1), (x_2, y_2), ……., (x_i, y_i), where $i = 1, \ldots, n$.

The purpose of this kind of analysis was to build a model that would provide the most reasonable approximation to the real conditions of farming. Hence, after parameters of the general linear model were estimated, the assessment of how well the model fits the data is done. A descriptive measure of the preceding was calculated as (Olsson, 2008):

$$R^2 = \frac{SS_{Model}}{SS_T} = 1 - \frac{SS_e}{SS_T}$$; where,

R^2	the coefficient of determination;
SS_{Model}	the sum of squares of the model;
SS_e	the sum of squares of residuals, and
SS_T	total sum of squares.

One disadvantage of this measure is that it increases when new variables are added to the model. For that reason, the model is assessed by using the adjusted R^2, which decreases with adding irrelevant terms into the model.

Beside the tabular presentation, the results from the GLM are moreover graphically illustrated with a normal probability plot of residuals, with a purpose to assess whether or not a data set is approximately normally distributed. In the figure, the data are plotted against a theoretical normal distribution in such a way that the points should form an approximate straight line. Departures from this straight line indicate departures from normality.

The probability of choosing between a small and large dairy as a buyer of the output was calculated using the binary logistic regression. The logit model extends the principles of generalised linear models to better treat the case of dichotomous and categorical variables. It

focuses on association of categorical or grouped data, looking at all levels of possible interaction effects. This model is based on the assumption of equal categories. Actually, the logit model shapes the proportions of cases in each category of the response for each category of the independent variable. The function used in logit is the natural log of the odds ratio. Logit regression yields results equivalent to logistic regression, accordingly:

$$y_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_{i1} + \ldots\ldots + \beta_{p-1} x_{i(p-1)})}}, \text{ where}$$

y_i	the output (response), confined to values between 0 and 1;
x_i	the independent variables (factors);
β_0	the intercept;
β_n	regression coefficients, and
e^x	a mathematical constant.

Each of the regression coefficients describes the size of the contribution of that risk factor. A positive regression coefficient means that that risk factor increases the probability of the outcome, while a negative regression coefficient means that that risk factor decreases the probability of that outcome. Furthermore, a large regression coefficient means that that risk factor strongly influences the probability of that outcome, while a near zero regression coefficient means that that risk factor has little influence on the probability of that outcome.

The more simplified equation of the logit model is the following:

$$\text{logit}(p) = \log\left(\frac{p}{1-p}\right), \text{ where p is the probability.}$$

The logit model utilizes the maximum likelihood estimation methods, which require a larger sample size than the corresponding OLS regression methods. Inadequate sample size will lead to too many cells with zero count and logistic analysis may fail to converge on a solution.

5 Empirical findings

A summation of the obtained data is presented in this chapter. All results are subject to further analysis. The challenges that constrained the research, which might influence the validity of data regarding the analysis, were outlined with the delineation specifications.

5.1 Clues for the empirical summary and ensuing analysis

A characterisation of dairy farming in the country was attained, which serves as an outset for the further analysis, hence, addressing analyses of the transaction costs occurred during the farm operation and marketing. The farm and household characteristics relate with the factors influencing the level of transaction costs, and that is the asset specific investments of the farm. Therefore, a summary of the obtained empirical data regarding the preceding issue was prepared and subsequently presented.

Since theory puts asset specificity as a major cause of transaction costs, the necessity for a deeper understanding of its influence on the dairy marketing was primarily accomplished by presenting the dairy farm characteristics. Additionally, to illuminate this field another important feature that affects the transaction cost level was presented, and that is the socioeconomic characteristics of the farm (see Figure 6).

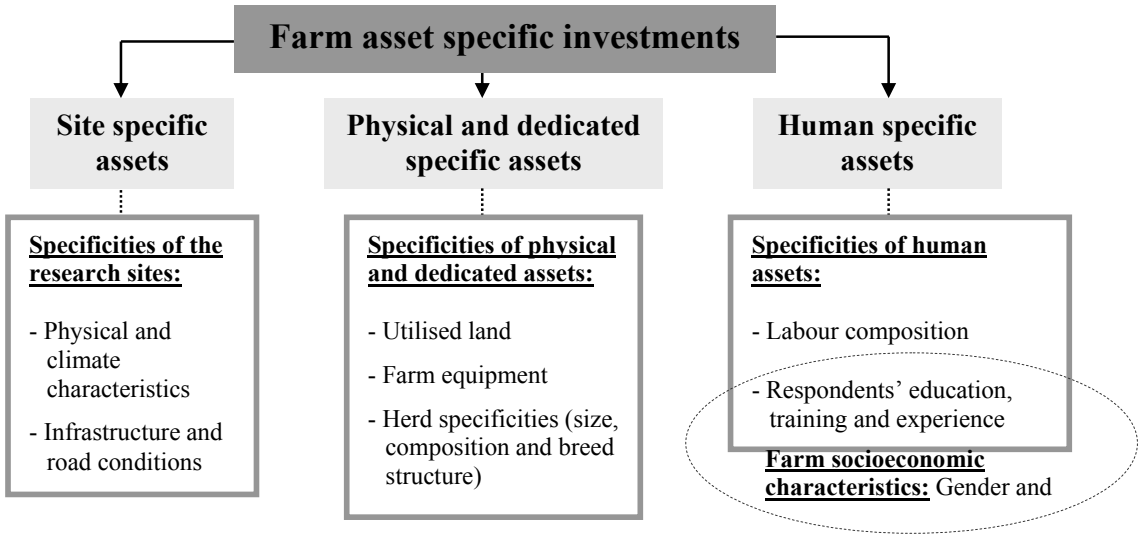


Figure 6 Consecutive elaborations of the farm specific assets for the empirical presentation

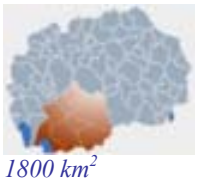
The farm output was detailed as an outcome of the aforementioned groups of factors, reflecting the level of the efficient performance of the farm. The farm output description was made, in order to fulfill the farm characterisation procedure. This was necessary since the raw milk is the core object in the marketing process. In addition, the milk market was described. All the costs before, during and after the exchange of the raw milk are due to transaction relations between the involved parties, herein between farmers and processors, thus the assessment of the transactions between them was developed, whereas the analysis of

transaction costs is included in the next chapter, emphasising the behaviour of the transacting parties, and the influences to the farmers' choices of buyer.

5.2 Specificities of the research sites

The Republic of Macedonia is divided into eight regions and 84 municipalities within. The survey was conducted in three regions and therein six municipalities. Their main physical characteristics are presented in Table 5.

Table 5 Physical characteristics of the research municipalities and interviewed per site (%)

Region	Location	Municipality	Level of municipality development	Population	Village	Responded (%)[6]
Pelagonia		Bitola	Urban	95,385	Dolno Orizari	6.7
					Lera	3.3
					Ramna	3.3
		Bitola Total				*13.3*
	Bitola	Mogila	Rural	6,710	Dolno Carlija	3.3
					Radobor	6.7
					Mogila	16.7
1800 km²		*Mogila Total*				*26.7*
		Novaci	Rural	3,549	Novaci	6.7
		Novaci Total				*6.7*
Pelagonia Total				*105,644*		*46.7*
North-eastern		Kumanovo	Urban	105,484	Rezanovce	10.0
					Romanovce	10.0
					Tromege	13.3
	Kumanovo	*Kumanovo Total*				*33.3*
432 km²						
Northeastern Total				*105,484*		*33.3*
Skopje		Ilinden	Rural	15,894	Kadino	10.0
		*Ilinden Total*				*10.0*
		Karpos	Urban	59,666	Bardovci	10.0
	Skopje	*Karpos Total*				*10.0*
118 km²						
Skopje Total				*75,560*		*20.0*
Grand Total				286,688		100.0

Source: www, SSO, 2007; Survey data, 2007

The study locations slightly differ in their biological characteristics. Bitola has a continental climate, whereas Kumanovo and Skopje have a moderate continental climate. However, the climate characteristics are not crucial for the milk production since farmers practise the stall

[6] The percentage is derived from the total interviewed farmers, not from the total population per site.

system of keeping cattle, therefore are mainly held in stables during the whole year (99.9% of farmers do not take the animals on pastures). The climate is an important factor only for farmers who produce feed. Figure 7 presents the frequency of different percentages of the input of feed for production of milk that is produced on farm.

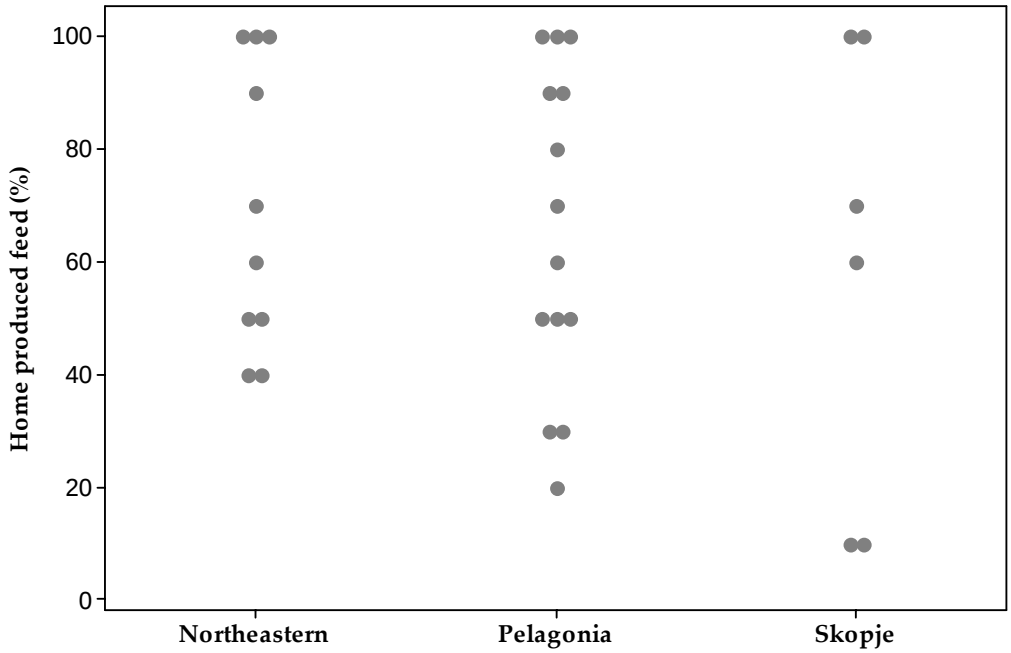


Figure 7 Illustration of the percentile of home produced feed by farmer per region
Source: Survey data, 2007

The data show that the majority of farmers produce feed on farm, so it can be assumed that this production is very dependent on the weather conditions (see Appendix 3).

Other important site specific assets are infrastructure and road conditions. The researched regions are characterised by fragmented units of milk production, so there are numerous farms of small size. This creates high costs of milk collection, and low investments in mechanisation and modernisation often cause a low competitiveness. The roads are in relatively good condition, and their network is well developed, so there is a good access within and between the milk shed[7], and the relating marketing nodes[8].

5.3 Respondent and household characteristics

The socioeconomic characteristics of the farm household are characterised by a range of variables, which might influence the farmers' decision as to buyer. In this model, respondents are characterised by the age, the education level and the experience in cattle farming, whereby

[7] A milk (dairy) shed is an area where milk production is a major activity (FAO, 2007). The milk shed may serve one or more consumption centres or cities.
[8] A marketing node is defined as any point in the marketing chain where an exchange or transformation of a dairy product takes place. A marketing chain may connect one or more milk sheds (FAO, 2007).

households vary in their gender composition and number of children in a household. Therefore follows an outlook of the preceding variables.

Most of the respondents interviewed were male (circa 77%), besides the respondents from Skopje who were mainly female (83%). The target population is middle aged (on average 46.5 years). The respondents from Pelagonia were relatively younger with 50% of the respondents below 40 years, and with the oldest respondent on the age of 59 years (detailed summation in Appendix 4). An interesting finding was that children were no longer employed in farm activities, not even part time, having other interest than farming (see Appendix 5).

Figure 8 presents the variability in the age between respondents. This variable significantly differs between regions. The median age is highest in the Northeastern region (51.5). This observation demonstrates the greatest variability, with an interquartile range of 35.5. The distribution is negatively skewed. The other two regions show similar variability in the age of the interviewed, and have moderately different medians (40 and 46, respectively).

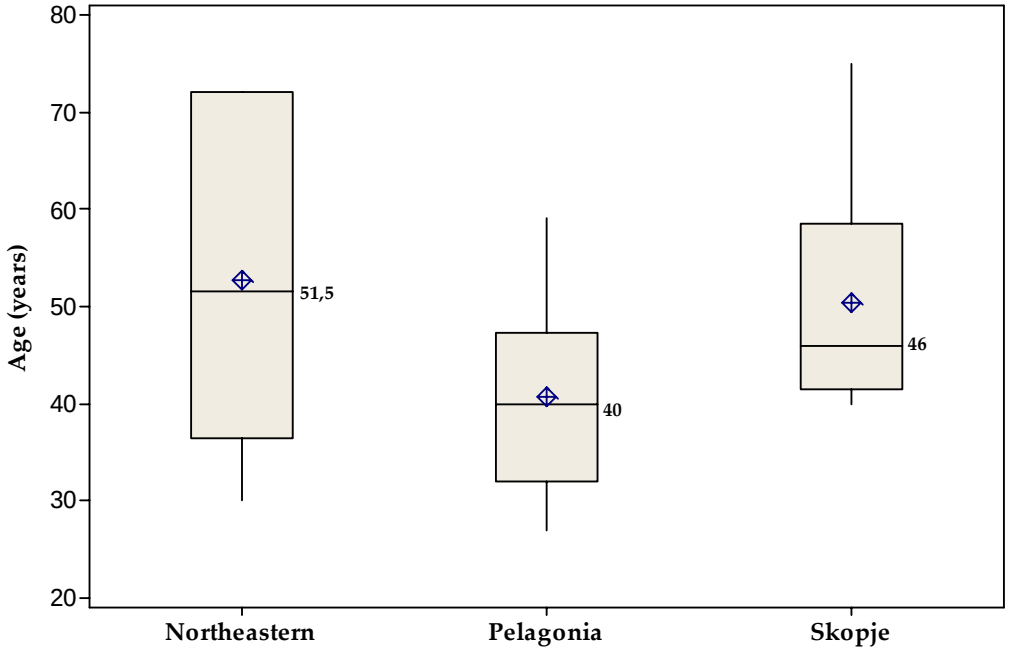


Figure 8 Age distribution per region
Source: Survey data, 2007

Another variable that characterise the respondents is their education. Small-holders have the weakest educational and professional level. The mode of the education level among the respondents is found to be the high school education and is presented in Figure 9. As follows from the descriptive statistics, the level of the educated respondents in Kumanovo deviate the most (s.d.[9] 1.03), where were found respondents with a low (four year primary school) and with a high level of education (bachelor degree). The education levels of the respondents from Pelagonia vary the least, as 86% have finished only high school (see Appendix 4).

[9] s.d. is an abbreviation of standard deviation.

There is an inverse relationship between the age and the education (ρ = -0.2506) of the respondents. This correlation coefficient shows that the two variables tend to move in an opposite direction, which may mean that the older the farmers are, the lower the education level is. These variables affect the income from the dairy farm managing. The more educated farmers contribute more for the farm profitable working. Opposed to the foregoing, the correlation between the age and the experience (ρ = 0.47206549) of the respondents is positive, which may mean that older people have longer experience than the young people (Appendix 4).

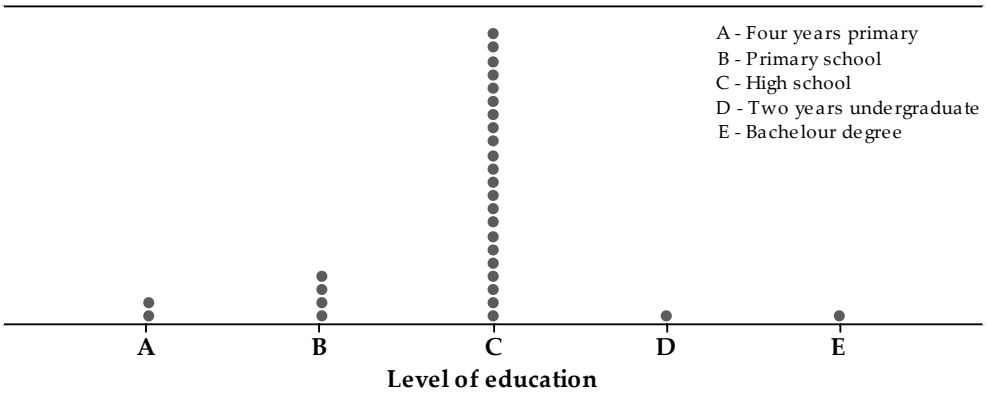


Figure 9 Education levels of the respondents
Source: Survey data, 2007

The surveyed farmers were mainly engaged in cattle breeding (above 50% of the farm income is derived from this kind of farming) (see Appendix 5). The main activity on most farms is milk production, where some of the farmers tend to sell live animals as well. The main reason for choosing the milk market instead of the meat market is that milk sale brings more frequent turnover of the capital invested. Moreover, farmers claim that it is cheapest to produce milk since the price of the feed has increased dramatically.

5.4 Characterisation of the farm

5.4.1 Herd size and composition, and breed structure

The visited dairy farms considerably diverge by region (see Figure 10). Small-holder farmers are mainly found in the Skopje region. Approximately 80% of the farms have one to five cattle in a herd (see Appendix 6). This circumstance is explained with the fact that Skopje is an urban region and offers wider range of employment opportunities than the rest of the regions. In this region, cattle farming is not considered as a main income source, but

households receive income from other sources as well. Other specificity in this area is the herd composition, as artificial insemination is compulsory, so bulls are not constituents of a herd. This condition is not regulated in the other regions, but still farmers prefer the prior kind of insemination, except holders of a large herd (see Appendix 6).

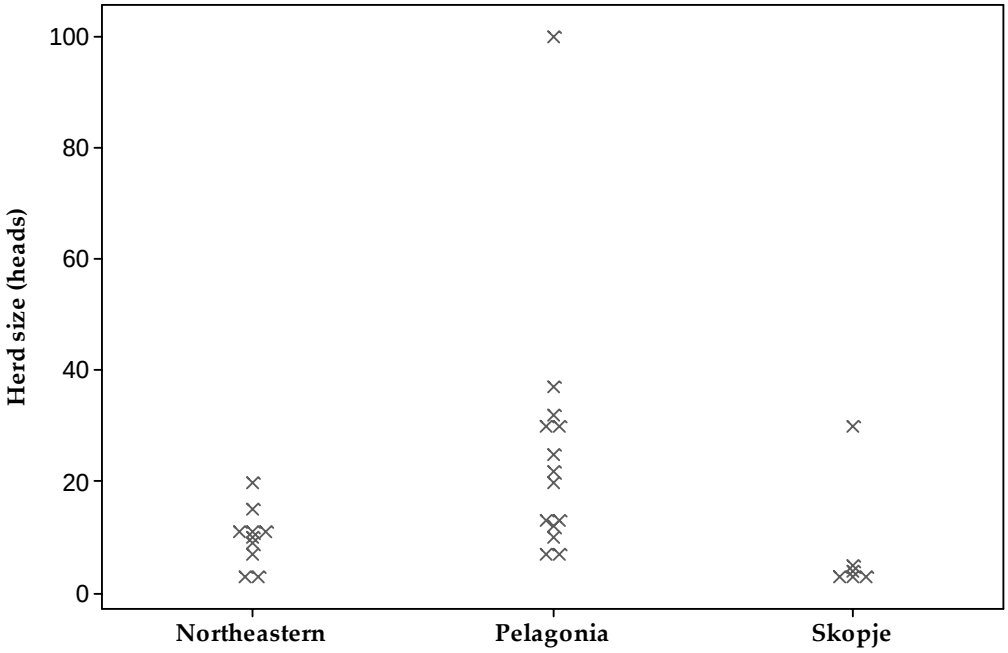


Figure 10 Distribution of the number of cattle in a herd per region
Source: Survey data, 2007

The most intensive milk production is found in the Pelagonia region. This region is traditionally famous for this kind of farming. Farmers usually own 11 to 30 cattle, with different composition in the herd. There were even larger farms within this region, with more than 30 cattle and smaller farms as well, but nobody has less than six cattle in a herd (see Appendix 6).

The Northeastern region has least variation regarding the herd size. The number of cattle in a herd is mainly distributed in an interval from five to twenty (see Figure 10).

The breed structure includes mainly breeds for dual purpose (milk and meat), but the main orientation is for milk production. Meat production is generally subordinate and based on culled cows and fattening of male calves. The main cattle breeds held by the interviewed farmers were the following crossbreeds: East-Friesian (50%) and Holstein-Friesian (circa 33%), both representatives of the black and white cattle with emphasised milk productivity (presented in Figure 11). However, this characteristic is not so common for the cattle in the surveyed area. The productivity per cow is low due to the inappropriate conditions, under which they are kept, as well as the low quality feed and management practises.

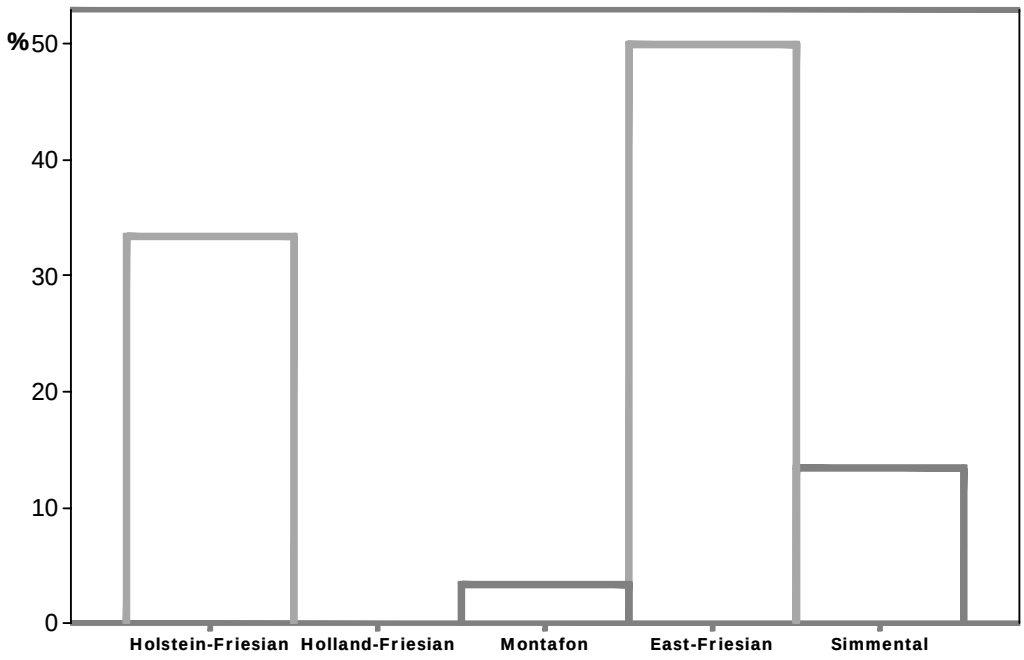


Figure 11 Distribution of cattle breeds in the research regions (%)
Source: Survey data, 2007

Breed composition significantly differs by region. The farmers in the Northeastern region did not hold the East-Friesian breed, but mainly Holstein-Friesian and Montafon, whereas all the farmers from Skopje preferred the East-Friesian breed (Appendix 7).

5.4.2 Farm equipment specificities

All the visited farms were equipped with milking machines, indeed not as modern types as robotic milking machines. There were not implemented advanced milking systems. Only farms with large herds were well organised in a single line connection system for milking, where the milk immediately after milking flow into pipes and ends in a lacto freezer, where it is kept until delivery. In this way milk is protected from contamination. It can be concluded that hygienic management practices are not familiar to most farmers, because generally they have not yet exploited the modern systems of farming, including cooling equipment.

5.5 Farm inputs

5.5.1 Land and feed production

The land in the Republic of Macedonia is partly privately and partly state owned. Around 80% of the arable land is owned or leased by private farmers, whereas the rest is owned by the state which leases to the agricultural enterprises without compensation for a limited period of time, or to individual farmers with compensation (NARDS 2007 – 2013, 2007).

The agricultural land is not effectively used, since it is fragmented and parcelled out (see Appendix 8) as a result from previous limitations on usable areas and ownership, inheritance customs, as well as a tradition of informal relations in the land market (Annual Agriculture Report, 2006; NARDS 2007 – 2013, 2007).

The study locations differ much in the utilisation of the arable land (Figure 12). These diversities are related to the farm specialisation. There is a strong correlation between the total utilised land and the herd size ($\rho = 0.568$), and even more significant correlation between the total utilised land and the land for feed production ($\rho = 0.985$). Most of the land utilised by the dairy farmers is mainly used for feed production, whereas larger farms tend to give priority to self-produced feed ($\rho = 0.604$). Only the ratio between the land for feed and total arable land is lesser for Skopje (0.63) than the rest, which can be explained with the fact that this is a prominent region for intensive vegetable production.

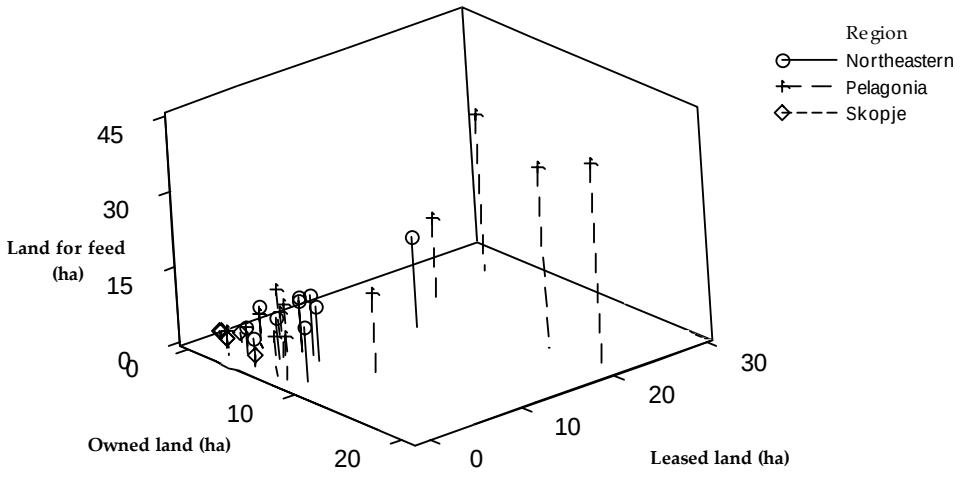


Figure 12 Relationship between variability in the utilised land by region
Source: Survey data, 2007

Pelagonia has larger farms (with an average herd size of 26 cattle) that operate with larger land (14.6 ha on average) than the rest of the research localities. So, intensive milk production creates necessities for expansion of the utilisation of the land particularly for feed production. The preceding reasons explain the fact that in Pelagonia farmers lease more land than they own. All the information gained with the survey regarding the inputted land is presented in Appendix 9.

Crops are mainly grown for fodder as well for producing concentrates at farm (see Appendix 10). The grain production used for feed is mainly wheat and maize, also barley, rye and oats growing, which are ground into concentrates. Different crops of hay are grown on the farm land, and varieties of crops for silage, as alfalfa, soy, clover and the preceding grains. None of the farmers was using pastures for feeding the herd.

Farmers were complaining about the expensive feed on the market, which gives them incentives to produce feed at farm. The sector analysis for the EU (2006, 43) claims that the cost-price relationship between raw milk and compound fodder is excellent, nevertheless, farmers' complaints about the expensive feed is mainly a consequence of the drought that stopped farmers to grow crop for feed that period of time. Therefore, they were forced to purchase feed from the nearest market at a higher price than if it were produced on farm. The feed sold on the market is mainly imported, which may explain the high price, and is mainly in a form of coarse grains and different supplements.

5.5.2 Labour

Around 19.5% of the active labour force in Republic of Macedonia is employed in the agricultural sector, of which 93% on private farms and the remaining by agriculture enterprises (NARDS 2007 – 2013, 2007). The net salaries of labour engaged in agriculture amount MKD[10] 460 a day (about € 7.5) (NARDS 2007 – 2013, 2007). However, from the obtained data it is obvious that most of the employed labour constitutes the family labour engaged full-time hours, whilst it is not common for farmers to hire labour. Mainly part-time employees are the children of the household. There were not any part-time employed which are not part of the family (Appendix 11).

Hired labour is significantly correlated with the size of the utilised land ($\rho = 0.685$), therefore it is considered that large-scale holders employ external labour force, mainly men, which can be seen from the correlation coefficient between hired labour and the number of male employed on farm ($\rho = 0.69$). Nevertheless, not all of the holders of a large herd have hired labour for the farm activities. Actually, only three of all the visited farms were operated including additional labour out from the family members.

Whilst men often work on a field to produce fodder crop or to grind the grain into coarse feed, women are responsible for looking after the cattle, in a way of feeding them, milking the cows, and other household activities. In the farm, management activities involve men and women equally, even though these are not at an advanced level. The only inequality is found in attendance at seminars and having membership in an association, where only men participate.

5.5.3 Other farm inputs

Assets, such as milking equipment and cooling systems, are important inputs in the milk production, which affect the amount of the farm-gate pricing. Every visited farm, not depending on the herd size, is outfitted with milking equipment. Variation is found among small and large-scale producers, in equipping the farm with a lacto freezer. Mainly larger farms are outfitted with a cooling system and this reflects on the farm-gate price received from the dairy. The cooled milk is priced higher than other milk.

Veterinary services are other inputs in the production of milk. In average farms are visited four times per month by a veterinary surgeon, mainly for prophylactic controls and mastitis

[10] MKD (Macedonian Denar) is a currency used in the Republic of Macedonia, with exchange rate of:
1€ = 61.2204 MKD (www, nbrm, 2008).

curing, as well as for insemination and reproduction of the herd. As shown in the Appendix 12, larger farms are visited more frequently than smaller ones. It is logical that a larger number of cattle in the herd require recurrent veterinary services. Veterinary cost for one visit per cow on average is around MKD 750.

The investment in labour specific assets, such as training in cattle farming, is low. The existing media programmes regarding agriculture are limited in duration and very general in scope. Farmers' practical education in milk production is mainly based on the experience inherited from their parents. The kind of training, if any, that farmers have is primarily gained by attending to locally organised seminars. Also, the Agency for Agriculture Development in the Republic of Macedonia provides training, especially for farm management practices.

The survey data show that there is no progressive relationship between the herd size and the investments in training (see Appendix 13). The assumption that large-scale producers invest more in labour skills development is rejected, because the data indicates that holders of a herd with over 30 heads do not have training at all. Farmers that own six to 30 cattle have devoted the most in human asset development.

There are numerous other fixed and variable inputs that are connected with dairy cattle farming, but are difficult to measure, so they were not covered within the research. Relating inputs are regarded as water, electricity, renewal of the herd, farm maintenance, *etc.* The marketing costs are being analysed subsequently.

5.6 Output

5.6.1 Milk production

Dairy farming is intensive production which is intended to produce maximum yields; therefore cows are pushed to their physiological limits through a combination of selective breeding, high-protein feeds, and corresponding technology. To keep milk production as high as possible, farmers artificially inseminate cows every year, with creating in advance an unnatural milking schedules to keep the cows pregnant. Consequently, the dairy cow is made pregnant again whilst lactating. Nonetheless, the main calving season is supposed to be from February until March.

The dairy cow has her first calf at the age of 2 years. The cow is milked for 10 months, but in the third month the cow is made pregnant again. The cow bears a calf each year until worn out and sent for slaughter, therefore will not reach the cow's natural lifespan. In developed countries, dairy cows are sent for slaughter at about 5 years old, after only three or four lactations, whereas in Macedonia some farmers tend to milk the cow longer (see Figure 13).

The average age of the dairy cow in a herd is 4.5 years, but there are certainly enormous variations within a herd, whereby the maximum age of a dairy cow is found to be 7 years old (the data statistics are presented in Appendix 14).

The period of lactation, or milk production, lasts on average for 305 days, producing 6212 kg of milk at average, which is less than the average of the developed countries (7000 kg). However, there were dairy cows that give 7625 kg milk per lactation (see Figure 14, and more detailed in Appendix 15).

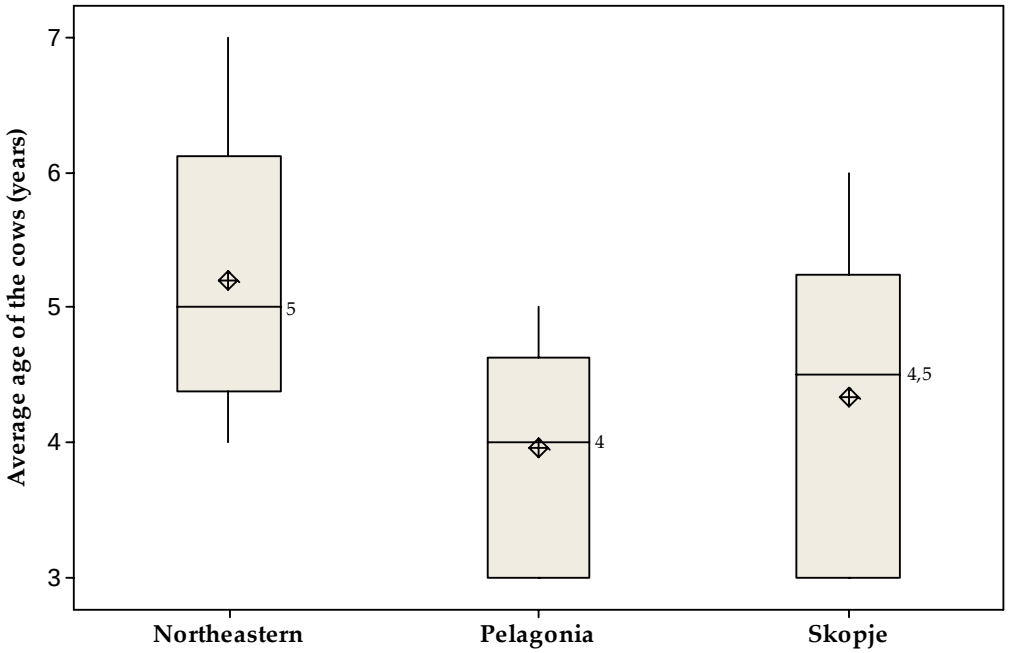


Figure 13 Age of the cows (average from farm) per region
Source: Survey data, 2007

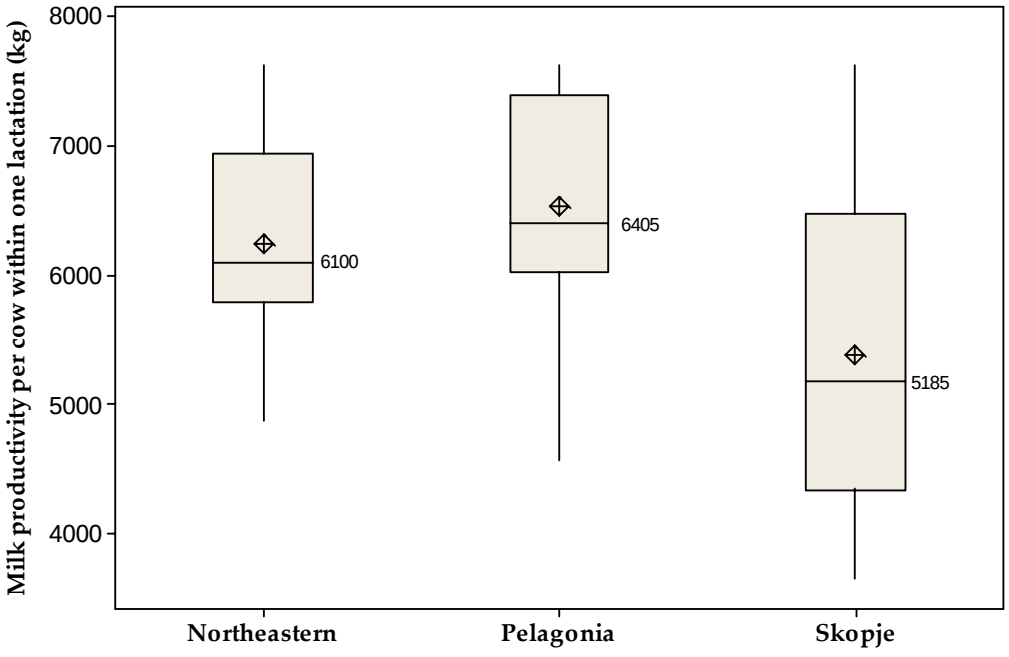


Figure 14 The milk productivity per cow in one lactation period per region
Source: Survey data, 2007

The data shows that the productivity of cows varies among farms in the Skopje region. The cows give less milk than the other regions. The average production of milk of the cows per lactation, in both Pelagonia and Northeastern region, slightly differ, but the least variations in the cows' milk productivity were found in the Northeastern region.

Within the lactation, the highest yield is 2-3 months post-parturition, yielding 40-50 l/day. Within the milking lifetime, a cow reaches a peak in production about her third lactation, but can be kept in production for 5-6 lactations, and even more if the yield is still good. Afterwards, the worn out dairy cow is sent for slaughter.

A dairy cow is milked once a day, early in the morning, or twice a day, also in the late afternoons. Thereafter, the milk is collected in milk cans, on smaller farms, or directly after it has been milked flows into a lacto-freezer, practised on larger farms. Then, the filled milk cans are brought with hand-trailers to the collection points (in the centre of the village) every morning and also in the afternoons, while milk from the cooling trunks is collected by the dairy, normally once every second day, and transported with milk transport vehicles (milk collection trucks). The frequency of the milk delivery (once a day, twice a day, or once every second day) is negatively correlated with the type of the contract between farmers and dairies ($\rho = -0.523$). The large dairies (which contract formally with farmers) prefer to collect the milk less frequent directly from the farm, so as to reduce the costs of transporting the milk.

The total milk sale per farm is estimated to be 132 litres at average per day. There were also variations within and between regions (see Appendix 16). The Pelagonia region has achieved the greatest daily milk sale (206 litres), but also the greatest variability (s.d. 216.8). Conversely, the sale of milk in Skopje is relatively lower than in Pelagonia (43.5 litres), but exhibits the least variability (s.d. 36.2). This situation is explained by the size of a herd reared on farms from all the regions, whereby milk sale is strongly positively correlated with the number of cattle in the herd ($\rho = 0.969$), and moreover with the current number of milking cows ($\rho = 0.976$). As expected, the larger the number of milking cows, the higher the sale of milk tends to be (illustrated in Figure 15).

The milk is sold to dairy plants at average fixed farm-gate price of MKD 17, or at price of MKD 16.33 at average, if the price of the milk is formed according to grades related with the percentage of fat and proteins, as well as the number of bacteria and somatic cells in the milk. Very often, the dairies compensate the agreed amount of payment, so they pay the farmers in kind (mostly in white and yellow cheese).

5.6.2 Sale of live animals

In average in the researched locations, the total income of the farmers from selling milk is seven times higher than the income received from selling live animals. Consequently, farmers are more oriented on milk production rather than selling live cattle. Milk production provides farmers a steady income during the whole year. But to fully maximise profits farmers use dairy cows as breeding machines to produce calves for the beef industry and to replace the dairy herd itself.

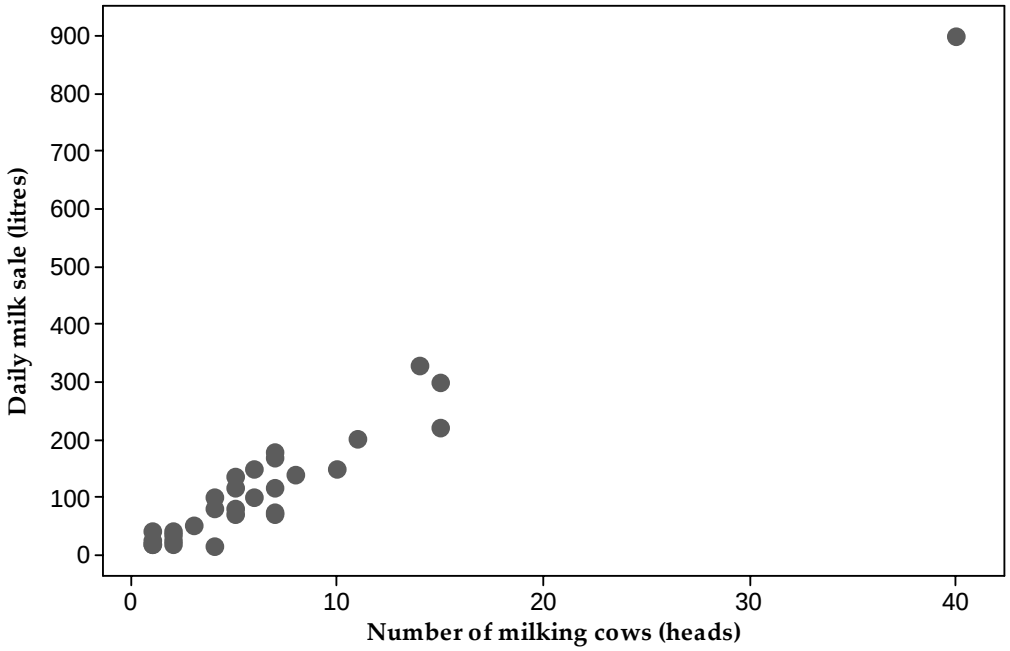


Figure 15 The relationship between the milk sale and the number of currently milking cows
Source: Survey data, 2007

Male calves of a pure dairy breed are perceived by many farmers as not being worth rearing for meat, so they are considered as a *by-product*. The male calves are sold on the local stock markets at an average price of € 220, usually 60 days old. The live animal sale consists also of selling worn out or sick cows and bulls, and sick heifers. The healthy female calves are selected as 'herd replacements'.

5.6.3 Factors influencing the milk production

In every production, as it is in the milk production, the final outcome is the most important. The total output of milk is influenced by a range of asset specific factors and the level of their investment on a particular dairy farm, as well as from certain characteristics of the household. For this purpose, a particular model should be composed in order to give a simplified picture of the reality. It was assumed that the general linear model would give appropriate results.

The first step in the modelling is to choose among many different variables (summarised in the previous section) that might influence the total production of milk on the surveyed farms, so called stepwise regression (Olsson, 2008). Specifically, backward elimination of the factors was used, in a way that firstly the variables with a large *p*-value were removed from the model, and subsequently, the model was re-run continuously until all variables have small enough *p*-values ($p < 0.05$) (pers. com., Olsson, 2008). From the many trials prepared, the following model was chosen as most suitable one, with adjusted sum of squares (R^2-adj = 99.72%):

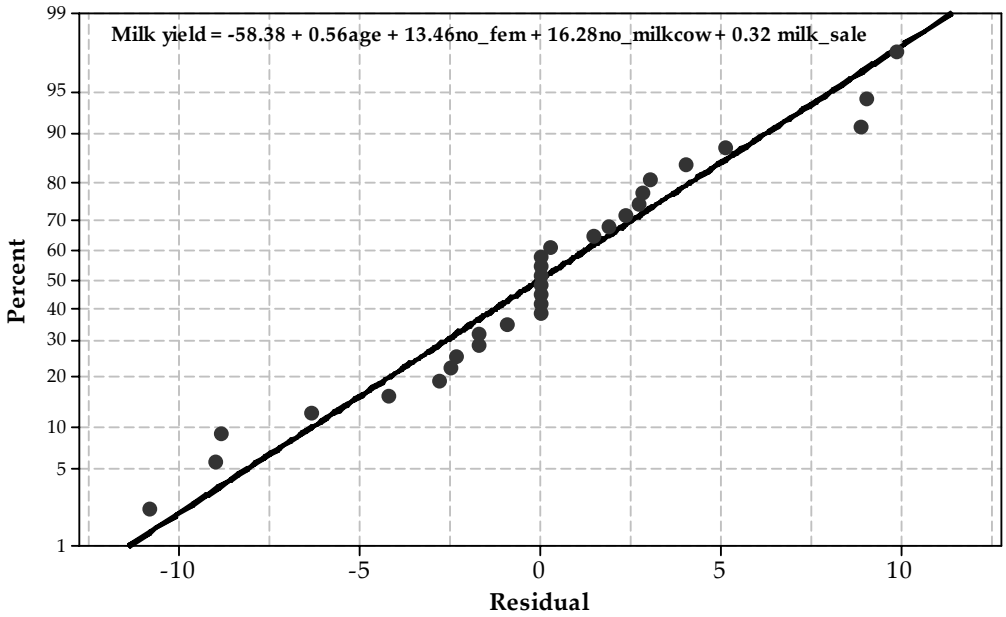


Figure 16 Relation between the total milk yields per farm with corresponding factors
Source: Survey data, 2007

The variables presented on the normal probability plot of residuals form a nearly linear pattern, which indicates that the normal distribution is a good model for this data set, and that the relationship between the preceding independent variables with the response variable is linear.

From the results it can be seen that significant influence on the total daily milk production have the age and the farm experience of the respondents, as well as the number of female family labour employed for the farm activities. To improve the model, the main but obvious factor influencing the level of output was included, and that is the number of milking cows at the farm. The model estimates that more frequent veterinary visits could increase the farm productivity. Veterinary surgeons in the country are also known as chief advisors for a farm management practices, therefore this fact is assumed to give importance to this variable. Finally, the demand for milk from the dairy processors is another factor that influences the level of milk produced on a farm. All the features of the model show a positive coefficient so can be concluded that the milk yield increases significantly with increasing the factors' level.

The attained model is intended to provide a convenient summary of the data, accounting for the possibility that the relationship between the response and the variables is not perfect (Olsson, 2008). It is mainly a reasonable approximation of the actual conditions in order to interpret the reality.

5.7 The raw milk marketing channel

Dairy cattle farmers are mainly engaged in the milk market. They have two alternatives where to sell the milk, namely large and small dairies. The survey data show that 60% of the farmers sell their output to the large dairies (see Appendix 18), while the others sell to small dairies. Nevertheless, the percentages should be carefully rendered since the sample of representative farmers is the largest for the Pelagonia region. The chosen type of buyers differs by regions, and this difference is mainly due to the accessibility of the different type of dairies in the nearby site. Figure 17 presents the relationship between the size of a farm and the type of a dairy in the researched regions. The remaining factors that influence the farmers' choice to what type of dairy farmers sell the milk, are analysed in the next chapter.

The Figure 17 shows that all farmers from Pelagonia region sell milk to the large dairies, since there are no micro dairies in this origin. The reverse situation is found in the Northeastern region, where a multitude of mini dairies are located, whereas farmers from Skopje collaborate with both types of processor, and generally, only traditional small-holders sell milk to the small dairies.

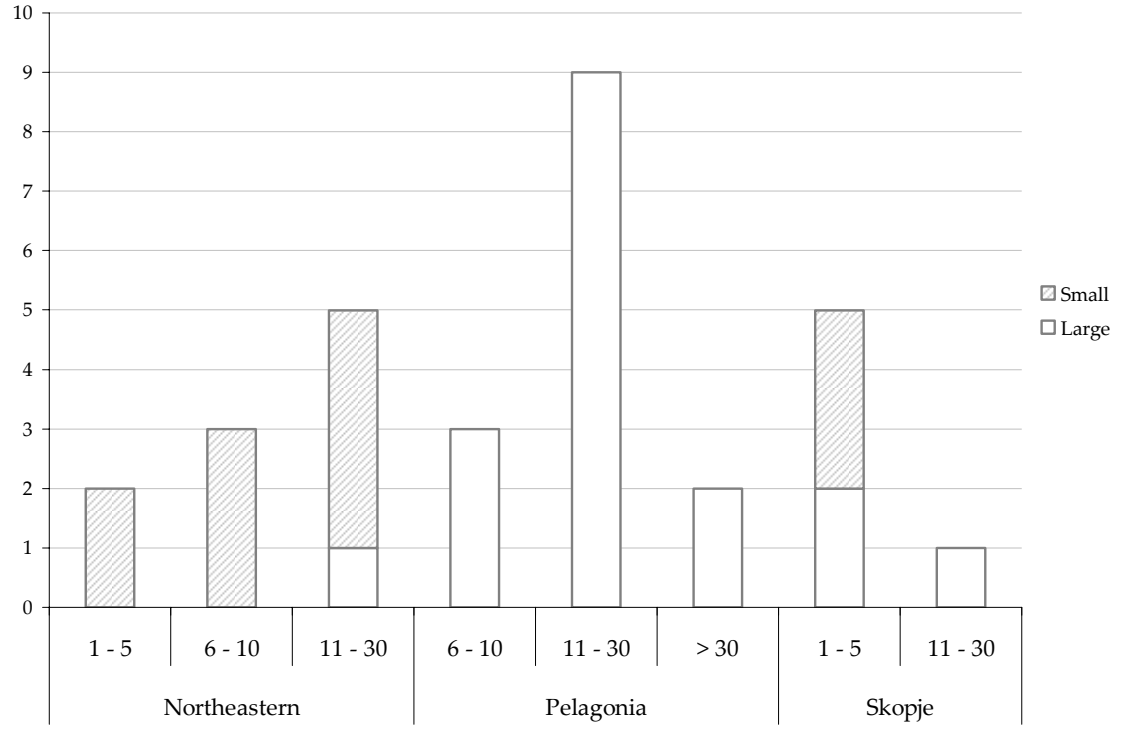


Figure 17 The choice of a dairy type regarding the size of the farm
Source: Survey data, 2007

The milk collection and transport also differ by regions (Figure 17). In Skopje and the Northeastern region, milk after milking is collected in milk cans, and is therefore every morning picked up at the farm with refrigerated trucks owned by the dairy processors. The milk collection and transport is more organised in Pelagonia region. The small raw milk suppliers collect the milk in a can and take it with small barrows to the collection centre. This

procedure is practiced early in the morning and in the late afternoon. Afterwards, the cooled milk daily is picked up at the collection centre by a milk tanker and transported to the processing plant. Unlike small-holders, large suppliers store the milk at farm in bulk, for instance in farm cooling tanks (lacto freezers) for a couple of days, and hence the storage tanks are pumped out directly into the milk transport truck or tanker and thereafter transported to the milk processor.

The differences in the milk collection are due to the organisational and economic difficulties regarding the farm size. Milk cooling requires an adequate supply of electricity and water. These are available on all farms, but can only be arranged at relatively high costs. The volume of daily milk production may be too small to justify a cooling system, and it would be too expensive to cool a small amount of milk on the farm and too expensive to collect it. The collection of milk on farms also requires a good road access for the milk transport trucks, which is not a focal problem among the small-scale raw milk producers.

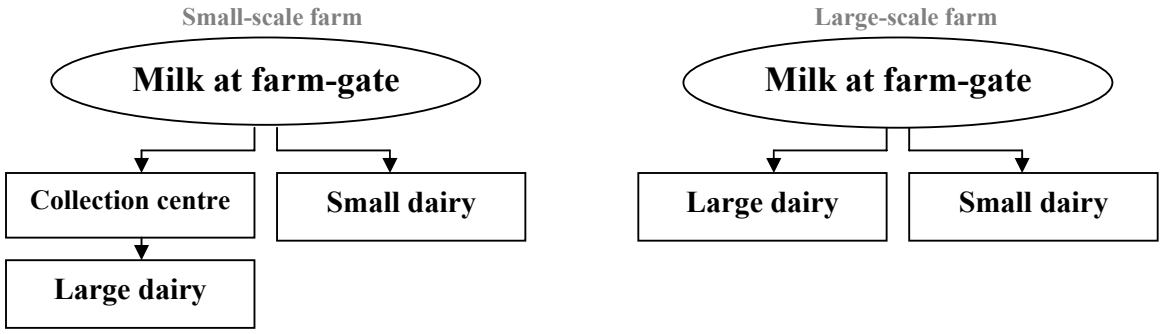


Figure 18 Differences in the milk collection between small and large holders in Pelagonia
Source: Survey data, 2007

Even though the logistic of milk supply is comprehended, the matter why farmers choose to sell to a particular type of dairy remains unexplained. Since the effective performance of the dairy farm is not run by transportation costs (settled by the dairy), in that case farmers' decision making about the type of buyers is not affected by the dairy plant's location. Therefore, with using the binary logistic regression is estimated which sample variables influence the decision of a farmer for the type of purchaser. The same method of factor elimination was used as in the general linear model. Thereby, significant influences on the response variable (the type of dairy) were found. However, no considerable multi variable model, that would give an appropriate picture of the reality, was developed since factors that showed significance were under condition of a single relation with the response. In other words, only one-way relation between a factor and the dependent variable showed significance, whilst a logistic regression including different combination of variables did not show significance. Significant influence showed the following variables: *how much experience in cattle farming the respondents have, the size of the herd, the number of cows in the herd and their average age, the total daily milk sale of a farm, the type and the length of contract that farmers signed with the dairy, and if the dairy control the milk* (see Appendixes 19).

The single factor influence on the choice of buyers might be a result of the complexity of the subject which cannot be explained by only using a statistical model, since transactions are not easy to be observed and measured.

5.8 Assessment of transactions

As theory implies, the presence of transaction costs is impacted by the search of information, negotiation, monitoring, coordination and enforcement of contracts. All of these transactions have an important effect on the organisational relationships between the transacting parties, so in accordance with their levels of exposure, the farmers' choice of a dairy marketing channel is influenced. In this regard follows an outline of the differences of transaction nature between milk channels from the farmers' perspective.

Information can be defined in many ways, where in the institutional theory a key assumption is that information is a commodity that can be purchased. Since the performance of the market supporting institutions for disseminating market information and providing services is poor, the obtained information is being transferred through the channel in the communication process. Mainly the nature of the information that farmers receive is for the process of the production itself and the prices at each marketing node. The sources of information for the farmers engaged with a different size of dairy differ. For that reason, Figure 19 shows the main suppliers of information to dairy farmers in both channels (see also Appendix 20).

The farmers, who sell the milk to the small dairy, enjoy governmental services, as well use NGOs as a source of information. Particularly, this practice is common for the Northeastern region, where most of the small milk processors operate. Unlike the preceding, collaborators with the large dairies, obtain information from individuals to whom the milk is delivered, either to collection centre or directly to the dairy, which is custom for the Pelagonia region. Other type of information which flows in the channels is the informal one, usually transferred between farmers with common interests or disseminated from veterinary surgeons.

The farmer associations, as a potential source of information, perform activities with different efficiency between regions. The most active are in the Northeastern region, where mainly suppliers to the small dairies perceive the membership in these associations as useful. Not discrepant opinions from the previous were found between farmers in Pelagonia, but the difference was found in the sample group, in this region, represented mostly by suppliers to the large dairy. However, no farmer expressed full trust in associations and perceived the membership as useful. Although farmers greatly collaborate with each other, mainly for producing concentrates on the farm and for information sharing, still they not properly coordinated. The poor horizontal coordination is a result of the mistrust between them and as well, regarding the farmer associations. They cannot relay on associations, because their principals take advantage of the position they have and operate primarily for their own behalf.

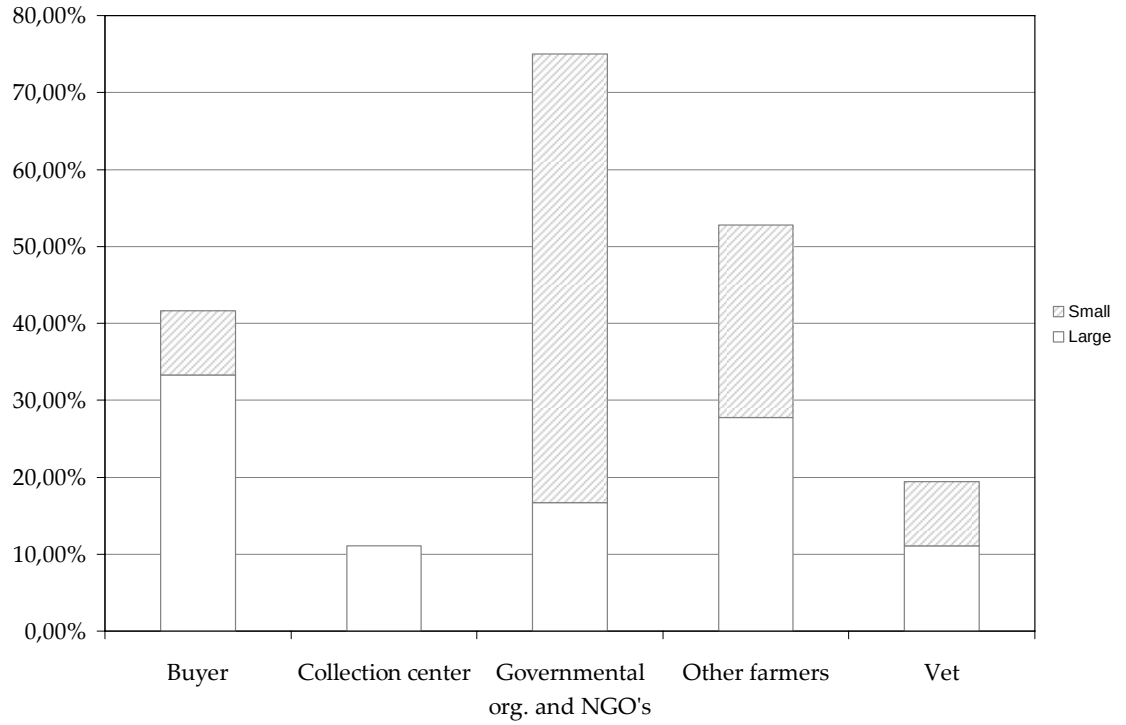


Figure 19 Main information sources in different milk channel (if sell to small or large dairy)
Source: Survey data, 2007

The price of the milk is formed on different bases for different types of buyer. The quality of the raw milk is assessed only by the large processors, whereas the small dairies pay a fixed amount to farmers. However, the information about the milk quality at farm-gate is almost unavailable for farmers. Farmers recurrently receive milk test results which were thought as unreliable (on average trust was calculated to be 2.23, in the scale from 1 to 5). The independent laboratories, from farmers' perspective, seemed to operate on behalf of the dairies. This was found to be one of the major constraints in the communication process between the transacting parties. Farmers seemed to be week in the negotiation process, having low bargaining power regarding the price, even though the dairies do not regularly monitor the farm.

Farmers are attached with the large processors mainly though formal contracts, unlike the farmers engaged with small dairies, where informal agreements are generally decided. Both samples of farmers expressed dissatisfaction of their current agreement with the dairy, even though the ones selling to small processors seemed to be slightly more satisfied than the other group. However, the opposite attitude for the price satisfaction was uttered. All transactions relating to the marketing of raw milk are summarised in Table 6, where farmers' perception was considered.

Table 6 Transaction diversity between two optional channels

Variable	Unit	Type of dairy	
		Small dairy	Large dairy
Negotiate the price	1-5 (1=always accept)	1.08	1.11
Monitoring and control			
Monitor the farm (by dairy)	% yes	16.7	5.6
Milk control (by dairy)	% yes	25.0	88.9
Confirm test results (by farmers)	% yes	-	11.1
Coordination			
Collaboration with other farmers	1-5 (1=not at all)	3.92	4.22
Members of association	% yes	58.3	33.3
Enforcement of contracts			
Type of contract	% formal	8.3	55.6
Pay on time	% always	58.3	72.2
Do not pay	1-5 (1=no chance)	1.33	1.50
Satisfied with the agreement	1-5 (1=not at all)	2.50	2.11
Satisfied with the price	% yes	8.3	11.1

Source: Survey data, 2007

A deeper analysis of the contractual relations is required to sum up all the features that might be important for the farmers to make decisions for contractual arrangement. The ensuing subject is analysed in the following chapter.

6 Analysis and discussion

To detect the farmer's choice among alternative organisational arrangements, a comparison of the costs of transacting under each option was deployed. A link with the empirical content is done with relating the transaction costs to observable attributes of transactions. The internal organisational costs also play a significant role in the decision. Given that transaction costs are difficult to observe and measure, the analysis relies on estimations of reduced-form relationships between observed characteristics and organisational forms. It should be considered that the observations were taken from a non random sample, which however proved to have a good fit for explaining the reality.

6.1 Analysis of the production of milk

In neo-classical economics, a farm is seen as a production function, where the level of output is influenced by a range of inputs specific for the milk production, moreover regarding the feed management practices and other investments which directly affect the costs of production. Unlike this theory, institutional economics is more likely attached to the farm governance, where a multitude other factors, mainly qualitative in nature, influence the level of farm performance. These factors have not only an effect on the production, but moreover on the marketing. All the costs incurred during the economic exchange of the milk are referred as transaction costs, influenced by those specific factors.

Previously in the study, there was an attempt to partially quantify the transaction costs in a way to present their relationship with the total output of milk, following the neo-classical model, so a linear production function was created, having the following form:

$y = -\beta_0 + \beta_a x_a + \beta_f x_f + \beta_c x_c + \beta_s x_s$, where

y	Total daily milk yields per farm;
β_0	Constant;
β_n	Estimated parameters for a particular variable;
x_a	The age of respondents;
x_f	Number of female employed on farm;
x_c	Number of currently milking cows, and
x_s	Daily milk sale per farm.

These variables linked in a linear function proved a significant influence on the production itself. Their quantitative nature enabled model estimation. All factors have a positive sign which suggests that with an increase in the input of these variables, the output of milk on the farm increases as well. However, there are more complex factors which influence the economic performance of dairy farm but are hardly observable, thus cannot be quantified and measured. These costs occur in making economic exchanges, represented by the costs above and beyond the cost of milk production. To describe what has just been said, the qualitative description is required, and subsequently is pursued.

6.2 Household specific variables and transactions

Numerable household specific variables have an impact on transaction costs, such as age, gender, education, and related aversion to uncertainties. These variables influence the cost of information seeking, negotiation, monitoring and enforcement.

Gender, age and education can affect transaction costs in different ways. Gender appears to have a considerable impact on the choices of institutional arrangement. From the results from the logistic regression in the empirical presentation, it was assumed that the number of women that operate the household, especially employed on the farm, affect the choices of buyer. With an increase in the number of women in the household, the impact on the choice of a specific buyer increases. If there are more women in the household, the general decision is to sell to the small dairy, although this average does not diverge significantly with the average to those who choose to sell to a large dairy. An explanation is that men work on a field crops while women spend more time on social events with other farmers, and also have time for different sources of information, as media. But advanced information sources are not well developed in the country, since the institutions for disseminating market information are not performing well. So, informal information being transferred through the channel in the communication processes might increase the uncertainty in the production and marketing, since no other reliable sources were used. Also, the formal information gained through media could be constrained with the aforementioned disadvantage, and might increase uncertainty, since sometimes farmers have low education and invest a little in skill and expertise development so they cannot interpret the information correctly. This is called information asymmetry, which is assumed to give rise to transaction costs.

Age can often be indicative of farming experience, which make certain informational and search costs easier and thus cheaper. This was estimated in the logit model, and it was clearly confirmed that older farmers are more experienced, thus they have great impact to the choice of buyers. Since the sample of respondents is on average middle-aged, they have great experience in cattle farming (20 – 30 years), given that the majority of farmers have inherited the farm as well as the experience in dairying. These farmers spend less effort in searching for new contractors and in negotiating the price, because they are more experienced with the contractual relations, and know the eventualities from the existing types of buyer.

Education matters in terms of reducing the costs of searching for information, knowing available sources and the route how to get it, which also could be a response to the previous experience. The higher the level of education, the more correctly will information be processed, and this will increase its implementation value. The sample farmers have mainly high school education, so they are generally literate having the essential knowledge of communication and negotiation with the buyer, but still do not possess a great expertise and power to limit the opportunism from the other party in the transaction process.

The analysis of the household characteristics is complex. Sometimes none of these variables can influence to make the right choice of buyer, because humans are boundedly rational and cannot judge if the recommended choice would provide the best decision, since individuals cannot predict all possible outcomes in the exchange process. Therefore, sometimes, neither the experience and expertise nor the learning could eliminate bias, but could explain the existing and sometimes possible actions of the farmers.

6.3 Transaction attributes and optional contractual arrangements

Asset specificity is identified to have a strong impact on transaction costs. Agricultural production includes more transaction specific assets than most other industries. Most dairy farms in the country are small, privately owned, and run as family businesses. Transaction costs in milk production specifically emerge from dealing with large numbers of small farms, and fragmented production units are difficult to deal with. Milk is a time specific commodity, referring to time pressure to do the transaction. Because it is perishable, frequent deliveries must be done, so the small and fragmented farms protect the quality of milk, and also increase the price for transportation. This was not found as a crucial problem among large producers, since their farms have cooling tanks, so the milk is exposed to less frequent transactions, and the milk has higher quality. Furthermore, large milk producers make higher investments in other farm-specific assets as well, specifically in high selective breeds, hygienic and management practices. The high and steady quantity and quality output increases the bargain power of the large holders, especially those who own about 100 cattle. However, this type of farms is rare in the country, so most farmers have poor relationships with the buyer.

The milk supply mostly consists of small farms that implemented low risk investments. It is very common for the smallholders to be engaged with a small dairy which do not require specific production standards. The transactions between them are organised with informal agreements and milk is paid with a fixed price. The contracting costs are significant as social relations between the transacting parties need to be maintained. However, trust is established through maintaining good social relationships, which reduce the opportunistic behaviour to some extent. Small dairies face monitoring costs with regard to farm monitoring, especially they occasionally monitor the family farms (6-30 cattle), in order to provide better social relationships with the farmers. Dairies have increased interest purchasing their milk, since it has better quality, and also the large quantity reduces the dairy's transportation costs.

Large farmers are primarily involved with large dairies by formal written contracting. The contract terms are simple and result in low contracting costs. But the contract enforcement through court is constrained since the legal system in the country is poorly functioning, so the institutional arrangements in the milk channels are disrupted. Even though contracts formally link the large milk producers with large processors, the agreements are easy to manipulate by the both parties, so one will deceive the other. Especially, the possibility of opportunistic behaviour from large processors may concern the results from the tested milk. A major concern for farmers is the difficulty to verify the test results. Farmers do not have access to the testing procedure so they feel they have been deceived and paid a low price. Thus, the trust is limited, which implies transaction costs.

The reverse relationships exist when smallholders are engaged with large dairies, and vice versa, accordingly the related contractual relations are developed. The only exception is that large holders, involved in either formal or informal contracting, have greater bargaining power.

Considering the theoretical concept regarding the investment characteristics and frequency of transactions, the subsequent governance structure should be depicted as illustrated in Figure 20, if good relationships under certain regulative were developed. The frequency of transaction does not show a particular influence on the level of transaction costs, but it could elucidate the current or the right institutional arrangement.

		Investment characteristics		
		Nonspecific	**Mixed**	**Idiosyncratic**
Frequency	**Occasional**	**Market governance**	**Trilateral governance**	Large farms
	Recurrent		**Bilateral governance**	**Unified governance** Small farms

Figure 20 Effective governance structure of the farms in the country if operate under regulation
Source: Williamson, 1985, 79 – modified

The assets employed in the milk production are hard to redeploy in other uses, so dairy farms have high physical specific investments. Large milk producers face occasional transacting frequency, since they sell the milk every second day, unlike the smallholders faced with recurrent transactions, selling the milk twice a day. So, as theory suggests, between the large farms and the buyer a third party should intervene, officially chosen to make decisions between the involved parties or the government should take involvement; whilst smallholders should join into one organisation. However, the situation in the country is far different from the theoretical insight. The current arrangements result in high transaction costs which affect the farms' performance.

Milk producers are exposed to high uncertainty of environmental factors. If the bad weather conditions destroy the feed crop, the farmer will be forced to purchase feed, and it costs more than to produce the feed on the farm. This increases the production costs. However, marketing costs, under high uncertainty related to human behaviour might be higher for farmers than under environmental uncertainty, especially if they occur continually. Further, emphasise would be given to the risk of the payment received from the dairy. Even though farmers experience delays in payment, they are risk averse with regards to not being paid at all. However, sometimes dairies, particularly large ones, do not hold to the agreed way of payment and to the agreed price, so they pay farmers in kind, especially in yellow cheese. The increased uncertainty in payment creates dissatisfaction among farmers and decreases their trust. As all contracts are incomplete the possibilities of opportunistic behaviour with the trading partner arise, and thereby enforcement costs are high.

Farmers engaged with small dairies – although paid with fixed price so the risk of not being paid according to the test results is eliminated – still suspect they become cheated regarding the milk quantity measured by the dairy. However, the enforcement costs are not as high as being involved with the large dairy, since farmers expressed tolerance with that kind of behaviour as long as they are satisfied with the price. Particularly, these farmers have not invested much in hygienic and quality standards and thus accepted to be paid with fixed price. As long as they receive regular payment, they are satisfied. They find that the costs of enforcement if engaged with large dairy are lower.

The two milk marketing channels face dissimilar agency problems and transaction costs. Agency problems arise because of the impossibility of perfect contracting so they give emphasise on the monitoring costs. The key question is which milk marketing channel provides better organisational arrangement for farmers, with reduced transaction costs, and if the size of the farm might incentive aberration from the contemporary contractual relation.

7 Conclusions

This chapter intends to address the principal aim of the study which is *how the transaction costs affect the efficient performance of the dairy farms* in the Republic of Macedonia and *how these influence the choice between alternative buyers.* The accomplishment of the prime objective would be achieved with the answers from the following questions, which were highlighted in chapter 1:

- *How is the dairy farming characterised?* (Size, structure and organisation of the dairy farms; products marketed; physical environment within the marketing, *etc.*).
- *How do the transaction costs affect the marketing performance of a dairy farm?*
- *What is the farmers' choice of buyers?*

7.1 Farm characterisation

Dairy farming is spread all over the country except in the high mountainous regions where the costs of milk collection would be very high. The main milk production areas are the Pelagonia region in the south, Polog region[11] in the north-west and the Northeastern region in the country. The Skopje region, even though is not a major, still is important because the dairy farmers from the rural areas have potential to develop their production, as since 2008 the largest dairy in the country was established in the nearby neighbourhood. The dairy farming throughout the country differs fairly much, mainly due to the different institutional arrangements which have evolved differently over time. The conventional dairy production areas have a long tradition and experience in milk production, since they have established long-term relationships with their buyers, although sometimes under not agreeable conditions.

The most intensive milk production area is Pelagonia, where farmers usually own herds with 10 to 30 cattle. In this region, there are specialised farms (with roughly 100 cattle), which are not so common in the rest of the country. The Northeastern region has less intensive milk production since the farms are smaller. Due to the neighbouring dairies in the region, which are principally small, farmers operated under bad production conditions, since the quality of the produced milk does not affect the farm-gate price. At last, in the Skopje region mainly small-holders are found having one to five cattle in the herd. Even though of small size, they have well developed farm conditions, and some of them have established a farm accounting system, which is the first step for development of the managerial practises. Their small size is explained by the fact that Skopje is in general an urban region that offers a wide range of employment opportunities, so farming is not the major occupation of the household. Even the rural areas in this region are more oriented towards early vegetable production.

Dairy production is generally characterised by small, subsistence family farms oriented primarily towards milk production, which is the major product marketed. Dairy products besides milk are not produced at farm level. There are large farms, as well, not differing from the preceding in their orientation, but only in the farm organisation and facilities, which are more developed in the large households, especially in those with above 30 cattle. Farmers mainly produce feed at farm, and large holders utilise more land than others. These households also differ in labour composition, so have hired full-time labour for the farm

[11] The survey did not cover the area of Polog.

activities since the family is not enough for the all engagements in the milk production. Other households have only family labour to manage the farm.

The milk supply slightly differs by farm size, which is also dependent on the type of dairy located in the vicinity. The organisation of the milk supply in Pelagonia is the most developed. The small milk suppliers collect the milk at farm in a milk can and take it to the collection centre with small barrows twice a day. From this point, the milk is collected every day by a milk tanker and thereafter transported to the processing plant. Larger suppliers store the milk at farm in bulk and cooled with lacto freezers for few days, where after it is collected by the dairy and transported with refrigerated trucks. Farmers from Skopje and Northeast have less advanced milk delivery, particularly milk is collected from the farm-gate every morning by the dairy's transport vehicle, irrespective of the farm size and type of dairy.

7.2 Transaction costs in dairy farming

As transaction costs are difficult to measure the analysis of transaction costs relies on estimations of reduced-form relationships between observed characteristics and organisational forms. There are different environmental and human factors which combined together influence the transaction cost dimension.

Dairy farming includes highly specific assets, which cannot be redeployed in many other uses. The dairy farm assets in the country are high risk investments, especially for the small-scale farms, which is the result of the high uncertainty in markets caused by the opportunistic behaviour between the involved parties, as contract enforcements are not run under legislation. So, the parties involved in the transacting process may deceive one another. Farmers are more vulnerable in dealing with the opportunism arisen from the buyer's side, submitting dairies to work on their own behalf, since they have weak bargaining and control power due to their small size and the not well developed horizontal coordination. They also face other constraints due to the lack of organisational techniques, such as implementing feed management and hygienic standards, and also marketing practices. These disadvantages diminish farmers' power, leaving them exposed to great uncertainties, especially for the accuracy of the agreed price, since the transactions are held under not regulated institutional environment. All these challenges facing the Macedonian farmers, contribute to high transaction costs, which lead to poor farm performance.

The transaction cost theory aims to explain the institutional arrangements. Given the theoretical propositions it can be concluded that dairy farms in the country operate under conditions of high asset specificity and high uncertainty, due to human factors. These circumstances give rise to transaction costs for the Macedonian dairy farmers. Therefore the most efficient governance to organise the economic activity would be hierarchy. This is illustrated in Figure 21.

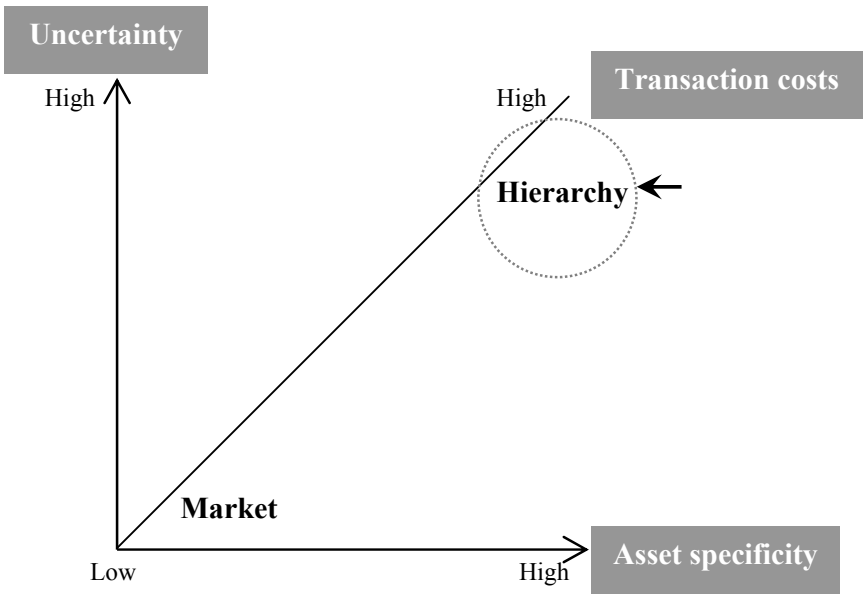


Figure 21 The theoretical proposition of governance type for the dairy farmers in the country
Source: Grover & Malhotra, 2003, 458 – own depiction

The dairy farming institutional arrangements in the Republic of Macedonia differ from the theoretical perception. The farmers are not coordinated properly, so given the high transaction costs and the poor hierarchical composition, farmers are fated to organisational failure. However, there are exceptions, especially for the large holders. They operate under more organised institutional arrangements, since they are large and since the implemented farm management and marketing practices are more advanced. Their milk output is in bulk and with pleasing quality, so these stimulate buyers to decrease their opportunistic behaviour, since they have a great interest to contract the large farmers.

The size of the farms affects the contractual relations with the buyer. The institutional arrangements in the two alternative milk marketing channels differ significantly, yet there are differences in the channel itself regarding the suppliers' farm conditions. The current governance structure between farmers and the small and large dairies is described below.

7.3 The farmers' choices of buyers

The institutional arrangements differ fairly much between the farmers and the alternative raw milk channels. Figure 22 shows the discrepancy of the incurred transaction costs that *farmers are facing* during the transaction of their output with the chosen type of buyer.

The *entrance costs* to a certain type of dairy are represented with how well the farmers are informed for the particular conditions in both of the alternatives. Generally, the search costs for entering to small dairy are lower, since farmers have maintained good social relationships with this buyer, as the dairy is not a complicated hierarchical organisation and farmers have easy access to the internal information. The demands that small dairies have on good quality products encourages farmers to form informal contractual relation with the dairy, especially

the small-scale producers who have not fulfilled the basic production handled standards. Farmers who have entered into large dairies' contractual arrangements experience high transaction costs. Particularly, large dairies demand high quality product or/and large quantity, so this limits the access of the farmers. Moreover this hinders the small-holders (who own 1-5 cattle) to contract the dairy. The large milk producers have easy entrance to the large dairies, but they are very few.

<table>
<tr><th>Large dairy processor
Small dairy processor</th><th>High transaction costs for the farmer</th><th>Low transaction costs for the farmer</th></tr>
<tr><td rowspan="2">High transaction costs for the farmer</td><td rowspan="2">Monitoring & control costs</td><td>Coordination costs</td></tr>
<tr><td>Maintaining contracts</td></tr>
<tr><td rowspan="3">Low transaction costs for the farmer</td><td>Search & information (entrance costs)</td><td rowspan="3"></td></tr>
<tr><td>Bargaining costs</td></tr>
<tr><td>Enforcement costs</td></tr>
</table>

Figure 22 The general transaction cost level in the two optional channels from farmers' perspective
Source: Survey data, 2007

Since the small dairies pay a fixed price for the milk, farmers do not negotiate over the price. These farmers are mainly satisfied with the price since they face low risk investments. Therefore, the *bargaining costs* are low. Farmers attached to the large dairy experience high costs for negotiating the price, since they do not trust the buyer's the test results from the milk control, and they desire a higher price than the evaluated, as they are convinced about the good quality of their milk. This gives rise to *monitoring and control costs*. Farmers deal with high uncertainty for not being paid accurately. The monitoring and control costs are also high for the farmers who sell to small dairies, since the trust among them is not entirely developed. These farmers fear from an opportunistic behaviour from the buyer in regards how correctly their output has been weighted, and also suspect that the dairy is involved in adulteration processes.

Usually, the farmers who sell to small dairies are small-scale. These farmers are not coordinated properly and face high costs due to the low coordination, while it is the reverse situation for the farmers engaged with large dairies. Even the small-holders who sell to a large dairy are better coordinated than those who sell to a small one, with regards to the milk collection; therefore they face lower *coordination costs*.

The costs of making sure the other party sticks to the terms of the contract, and taking appropriate action, are *enforcement costs*. These costs are low for the farmers engaged with

small dairies since there are not many features in the informal contract that should be complied to as the milk is paid a fixed price, and the agreed terms are not very demanding as regards milk quality. Furthermore, there is not limited quantity that should be delivered. The contrary costs are dealing farmers involved in a contractual relationship with large buyer, because they have established formal written contracts. It is very difficult for farmers to track the dairy's aberration from the agreement, especially regarding the price, as the legislation is poor, which condition incentive the opportunism. However, the long term written contracts decrease the *costs of maintaining contracts*, while the informal agreements contribute to amplifying these costs, because farmers are uncertain about the next sale and the future terms of the agreement, which might change in a short period of time.

The levels of the costs incurred during the exchange in both alternative channels also differ fairly much with regard to the size of the farm that supplies them, as well as of how well equipped it is. Therefore, when farmers choose a milk channel, they take into consideration the preceding attributes or challenges. All farmers could lose or gain, more or less, from the contractual arrangement with the buyer according to the strengths and weaknesses that farmers are dealing with.

Epilogue

Many of the analysed relationships between transacting parties might have changed since the survey was conducted (2007). A new large dairy, Swedmilk, was incepted and new contractual relations were developed. The new dairy's contract terms seemed promising, especially for the contract enforcement under normal circumstances, where the contract will have its real meaning and value. The contractual arrangement will be changed with this new dairy, and the specific asset investments on the farm will change, since the dairy promised the farmers accessible credits for purchasing cooling tanks. Therefore, the frequency of milk delivery will change; accordingly the farm arrangement and the institutional environment will change as well. This might spur farmers to increase their herd sizes. Thus, an institutional change in the dairy sector might happen, if Swedmilk maintains the promised contractual relationships, and if farmers are satisfied with those. From the preceding it can be perceived that not only governmental regulative and policy measures could be attached to the change in institutions, but sometimes institutions evolve due to other causes independent from the country's legislation.

TCE could provide an understanding of the past and current institutional changes in different sectors of one country; as well these could serve as a base for future development, with tracking the system's transformation. That is why this kind of study is useful, especially for transition countries like the Republic of Macedonia and for the developing world as well. Therefore it will be constructive and helpful to have this kind of analyses from different sectors, especially if they could involve the whole marketing chain of one industry.

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Personal messages

Dimitrievski, Dragi
Professor, Faculty of Agricultural Sciences and Food, Skopje, R.Macedonia
Personal meeting, 2007-05-14

Gjorgjevski, Dragan
Local Coordinator, MAASP, *Kumanovo Unit,* R.Macedonia
Personal meetings, 2007-10-16 and 2007-10-16

Kotevska, Ana
Professor Assistant, Faculty of Agricultural Sciences and Food, Skopje, R. Macedonia
Personal meetings, 2007-11-12, 2007-11-21, and 2007-12-11

Mark-Herbert, Cecilia
Professor Assistant, SLU, Uppsala, Sweden
E-mail contact, 2008-02-16

Martinovska-Stojcheska, Aleksandra
Professor, Faculty of Agricultural Sciences and Food, Skopje, R. Macedonia
Personal meetings, from 2007-09-21 continually until 2008-01-08

Nikolov, Jordan
Raw Milk Manager, *Swedmilk Makedonija,* Skopje, R. Macedonia
Personal meetings, 2007-06-09 and 2007-07-15

Olsson, Ulf
Professor, SLU, Uppsala, Sweden
Personal meetings, 2008-01-24, 2008-02-05, and 2008-02-12

Sandberg, Christian
Local Coordinator, MAASP, Skopje Unit, R. Macedonia
Personal meeting, 2007-09-03

Tasheva, Elisaveta
Regional Manager, National Extension Agency, Skopje Unit, R. Macedonia
Personal meetings, 2007-10-19 and 2007-11-07

Appendices

Appendix 1 Dairy processors' characteristics

Dairy	IMB	Ideal Shipka	Zdravje Radovo
No of plants	1	1	2
Raw milk processing capacity	200 tonnes/day	100 tonnes/day	20 + 30 tonnes/day
Raw milk processed	120 tonnes/day in winter and 170 tonnes/day in summer	80 tonnes/day	18 tonnes/day
Turnover	27,000,000 €	9,000,000 €	5,000,000
No of employee	100	95	64
No of contracting farmers	4,000	1,400 – 2,000 (depending on the season)	800 smallholders + 30 farms
No of milk collection centres	1 large near Skopje + 15 smaller	5 near Bitola and Prilep	5 near Kumanovo and Skopje
Transport cost – farm to dairy	1.5 MKD/litre	1 MKD/litre	1 MKD/litre
Average price for the raw milk	16 MKD/litre	16.2 MKD/litre	16 MKD/litre
Price determination	% milk fat, % protein, hygienic quality parameters	% milk fat, % protein, hygienic quality parameters	Flat rate
Milk fat % (average)	3.7	3.8	3.6 – 3.7
Milk protein % (average)	3.2	3.2	3.2
Bacteria	100,000 – 1,000,000	100,000 – 1,000,000	1,000,000 – 3,000,000
Somatic cells	400,000	400,000	400,000
Laboratory	Mlekokontrol, Bitola (independent)	Mlekokontrol, Bitola (independent)	Land O'Lakes, Skopje (independent), once a month
Payment target	30 days	30 days	30 days
Marketing of dairy products	Own wholesale distribution centre	-	Own wholesale distribution centre
Marketing via own shops (%)	3	5 (together with export)	0
Marketing via wholesale trader (%)	50	15	20
Marketing via retail chains (%)	47	80	80
Transport cost – dairy to market	0.5 – 1 MKD/kg	0.5 – 1 MKD/kg	0.5 MKD/kg

Source: EU Framework Contract, 2006

Note: The outlined dairies are the main purchasers of raw milk of the sample farmers.

Appendix 2 Swedmilk's contractual arrangements

	Currently	Planned
No of employees	70	100
Daily output of various dairy products (litres)	50,000	250,000
Partner farmers	Subcontractors with own milk collection points Farms with own lactofreezer Group of farmers with common lacto freezer Subcontractors with own organisation for milk collection	
Contracting	Long – term (1 – 5 years)	
Average price of the raw milk per class	17.93 MKD/litre = extra class (+12%) 17.29 MKD/litre = I class (+ 8%) 16.01 MKD/litre = II class 14.41 MKD/litre = III class 12.81 MKD/litre = IV class	
Price determination	% milk fat, % protein, hygienic quality parameters	
Laboratory	Swedmilk, Skopje (according to EU standards)	
Payment target	30 days	
Way of payment	Through bank (NLB Tutunska Banka) *No payments in kind*	

Source: Swedmilk, Macedonia, 2007

Appendix 3 Weather indicators (average for 2005)

		Location		
Indicator		Bitola	Skopje/Kumanovo	Kriva Palanka
Annual temperature (°C)	(mean)	11.13	12.24	10.08
	(max)	17.15	17.93	16.79
	(min)	5.15	7.31	4.36
Annual rainfalls (mm)		643.8	574.7	672.3
Rainy days		89	85	112

Source: SSO, Yearbook 2006

Note: Even though Skopje and Kumanovo constitute different statistical regions, the meteorological data for both is presented in one column, since Kumanovo doesn't have a meteorological station, and these localities (the city and the rural area nearby) are close to one another. The Northeastern region (herein, represented by Kumanovo), has a meteorological station located in Kriva Palanka, but the climate there significantly differ from the climate in Kumanovo (because Kriva Palanka covers more mountainous area) , which, as mentioned before, has more similarities with Skopje.

Appendix 4 Respondents' characteristics

Variable	Region			Total	F
	Pelagonia	Northeastern	Skopje		
Male respondents (%)	*93*	*90*	*17*	*77*	
Age (mean (years); s.d.)	*40.7 (9.7)*	*52.7 (16.3)*	*50.3 (12.9)*	*46.6 (13.6)*	*2.86*
<31 (frequency; %)	2 (14)	1 (10)	-	3 (10)	
32-39	5 (36)	2 (20)	-	7 (23)	
40-47	4 (29)	-	3 (50)	7 (23)	
48-55	2 (14)	3 (30)	2 (33)	7 (23)	
56-63	1 (7)	1 (10)	-	2 (7)	
≥64	-	3 (30)	1 (17)	4 (13)	
Education (mean; s.d)	*3 (0.39)*	*2.8 (1.03)*	*2.5 (0.84)*	*2.8 (1.58)*	*0.95*
*2 = 8 years; 3 = high school					
4 year primary (freq.; %)	-	1 (10)	1 (17)	2 (7)	
8 year primary	1 (7)	2 (20)	1 (17)	4 (13)	
High school	12 (86)	6 (60)	4 (67)	22 (73)	
Two years undergraduate	1 (7)	-	-	1 (3)	
Bachelor degree	-	1 (10)	-	1 (3)	
Experience in cattle farming (mean (years))	*16.71*	*29.50*	*37.17*	*27.79*	
0-5 (frequency; %)	1 (7)	-	-	1 (3)	
6-10	4 (29)	4 (40)	-	8 (27)	
11-20	4 (29)	-	-	4 (13)	
21-30	4 (29)	-	2 (33)	5 (20)	
31-40	1 (7)	1 (10)	1 (17)	3 (10)	
≥41	-	5 (50)	3 (50)	8 (26)	

Source: Survey data, 2007

Appendix 5 Household characteristics

Variable	Region			Total	F
	Pelagonia	Northeastern	Skopje		
No of males working on farm					
Sum	26	16	10	52	
Mean (s.d)	1.86 (0.95)	1.60 (0.70)	1.67 (0.52)	1.73	0.32
No of females - / /-					
Sum	16	13	7	36	
Mean (s.d)	1.14 (0.77)	1.30 (0.67)	1.67 (0.41)	1.20	0.16
No of children (<18) - / /-					
Sum	1	4	2	7	
Mean (s.d)	0.07 (0.27)	0.40 (0.10)	0.33 (0.85)	0.23	1.10
Income derived from cattle farming (%)	*69.1*	*68.5*	*47.1*	*61.5*	
Main activity in cattle breeding (100%)	*Milk sale*	*Milk sale*	*Milk sale*		
Secondary activity in cattle breeding (100%)	*Calf/Heifer sale*	*Calf/Heifer sale*	*Calf/Heifer sale*		

Source: Survey data, 2007

Appendix 6 Herd size and composition

Variable	Region			Total	F
	Pelagonia	Northeastern	Skopje		
Herd size (mean (heads); s.d)	*25.57 (23.57)*	*10 (5.12)*	*8 (10.81)*	*16.86*	*3.36*
1-5 (%)	-	20.0	83.3	23.3	
6-10	28.6	50.0	-	30.0	
11-30	50.0	30.0	-	33.3	
≥31	21.4	-	16.7	13.4	
Herd composition (mean (heads); s.d)					
No of cows	13.9 (9.49)	7.2 (3.79)	3.5 (3.33)	9.6	5.33
No of milking cows	9.6 (9.60)	5.9 (3.90)	2.3 (2.34)	6.9	2.33
No of bulls	0.4 (0.76)	0.7 (1.25)	0 (0)	0.4	1.15
No of calves and heifers	11.3 (14.20)	2.1 (1.79)	4.5 (7.61)	6.6	2.45
Milking cows – total cows ratio	*0.82*	*0.69*	*0.67*	*0.72*	

Source: Survey data, 2007

Appendix 7 Cattle breed composition (%)

Breed	Region			Total
	Pelagonia	Northeastern	Skopje	
Holstein – Friesian	28.6	60.0	-	33.4
East – Friesian	64.3	-	100.0	50.0
Montafon	7.1	-	-	3.3
Simmental	-	40.0	-	13.3

Source: Survey data, 2007

Appendix 8 Structure of the farms

Arable agriculture land (ha)	Number of a agriculture holdings
1 -2	39,817
2 – 3	18,767
3 – 4	8,960
4 – 5	5,222
5 – 6	3,118
6 – 8	3,083
8 – 10	1,584
10 – 15	1,047
15 – 20	342

Source: Annual Agriculture Report, 2006

Appendix 9 Inputted land

Variables	Region			Total
	Pelagonia	Northeastern	Skopje	
Total utilised arable land (mean (ha); s.d.)	*14.6 (12.48)*	*9.8 (4.99)*	*3.0 (1.22)*	*10.7*
Land owned	6.6 (5.49)	5.4 (2.01)	2.1 (1.60)	5.3
Land leased	8.1 (9.14)	4.4 (4.17)	0.9 (0.83)	5.4
Land for crop (feed) production (mean (ha); s.d.)	*14.0 (12.24)*	*9.0 (3.63)*	*1.9 (0.38)*	*9.9*
Land for feed - total arable land *ratio*	*0.92*	*0.96*	*0.63*	*0.93*

Source: Survey data, 2007

Appendix 10 Feed components

Feed		Region			Total
		Pelagonia	Northeastern	Skopje	
Bulky feed produced on farm (%)		69	71	57	67
Concentrate produced on farm (%)		53	51	48	51
Supplements (premixes) used (mean; mode)	0=no 1=yes	0.8 (1)	0.9 (1)	0.7 (1)	0.8 (1)

Source: Survey data, 2007

Note: The percentage is derived from the total usage of feed per category.

Appendix 11 Inputted farm labour

Variables	Region			Total
	Pelagonia	Northeastern	Skopje	
Total farm labour employed (mean; s.d.)	*3.1 (1.07)*	*3.3 (1.57)*	*3.2 (1.47)*	*3.2 (1.29)*
Family labour full time (mean; s.d.)	2.4 (1.08)	1.9 (0.99)	2.2 (1.33)	2.17 (1.09)
Family labour part time (mean; s.d.)	0.6 (0.87)	1.3 (1.64)	1 (0.89)	0.93 (1.19)
Hired labour full time (mean; s.d.)	0.1 (0.36)	0.1 (0.32)	-	0.1 (0.31)
Hired labour part time (mean; s.d.)	-	-	-	-
Utilised land – labour *ratio*	4.75	2.97	0.95	3.38
Herd size – labour *ratio*	8.33	3.03	2.53	5.32

Source: Survey data, 2007

Appendix 12 Average frequency of veterinary visits per region depending on the herd size

Herd size	Region			Total
	Pelagonia	Northeastern	Skopje	
1-5	-	1.5	1.7	1.6
6-10	2.3	5.2	-	3.9
11-30	3.9	7.3	-	4.9
>30	5.7	-	3.0	5.0
Total by region	*5.1*	*3.8*	*1.9*	*3.9*

Source: Survey data, 2007

Appendix 13 Training of the respondents in cattle farming

Variable		Region			Total
		Pelagonia	Northeastern	Skopje	
Training in cattle farming (%)	*0=no*	*57*	*10*	*67*	*43*
1=yes		*43*	*90*	*33*	*57*
1-5 (mean; s.d.)		-	0.5 (0.71)	0.4 (0.55)	0.43 (0.53)
6-10		0.5 (0.58)	1 (0)	-	0.78 (0.44)
11-30		0.6 (0.53)	1 (0)	-	0.7 (0.48)
>30		0 (0)	-	0 (0)	0 (0)
Total by region		*0.4 (0.32)*	*0.9 (0.51)*	*0.3 (0.52)*	*0.6 (0.50)*

Source: Survey data, 2007

Appendix 14 Age of the cows

Cows' age at average per farm	Region		
	Pelagonia	Northeastern	Skopje
Mean (s.d.)	3.96 (0.771)	5.20 (1.033)	4.33 (1.211)
Variance	0.595	1.067	1.467
Coefficient of variance	19.45	19.86	27.95
Minimum	3	4	3
Maximum	5	7	6
Median	4	5	4.5

Source: Survey data, 2007

Appendix 15 Milk productivity of a cow in lactation compared by regions

Productivity per cow (one lactation) (litres)	Region		
	Pelagonia	Northeastern	Skopje
Mean (s.d.)	6,536 (924)	6,253 (935)	5,388 (1359)
Variance	854,603	873,401	1,848,097
Coefficient of variance	14.14	14.95	25.23
Minimum	4,575	4,880	3,660
Maximum	7,625	7,625	7,625
Median	6,405	6,100	5,185

Source: Survey data, 2007

Appendix 16 Daily milk sale per region

Milk sale per day (litres)	Region		
	Pelagonia	Northeastern	Skopje
Mean (s.d.)	206.1 (216.8)	82.1 (62.3)	43.5 (36.2)
Variance	46981.5	3886.3	1312.3
Coefficient of variance	105.18	75.93	83.28
Minimum	35.0	16.0	17.0
Maximum	900.0	220.0	115.0
Median	150,0	77.5	32.5

Source: Survey data, 2007

Appendix 17 Results from the general linear model for the total daily milk output per farm

Variable	F	P - value
Age of respondents	7.28	0.022
No of female working on farm	12.84	0.005
No of milking cows	76.35	0.000
Experience in cattle faming (years)	6.52	0.006
Veterinary frequency	12.85	0.000
Milk sale	14.59	0.003

S = 8.35611; R-Sq = 99.90%; R – Sq (adj) = 99.72%

Source: Survey data, 2007

Appendix 18 Frequency of the chosen type of dairy regarding the size of the farm

	Type of dairy		
Herd size	Small	Large	Total
1 – 5	5	2	7
6 – 10	3	3	6
11 – 30	4	11	15
> 30	-	2	2
Total	12	18	30

Source: Survey data, 2007

Appendix 19 Results from the binary logistic regression for the choice of dairy using a single factor in the function

Variable	Z - value	P – value
Experience (21-30 years)	-2.32	0.020
Herd size	-2.34	0.019
Number of cow	-2.36	0.019
Age of the cows	2.23	0.026
Milk sale	-2.37	0.018
Type of contract	2.28	0.022
Short-term contract	2.56	0.010
Milk control by the dairy	-3.17	0.002

Source, Survey data, 2007

Appendix 20 Sources of information between the two channels per region (counted)

		Type of dairy		
Region	Info source	Large	Small	Total
Northeastern	Buyer	1	1	2
	Governmental org. and NGO's	-	6	6
	Other farmers	-	1	1
	Vet	-	1	1
Pelagonia	Buyer	5	-	5
	Collection center	2	-	2
	Other farmers	5	-	5
	Vet	2	-	2
Skopje	Governmental org. and NGO's	3	1	4
	Other farmers	-	2	2

Source: Survey data, 2007

Appendix 21 Transaction diversity between the alternative channels depending on the size of the farm

Variable	Unit	Herd size	Type of dairy	
			Small	Large
Negotiate the price	1-5 (1=always accept)	1-5	1.2	1
		6-10	1	1
		11-30	1	1
		>30	-	1.5
Monitor the farm (by dairy)	% yes	1-5	0	0
		6-10	20	0
		11-30	50.0	0
		>30	-	25.0
Milk control (by dairy)	% yes	1-5	40.0	0
		6-10	20.0	100.0
		11-30	0	100.0
		>30	-	100.0
Confirm test results (by farmers)	% yes	1-5	0	0
		6-10	0	0
		11-30	0	25.0
		>30	0	0
Collaboration with other farmers	1-5 (1=not at all)	1-5	3.8	4
		6-10	4.4	4.5
		11-30	3	4.25
		>30	-	4
Association members	% yes	1-5	40.0	0
		6-10	80.0	25.0
		11-30	50.0	50.0
		>30	-	25.0
Type of contract	% formal	1-5	0	0
		6-10	25.0	50.0
		11-30	0	70.0
		>30	-	50.0
Pay on time	% always	1-5	28.6	0
		6-10	75.0	100.0
		11-30	50.0	66.7
		>30	-	66.7
Do not pay	1-5 (1=no chance)	1-5	1.6	1
		6-10	1.2	2.75
		11-30	1.5	1.5
		>30	-	1
Satisfied with the agreement	1-5 (1=not at all)	1-5	2.4	1
		6-10	2.2	2.25
		11-30	3.5	2.5
		>30	-	1.75
Satisfied with the price	% yes	1-5	0	0
		6-10	20.0	0
		11-30	0	13.0
		>30	-	25.0

Source: Survey data, 2007

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Distribution:

Sveriges lantbruksuniversitet
Institutionen för ekonomi
Box 7013
750 07 Uppsala

Tel 018-67 2165

Swedish University of Agricultural Sciences
Department of Economics
P.O. Box 7013
SE-750 07 Uppsala, Sweden

Fax + 46 18 673502