

# Dairy Firms' Characteristics and Practices Intended for Economic Sustainability and Food Safety in Aydın Region of Turkey <sup>[1]</sup>

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## Summary

Many factors are able to impact economic sustainability and food safety concepts in dairy firms. This study aimed at identifying key constraints for economic sustainability and food safety practices in dairy firms. The paper consisted of a survey study carried out by 28 firms in Aydın, Turkey. In order to analyze the firms' characteristics and operations efficiently, they were separated into six groups based on a cluster analysis. The research was performed in two dimensions. In the first dimension, descriptive statistics, such as age, education level of the firm managers/owners, the number of product mixes, and total employees, reel firm capacity, net firm income, were identified due to their critical value being related with economic sustainability. In the other dimension, present practices and attitudes were analyzed for economic sustainability and food safety approaches. Small-scale production and marketing facilities focused on the domestic market were the most important characteristics of the firms. In the short run, although it was discovered that these firms would be able to achieve economic sustainability and sufficient food safety practices in the region, they would need to research enlargement facilities related to firm size and access to the international market conditions in the long run.

**Keywords:** Dairy firms, Economic sustainability, Food safety, Milk processing, Turkey

## Ekonomik Sürdürülebilirlik ve Gıda Güvenliğine Yönelik Olarak Türkiye'nin Aydın Yöresindeki Süt ve Süt Ürünleri Firmalarının Karakteristikleri ve Uygulamaları

### Özet

Süt ve süt ürünleri firmalarında, birçok faktör ekonomik sürdürülebilirlik ve gıda güvenliği konseptlerine etki edebilmektedir. Söz konusu çalışma, süt ürünleri firmalarında ekonomik sürdürülebilirlik ve gıda güvenliği uygulamalarına yönelik anahtar kısıtları tanımlamayı amaçlamaktadır. Makale, Türkiye'nin Aydın ilindeki 28 süt ürünleri firması ile yapılan anket çalışmasından oluşmaktadır. Firmaların karakteristiklerini ve uygulamalarını etkili olarak analiz edebilmek için, firmalar kümeleme analizine dayalı olarak 6 gruba ayrılmıştır. Araştırma iki boyutta yürütülmüştür. Birinci boyutta; firma yöneticileri/sahiplerinin yaşı, eğitim düzeyi, ürün çeşidi, toplam işçi sayısı, reel firma kapasitesi ve net firma geliri gibi ekonomik sürdürülebilirlik açısından önemli olan bazı parametreler tanımlanmıştır. Diğer boyutta ise; mevcut uygulamalar ve tutumlar ekonomik sürdürülebilirlik ve gıda güvenliği yaklaşımlarına yönelik olarak analiz edilmiştir. Küçük ölçekli üretim ve iç pazara yoğunlaşan pazarlama koşulları, firmaların en önemli karakteristikleridir. Kısa dönemde, yöredeki firmalar ekonomik sürdürülebilirlik ve yeterli gıda güvenliği uygulamalarını sürdürebilecek gibi görünmesine rağmen, uzun dönemde ise firmalar, ölçeğini genişletmek ve uluslararası pazar koşullarına ulaşabilmenin imkanlarını araştırmak durumundadırlar.

**Anahtar sözcükler:** Süt ve süt ürünleri firmaları, Ekonomik sürdürülebilirlik, Gıda güvenliği, Süt işleme, Türkiye



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## INTRODUCTION

Due to the strategic value of milk and milk products for the nutrition of human beings and the role of dairy industry in rural development and food economics <sup>1</sup>, determining economic sustainability and food safety practices implemented in dairy firms is a very important topic.

Sustainability is a multifunctional concept and thus is not easy to assess or to evaluate. It includes the ecological, economic, and social dimensions of sustainability <sup>2</sup>. Sustainability follows a normative approach; the Brundtland Commission <sup>3</sup> defines sustainability as a concept that meets the present needs without compromising the needs of future generations. Different approaches can be used to measure sustainability at farm and firm levels <sup>4-6</sup>. Moreover, indicator sets were developed by the European Commission <sup>7</sup> and the Organization of Economic Cooperation and Development (OECD) <sup>8</sup>. Another methodology, the Sustainable Value Approach (SV), follows an idea of financial economics that the return on costs must cover the costs of capital <sup>9</sup>. Food safety in the Turkish dairy sector is far less than satisfactory, since milk delivered to milk collection centers is generally obtained from small-scale family farms and is not of the desired quality from a food safety and food quality perspective <sup>10</sup>. European Union (EU) milk quality levels are only reached by a limited number of large scale dairy farms. This was documented in a recent study on the role and importance of the milk collection centers in Izmir <sup>11</sup>. It was found that quality control analysis of raw milk cannot be carried out because of the lack of qualified specialists and equipment inadequacies. A study reveals that there were a large number of dairy processors in the Izmir province that handle rather small volumes of milk and have little control over the raw milk supply. Most managers have a limited education concerning their positions, and resources were too limited in these firms, thus limiting their ability to adopt most regulations <sup>12</sup>. There were many constraints in the Turkish dairy industry on food safety concepts in respect to detailed literature reviews; however, there were not sufficient research papers analyzing economic sustainability and food safety approaches into the framework of integrated approach in dairy firms. Thus, the objective of this paper was to assess the economic sustainability performance and food safety practices implemented in the dairy firms established in Aydin, Turkey.

## MATERIAL and METHODS

The data used in the study that was directly collected by surveys from the managers/owners of the dairy firms. In the study, the dairy firms established in Aydin were investigated. This province is situated in the west of Turkey and has critical value in both dairy cows and milk production. In April-July 2010, 28 dairy companies, constituted of all dairy product firms in the region, were

visited and data were collected via surveys. The distribution of the firms were located in Çine (6), Center (5), Söke (4), Nazilli (3), Koçarlı (2), Germencik (1), Yenipazar (1), Ortaklar (1), Bozdoğan (1), Umurlu (2), Karpuzlu (1), and Kuşadası (1) in the Aydin region. The study was performed in two dimensions. In the first dimension, age, education level, and experience of the managers/owners, the number of product mixes and total employees, real milk processing capacity per day, and net annual income were determined. In the other dimension, present practices and attitudes were analyzed according to their economic sustainability and food safety approaches by using the responses to their statements. The five-point Likert scale was utilized in the determination of frequency, and attitudes were an ordinal measurement system, increasing from 1 to 5. A five-point Likert scale <sup>13</sup>, in which "1" was set as "highly inferior" and "5" was set as "highly superior," was applied to collect data. An increase in Likert scale averages means that there is greater adherence to sustainability as well as more compatible attitudes <sup>14</sup>. The variable costs that were calculated from the dairy firms' data belongs to raw materials (milk in particular), labor, utilities/fuel, electricity, water, packing materials, and other materials expenses. Depreciation of buildings, machines, and other movable properties, unpaid labor, and management costs were evaluated in fixed costs. While depreciation costs would be estimated for buildings, machines, and other materials, it was considered to be 4%, 10%, and 20% of their current prices, respectively. Total incomes of the firms were calculated based on the current prices of processing milk and milk products. Net income per dairy firm was calculated by subtracting the total costs from total income of the firm <sup>15</sup>. All variables' prices, including inputs and outputs, were recorded very carefully, and all calculations were performed with the (US dollar) \$1 equaling (Turkish Lira) TL 1.50, according to the exchange rate from April to July 2010, which matches the period of the study. A typology of dairy firms was set up from collected data. It took into account different elements of a processing system and characteristics. These parameters were age and education level of the firm managers/owners, real milk processing capacity per day, and net income of the firm. We carried out a hierarchical cluster analysis using Ward's method <sup>16</sup> applying Squared Euclidean Distance as the distance or similarity measure. This helped to determine the optimum number of clusters with which we should work. The data was analyzed using SPSS for Windows 16.0. First, descriptive statistics of the firms were summarized. For the variables, a Normal Distribution test was applied by the Jarque-Bera test <sup>17,18</sup>. Because the variables obtained from Likert scales did not display normal distribution, the Kruskal-Wallis one-way analysis of variance was engaged. This is a nonparametric test, which is used to compare three or more groups of sample data. Using the hypothesis in the Kruskal-Wallis test, a null hypothesis ( $H_0$ ) assumes that the samples, dairy firms, are from identical populations; alternative hypotheses ( $H_a$ ) assume that the sample comes from different populations. A Chi-square ( $\chi^2$ ) with  $k-1$  (the

number of groups-1) degrees of freedom was used to approximate the significance level for the test <sup>19</sup>.

## RESULTS

*Table 1* provided a descriptive summary of the dairy firms and firm managers/owners' characteristics used in this study. While the age of the firm managers/owners would vary between 28 and 71, the average education level was a high school degree. Their average experience in dairy industry was 25.54 years. While the number of

product mixes was between 2 and 9, these products were concentrated in milk, butter, cheese, yogurt, and dried milk (milk powder). The average milk processing capacity per day ranged between 0.01 and 140 tons. Finally, the net annual firm income obtained from the dairy firms varied between \$10.000 and \$7.000.000. These indicators stressed that the dairy firms in the Aydın region showed small and/or middle-scale characteristics.

The attitudes and perceptions of the managers in the firms are shown in *Table 2* for the preprocessing phase. It was specified that the differences among the firm groups

**Table 1.** Descriptive statistics for the dairy firms and firm managers/owners' characteristics

**Tablo 1.** Süt ve süt ürünleri firmaları ve yöneticileri/sahiplerinin karakteristiklerine yönelik tanımlayıcı istatistikler

Characteristics	Explanations	Mean	Min	Max	Std. deviation
Age	years	45.32	28	71	10.948
Education level	1: primary school, 2: high school, 3: university, 4: postgraduate	2.11	1	4	0.994
Experience in dairy industry	years	25.54	5	50	10.700
Product mix	number	4.5	2	9	1.711
Employees	number	10.18	0	43	9.565
Reel firm capacity	milk processing capacity per day (ton)	15.70	0.01	140	27.737
Net firm income	annual income (\$)	785178	10000	7000000	1386873.971

**Table 2.** Likert scale averages concerning the practices of the dairy firms in the preprocessing stage with regard to economic sustainability and food safety approaches

**Tablo 2.** Ekonomik sürdürülebilirlik ve gıda güvenliği yaklaşımlarına ilişkin olarak işleme öncesi aşamada süt ve süt ürünleri firmalarının uygulamalarını dikkate alan Likert ölçeği ortalamaları

Statements	Group I (n=9)	Group II (n=4)	Group III (n=3)	Group IV (n=5)	Group V (n=3)	Group VI (n=4)	Chi-square ( $\chi^2$ )	P value
Do you give sufficient care to the sufficient conditions of milking, collecting, and transportation of milk?	3.89	4.75	5.00	3.60	3.33	3.25	6.188	0.288
Do you take into consideration, before purchasing the raw milk, whether it should have good quality, composition, and contents?	3.78	4.72	4.98	3.63	3.67	3.75	6.952	0.224
Do you carry out research studies that would confirm the raw milk to be clean and imbued with sufficient quality?	2.67	4.00	4.85	2.20	2.67	1.50	13.05	0.023**
Do you take into consideration that the transportation lorry for raw milk should be clean and appropriate (having sufficient heat in particular) for usage?	3.56	4.25	4.92	2.80	3.33	3.00	7.147	0.210
Do you purchase the raw milk from producer cooperatives in general?	3.33	4.75	4.93	2.80	1.00	3.00	9.939	0.077*
Do you always purchase the raw milk from producers?	4.00	4.00	2.33	4.60	4.67	3.00	3.983	0.565
Do you give sufficient warnings on obtaining and processing procedures in milk according to the Turkish Food Codex?	2.00	2.75	4.33	1.80	2.33	1.50	9.383	0.095*
Do you always buy the milk from producers and/or producer cooperatives at a sensible price level?	4.22	3.75	4.33	4.40	3.00	5.00	4.467	0.484
Do you always take into consideration the cost of transportation and shipping of the milk at a reasonable price level?	3.89	3.75	5.00	4.40	3.00	5.00	6.044	0.302
Do you pay attention to the milk contents, whether they have dry matter without fat, acidity, or antibiotic content, and whether the milk is colostrum or not?	1.33	2.25	3.67	1.00	1.33	1.00	13.79	0.017**
Do you take into consideration whether the producers have carried out good practices?	1.67	2.00	5.00	1.60	2.00	1.25	10.47	0.063*

Values are means, \*Significant for  $P < 0.10$ , \*\*Significant for  $P < 0.05$

were statistically significant ( $P < 0.05$ ) for the statements; carrying out research studies, which would provide the raw milk as clean and imbued with sufficient quality and paying attention to the milk contents, whether they have dry matter without fat, acidity, antibiotic content, and whether it is colostrum or not. There were statistical differences among the firm groups ( $P < 0.10$ ) for several statements, including purchasing the raw milk from producer cooperatives in general, giving sufficient warnings on obtaining and processing procedures in milk according to the Turkish Food Codex, and taking into consideration whether the producers have carried out good practices. The rest of the statements were not statistically different among the firm groups. The attitudes and impressions of the manager/owners in dairy firms were clarified in the processing stage (Table 3). Although in many of the circumstances statistical differences among the firm groups were not obtained, there were statistical differences ( $P < 0.05$ ) on two particular statements. These included 1) making an analysis of the water used in the firm in order to learn its contents, and 2) giving sufficient importance to carrying out the product in loading, transporting, and delivering process that are suitable for the Turkish Food Codex in healthy, reasonable, and hygienic conditions. The perceptions and practices of the managers in the firms are given in Table 4 after the processing stage. There were statistical differences among the firm groups in the statement that customers would determine the product varieties ( $P < 0.05$ ), and the marketing profiles were developed as a result of whole-sale in general ( $P < 0.10$ ). For the rest of the circumstances, no statistical differences were obtained among the firm groups.

## DISCUSSION

Although most of the dairy firms in the region showed small and/or middle-scale characteristics, the managers/owners of the firms were younger, had high education levels, and earned a relatively sufficient net income. These structural parameters were explained in many studies for specific regions of Turkey and/or in general<sup>20-23</sup>. The main conclusions obtained from the study which defined key constraints intended for economic sustainability and sufficient food safety practices in the dairy firms in the region revealed five main issues. The issue is that implementation of good practices to obtain sustainability would not show different characteristics in small and large-sized dairy firms, except the few parameters indicated in the paper. As a second issue, most of the firms would buy raw milk from small dairy farms. Only small part of the factories functioning in the milk and dairy industry belong to the cooperatives. Therefore, most of the firms could not implement key solutions as necessities for a sustainable milk supply chain. The third issue is that most managers of the small-sized dairy firms, called mandiras, were not informed well or at all and could not implement good practices when necessary. On the other hand, the managers indicated they might be suffering from a lack of ability to establish and use advanced technology in the firms. The fourth issue is that although good practices intended for sustainability and food safety at a firm level would be implemented relatively well in preprocessing and processing stages, some of the applications would not be performed in the post-processing stages in most cases. Perhaps this is the most interesting result obtained from

**Table 3.** Average Likert scale for the attitudes of the firm managers during the processing period

**Tablo 3.** İşleme periyodu süresince firma yöneticileri tutumlarına yönelik ortalama Likert ölçeği

Statements	Group I (n=9)	Group II (n=4)	Group III (n=3)	Group IV (n=5)	Group V (n=3)	Group VI (n=4)	Chi-square ( $\chi^2$ )	P Value
Do you make the classifications of the raw milk in the firm?	3.67	3.00	5.00	4.80	4.67	4.75	4.341	0.501
Do you give enough warnings for delaying the raw milk in the cold air conditions?	2.67	4.00	5.00	2.80	3.00	3.75	5.759	0.330
Do you pay attention to the straining of the milk?	1.60	2.50	4.00	1.00	1.10	1.05	5.472	0.242
Do you take sufficient value for applied heat processing in the milk?	2.56	2.25	3.67	2.20	1.00	2.25	3.963	0.555
Do you take into consideration the thermal processing norms (heat and time) carried out in the processing stage of the raw milk?	4.67	5.00	5.00	4.80	4.67	5.00	4.210	0.529
Do you make an analysis of the water used in the firm in order to learn its contents?	1.67	4.25	5.00	1.80	2.00	2.25	15.122	0.011*
Do you pay attention to treating the product so it is suitable for the Turkish Food Codex (TFC) during all of its processing stages?	3.33	3.75	4.67	4.00	4.00	3.75	4.359	0.499
Do you give sufficient importance to carrying out the product in loading, transporting and delivering processes that are suitable for the Turkish Food Codex in healthy, reasonable, and hygienic conditions?	3.00	4.00	5.00	3.00	3.67	2.75	10.982	0.043*

Values are means, \*Significant for  $P < 0.05$

**Table 4.** The analysis of the perceptions of the managers for the dairy firms in regard to defining key constraints after the processing term**Tablo 4.** İşleme sonrası dönemde anahtar kısıtları belirlemeye yönelik olarak süt ve süt ürünleri firmaları yöneticileri tutumlarının analizi

Statements	Group I (n=9)	Group II (n=4)	Group III (n=3)	Group IV (n=5)	Group V (n=3)	Group VI (n=4)	Chi-square ( $\chi^2$ )	P Value
Do the customers determine the product varieties?	3.67	5.00	5.00	1.40	3.67	3.00	10.937	0.047**
Do the marketing profiles occur as a result of retail in general?	3.00	3.25	3.67	3.00	3.33	2.50	1.150	0.950
Do the marketing profiles occur as a result of wholesale in general?	2.78	3.75	5.00	5.00	2.67	4.00	10.083	0.073*
Do the marketing profiles consist of awarding?	1.11	2.00	1.00	1.60	1.10	1.05	7.002	0.221
Do the marketing profiles occur in boutiques (small retail stores)?	1.01	1.03	1.04	1.00	1.05	1.45	6.000	0.306
Are the marketing profiles formed by the franchise?	2.22	3.00	1.00	1.20	1.05	2.00	4.086	0.537
Do you create the advertisement activities for promotion?	1.89	1.50	1.05	1.60	1.09	1.04	2.535	0.771
Do you make the advertisement activities refer to taste?	1.11	1.75	3.67	1.05	1.33	1.01	8.749	0.119
Do you make the advertisement activities as visual publications?	2.44	3.75	2.33	1.60	3.33	1.50	5.996	0.307
Do you make the advertisement activities in poster form?	1.01	1.75	1.67	1.80	1.55	1.33	4.787	0.442
Do you try to improvement functioning competition?	3.00	2.75	3.00	3.00	1.33	2.00	5.530	0.355
Do you give sufficient importance to improving new products?	2.00	3.25	1.33	1.40	2.33	3.50	6.739	0.241
Do you put the products, ready to sell, in the store at a precise time?	2.78	3.75	3.00	3.00	1.33	3.75	7.494	0.186
Do the food safety systems aid the marketing of the products?	2.67	2.00	3.67	3.20	1.67	1.50	6.771	0.238

Values are means, \*Significant for  $P < 0.10$ , \*\* Significant for  $P < 0.05$

the study. Because the firms that carried out the survey study showed small-scale characteristics and implemented marketing activities for the domestic market, they would not need accelerating activities, such as advertisements and product segmentation, after the processing phase. However, most of the firms may be suffering from lack of competitive conditions and marketing facilities in the process of EU membership for Turkey in the long run. The fifth critical issue emphasized that there were some technical, socio-economic, and financial constraints to implementing good practices intended for sustainability and food safety concepts. Although many efforts have been accelerated to overcome the current constraints by the government, agricultural associations, and non-governmental organizations, substantive approaches from preprocessing stages to after processing phases in the milk supply chain should be completely employed on the basis of technical, socio-economic, and financial approaches in the dairy sector.

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