UNIVERSITY OF DEBRECEN
CENTRE OF AGRICULTURAL SCIENCES
FACULTY OF AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT
DEPARTMENT OF MANAGEMENT AND LABOUR SCIENCE

DOCTORAL SCHOOL OF INTERDISCIPLINARY SOCIAL AND AGRICULTURAL SCIENCES
Director: **Prof. Gábor Szabó, DSc.**

PhD Thesis

EXPLORING THE RESERVES OF DAIRY FARMS FROM THE ASPECTS OF WORK ORGANIZATION

Submitted by:

András Vántus

Supervisor:

Tibor Nagy, CSc. in Agriculture
Professor

DEBRECEN
2006

1. RESEARCH OBJECTIVES

Cattle breeding is one of the most important branches of animal husbandry in Hungary.

In spite of this, production is not free of problems and the farmers have to face numerous rendering factors. The unfavourable situation of the industry is demonstrated by the continuous marked reduction in the number of cattle in the last few years.

The quality requirements regarding raw milk have become stricter. Quality has become a keyword in competitiveness. As a result, those dairy farms which were not profitable were closed. Similar processes have occurred among the small farms. As there was a large reduction in extra quality milk, many milk collecting stations are being closed. Although, cattle breeding in small farms would ease the employment situation in villages of small regions, since the turnover from selling the milk could help the subsistence of families.

The large-scale dairy farms are in a more favourable situation, since the production conditions are considerably better both regarding the professional skills and technical equipment. However, the profitability of dairy production, the costs necessary for achieving high quality are important also for them. Since most of the farms can be characterized by a lack of capital, they have to reduce the inputs of production including labour inputs. This may give a higher importance to work organization and verify the study of its effectiveness.

Based on the above, my research objectives were:

- Improvement of working conditions
- Development of human resources
- Exploration of reserves in work processes
- Establishment of a proper wage system
- Improvement of the working atmosphere

Via studying the work organization of dairy production and analyzing the data, my objective was to reveal the reserves of work organization by exploitation of which the farms are enabled to continue or to increase their dairy production. I intend to help the experts and producers via the obtained results and I plan to use the acquired knowledge also in teaching.

2. MATERIALS AND METHODS

Description of materials

In Hungary, the Northern Great Plain region is one of the most important region as regards cattle breeding, 50% of the region's livestock are to be found in Hajdú-Bihar county (KSH, 2005). The importance of the county within the region is demonstrated by the data of Table 1.

Table 1

National, regional and county milk production data for the period of 2000-2004

	Milk yield (million litre)			Milk yield per cattle (litre)		
Year	National	Regional	Hajdú-Bihar county	National	Regional	Hajdú-Bihar county
2000	2080.6	473.4	220.6	5685	5441	5656
2001	2079.8	454.5	200.0	5892	5611	5556
2002	2067.8	468.2	199.6	5994	5780	5395
2003	1977.3	440.7	190.1	5992	5578	5281
2004	1844.8	402.9	173.3	5970	5596	5097

Source: Central Statistical Office (2005)

I have carried out my examinations at 40 dairy farms in Hajdú-Bihar county, I could receive all the necessary data from 35 farms, therefore, these were included in my thesis. The annual milk yield of Hajdú-Bihar county is 173 million litre, the farms included in the thesis produce 110 million litre milk per year, which is 63% of the county's raw milk production.

I have collected data about the conditions and profitability of small-scale dairy farms in 797 farms belonging to the milk collecting stations of 22 settlements in Hajdú-Bihar county.

Data were also collected from national and international literature sources.

Examination methods

To study the conditions of milk production, the collected data were examined according to the method of SZENDRŐ and SZÍJJÁRTÓ (1979). This is a complex method which studies the setup and arrangement of the workplace, the workforce, the work organization, the system of motivation and the working atmosphere.

The location, setup and the equipment of cowsheds were studied by methodical examination, the characteristics of workforce were gained by oral interviews and the analysis of documents. The organization of work processes was assessed by workday assessments and the analytical examination of the working operations, which were supplemented by video recordings and the application of the Kovaljov method. The system of motivation was studied via the analyses of documents and making written interviews.

About the social atmosphere of the workplace, I gathered data via making written interviews.

In addition to these, production and economic data were collected for the years 2000, 2001, 2002, 2003 and 2004 by document analysis.

Methods of data processing and data analysis

When evaluating the questionnaire about work satisfaction, I applied the method of principal component analysis. The size categories of the dairy farms were established by cluster analysis. For the work operations of milking, ANOVA analysis was applied. Workers' satisfaction was studied by the classification tree method.

3. MAIN RESULTS OF THE THESIS

Work organization of milk production at small farms

Cattle breeding has long established traditions in Hajdú-Bihar county, with its 38000 cows it is the county with the largest milk production in Hungary. Two thirds and one third of the cows are kept at large-scale and small-scale farms, respectively.

Regarding the conditions of milk production, it can be stated that most of the farmers having less than 10 cows have their stalls in the yard of their house. Most of the farmers having more than 10 cows keep their animals outside of the settlement. The average distance of these stalls from the road is 630 m, out of which 420 is cart-road, which makes it hard to go to the farm.

Since the farmers with less than 10 cows do not have a cooler, it is very important that they take the milk to the milk collecting station as soon as possible after milking. The distance of the farms to the milk collecting station ranges between 630 and 4590 m.

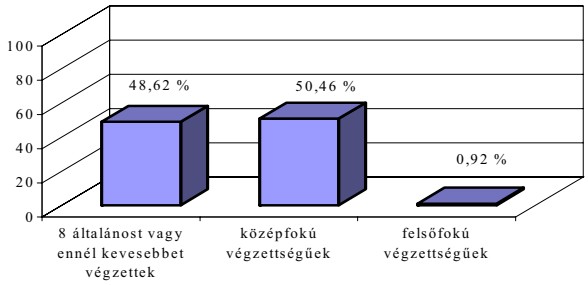
The technical equipment of small farms is characterized by the fact that in 551 out of the 797 farms, 5 or less cows are kept. Only 52 farmers have a tractor and only 38 possess a horse carriage. 404 farmers have auto-waterers while the others provide the water for drinking from a bucket or a trough. Most of the farmers (727) perform milking by using a milking machine.

Only 20 of the farmer have a cooler for milk. The milking machine and the milk dishes are cleaned in a separate room, while the others do the washing up in the stall or in the backyard.

In the small farms, the most important work processes except for milking such as feeding, dung removal, littering, grooming etc. are done manually.

The data of the survey on the qualification of workforce are presented in Figure 1. The figure indicates a significant proportion (48.62%) of workers who finished only elementary school or not even that. This fact suggests the importance of professional training and information of the owners of small-scale dairy farms.

Figure 1: Distribution of farmers according to their qualification



Elementary school or less Secondary school College or university degree

Source: Own examinations

According to my observation, there are mistakes in milking in udder preparation, machine milking, post-milking operations and in the technical and technological requirements

Another disadvantage is that most of the farmers do not have a cooler, although it is a requirement that the milk should be cooled under 8ºC as soon as possible. The quality of milk was frequently below qualification according to the former

qualification system of five categories in many of the studied settlements (Table 2), as proven by my earlier examinations.

Table 2

Data on milk yield and quality in small-scale farms at different milk collecting stations

Milk collecting stations	Number of farms	Number of cows/farm	Marketed milk (l/day)	Distribution of raw milk among the quality classes				
				Extra	1st class	2nd class	3rd class	Below qualification
CS 1	59	1-10	2900	11.11	88.89	-	-	-
CS 2	36	1-10	800	50.00	5.56	11.11	-	33.33
CS 3	19	1-10	2000	94.44	-	-	-	5.56
CS 4	26	1-10	850	61.11	11.11	22.22	-	5.56
CS 5	11	1-10	380	22.22	16.66	5.56	-	55.56
CS 6	64	1-10	3300	94.44	-	-	-	5.56
CS 7	13	1-10	360	-	-	5.56	16.66	77.78
CS 8	22	1-10	1000	33.33	22.22	-	-	44.45
CS 9	13	1-10	500	33.33	16.67	5.56	-	44.44
CS 10	12	1-10	450	44.44	5.56	-	-	50.00
CS 11	16	1-10	600	100.00	-	-	-	-
CS 12	56	1-10	2040	100.00	-	-	-	-
CS 13	43	1-10	1700	88.89	-	-	-	11.11
CS 14	61	1-10	1800	100.00	-	-	-	-
CS 15	11	1-10	500	44.44	16.67	-	-	38.89
CS 16	72	1-10	2300	100.00	-	-	-	-
CS 17	53	1-10	2800	83.33	5.56	-	-	11.11
CS 18	27	1-10	830	100.00	-	-	-	-
CS 19	31	1-10	1500	33.33	5.56	-	-	61.11
CS 20	23	1-10	1400	100.00	-	-	-	-
CS 21	53	1-10	3200	94.44	5.56	-	-	-
CS 22	76	1-10	3100	100.00	-	-	-	-
Average of the 22 milk collecting stations				**67.68**	**9.09**	**2.27**	**0.76**	**20.20**

Source: Own examinations

Of course, the technical equipment and hygiene of the milk collecting station also have a significant influence on milk quality. At most milk collecting stations, progress has been made in this field. This progress included: purchase of new cooling tanks, putting instant coolers in operation, tiling of walls, purchase of rust-proof equipment.

The processing firms have stipulated the introduction of HACCP system for milk collecting stations, I have found that many milk collecting stations have this qualification.

As shown in Table 3 (data from 2004), the number of farms has reduced for several milk collecting stations (CS 1, CS 3, CS 6, CS 16).

Table 3

Data on milk yield and quality of the studied small farms in 2004 at different milk collecting stations

Milk collecting stations	Number of farms	Daily milk yield (litre)	Extra quality (%)	Below classification (%)
CS 1	45	2800	100,00	-
CS 2	30	1000	100,00	-
CS 3	20	2000	100,00	-
CS 4	Closed			
CS 5	Closed			
CS 6	55	2200	97,00	3,00
CS 7	Closed			
CS 8	Closed			
CS 9	Closed			
CS 10	Closed			
CS 11	15	800	100,00	-
CS 12	40	2100	94,00	6,00
CS 13	Closed			
CS 14	100	5000	100,00	-
CS 15	Closed			
CS 16	30	2000	100,00	-
CS 17	40	1700	100,00	-
CS 18	24	800	94,00	6,00
CS 19	30	1000	80,00	20,00
CS 20	14	1500	83,00	17,00
CS 21	32	1900	100,00	-
CS 22	80	3500	100,00	-

Source: Own examinations

The most frequent reasons for this were that they could not satisfy the strict quality regulation, have given back their quota or they have stopped their farming simply due to their age. However, there are settlements where the number of farmers has not or only slightly reduced (CS 11, CS 18). This is because in these places most of the farmers earn their living from dairy production, they have no other income or

even if they have, the monthly sum received for milk is of determining role. In small farms, the working conditions are inferior, the risk of accidents is high, the work operations can hardly be mechanized, therefore, the most important work processes except for milking such as feeding, dung removal, littering, grooming etc. are done manually. Regarding the material conditions, in most small farms, the tools of hygienic milking and milk handling are missing or their maintenance is not of the proper level. The cleaning and storage of the milking machine and the tools in contact with milk is not according to the regulations.

Work organization at dairy farms

Determining the size of dairy farms

Among the farms with higher number of cows (around 50 cows and above), I determined the size of small-medium and large-scale farms by cluster analysis based on work efficiency indices and the average number of cows in the five years of the examination. For the analysis, the Ward method was used. As a result of this method, about the same number of farms was included in each cluster as represented by Table 4.

Table 4

Size categories of dairy farms (cluster categorization)

Farms	5-year average of cow number	Category
T1-T10	40-160	1
T11-T21	161-500	2
T22-T35	501-1126	3

(1) **small** dairy farms, (2) **medium** dairy farms (3) **large** dairy farms

Source: Own studies

Location, setup and equipment of the studied dairy farms

The location and equipment of the animal keeping units and the setup of stalls constitute the most important area for the study of work organization. Since the amount of work and the time required for performing the work, the number and qualification of workforce and even work organization are considerably influenced by the conditions of production.

Regarding the major characteristics of the studied farms, it can be stated that the distance of farms from the settlement varies greatly: 70 m(T34), 100 m (T5), 200 m (T29), 500 m (T6, T13, T16, T28), 600 m (T17), 1000 m (T19, T26), 1600 m (T25), 1800 m (T8), 2000 m (T1, T9), 2500 m (T7, T11, T35), 3000 m(T2, T10, T15, T20, T21, T23, T24), 3500 m (T14), 4000 m (T12, T22, T32), 5000 m (T3, T4, T18, T33), 10000 m (T27, T30, T31).

The distance from public roads also varies between large boundaries: 10 m (T5, T11, T12, T22), 15 m (T34), 30 m (T26), 50 m (T8, T28), 100 m (T6, T19, T23, T29), 150 m (T3, T14, T24), 200 m (T7), 250 m (T10), 300 m (T17, T21), 400 m (T32), 500 m (T2, T16), 800 m (T18), 1000 m (T1, T4, T13, T15, T20, T33), 1100 m (T35), 1500 m (T9), 1600 m (T25), 2000 m (T27, T30, T31).

The roads to farms are mainly of solid surface (bitumen, concrete), except for farm T1 with cart-road and farm T8 with slag-covered road. The road surface has importance In the accessibility of farms when there are large amounts of precipitation in all periods of the year.

Regarding water supply, it can be stated that all farms have their own well. The collection of sewage is also uniform by sewage shafts, from where it is transported when necessary.

The energy supply is solved in several ways. In most of the farms (29 farms), it is a combination of electricity and gas, while in farms T4, T17 and T31, it is exclusively electricity and in farms T11 and T21 a furnace is used (multiple fuels). The most modern and cost-effective combined solution is applied at farm T10. Here, the milk is circulated through a heat exchanger, which preheats water, then, water is further heated by a sun collector. If necessary, an electric boiler is also available to ensure the hot water supply of the farm. For safe operation, the flow of information and communication possibilities should be ensured. I observed that all the farms are properly equipped in this respect, since out of the 35 farms, there were only 7 farms, where only cell phones are available, in others both cell phones and regular phones are used.

However, a fax machine is not available at a significant portion of the farms (28 farms).

Production and breeding data are recorded and processed by computer at 28 farms.

For technical maintenance, a repairing dock is available at 29 farms. During my research, I observed that there is a great need for them, since the status of buildings,

folds, fences and machines requires it. Since presently there is a lack of financial sources, a significant portion of the farms are only able to operate their tools by performing the necessary reparations. Office and social buildings can be found at all farms.

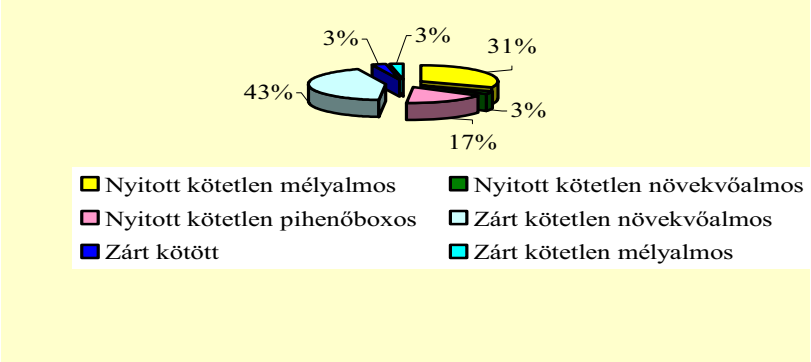
Also, there is a dressing room and the workers use these, since it is included in the regulations.

In Figure 2, the studied farms are classified according to the type of sheds.

It can be observed that in most dairy farms, the method of keeping is closed, loose keeping on increasing deep litter (43%) or open, loose-keeping on deep litter. The ratio of open, loose-housing with lying boxes is also significant (17%). Open, loose keeping on increasing deep litter and closed, loose keeping on deep litter represent 3-3%. Closed, tied up keeping is done at 3% of the farms.

Since the material conditions are also important elements of work organization, I also collected data on these.

Figure 2: The distribution of farms according to the type of coswheds



Open, loose-keeping on deep litter — Open, loose keeping on increasing deep litter

Open, loose-housing with lying boxe — Closed, loose keeping on increasing deep litter

Closed, tied-up — Closed, loose keeping on deep litter

Source: Own studies

One of the most important work operations of milk production is milking, which is performed in milking parlours in loose keeping.

Several types of milking machines and milking parlours are used in t-he dairy farms. In the studied farms, herringbone milking parlours were the most frequent. This is in agreement with the opinion of STEFLER et al. (1995) and BÁDER (2002), who found that this type is the most widespread in farms with loose-keeping.

The following types were found at the studied farms: 2x4 (T6), 2x5 (T1), 2x6 (T2, T5, T8), 2x2x6 (T12), 2x10 (T15, T19), 1x8 (T3), 2x8 (T7, T9, T13, T14), 2x2x8 (T17, T22, T27, T32), 3x2x8 (T28, T31), 4x2x8 (T34), 2x12 (T10, T16, T21, T26) and 2x2x12 (T35). Parallel milking parlours are used in farms T11 (2x8), T23 (2x14) T20, T24, T30 (2x16). Polygonal system is used in farms T25 (4x6) and T29 (4x8). In farm T18, a rotational-type milking platform is operated with 16 places. The type of the milking parlour should be adapted to the number of cows. For example, for the herringbone milking parlour, 100-400 (or 600) cows are optimal. The rotating-type milking platform is most suitable above 400 cows (rotating-type milking platform for 40 cows is optimal for 1000 cows). In relation to this, it can be stated that in one of the studied farms, where a rotating-type milking platform with 16 places is operated, the number of cows is 400. In this way, the ratio is the same, 25 cows per milking place.

In farm T4, milk pipelines are applied. In this case, teat cups are located on a mobile equipment, which is equipped with automatic teat cup releasers. With this solution blind milking can be reduced and prevented. Such equipment can be found in 83% of the farms. In order to stop the propagation of bacteria in the milk, most farms operate instant coolers.

In some farms (T1, T3, T5, T6, T13, T20,T22, T29), the milk storage tanks have such a cooling capacity, that the arriving milk can be constantly cooled, therefore, the traditional instant cooler equipment is not necessary. The washing of dishes, pipelines, milking machines in contact with milk is done via automated washing programmes in all farms, the worker just starts the operation and checks whether there is enough detergent in the system.

Regarding feeding, I studied the storage of concentrated and bulk feed, since I anticipated that it has an impact on the working time requirement of feeding. I observed that in larger and smaller farms, concentrated feeds are stored in tower silo and buildings, respectively. Bulk feed is kept in the silo space or in stack-yards in most of the farms.

The time requirement of feeding is diminished if the water supply is automated. Auto-waterers could be found at all observed farms with loose-keeping. In the farm with closed, tied-up system, troughs are used for drinking the animals.

Feeding is performed by a feed-distributing car in most farms. However, it also happens that donkey carriage (T5) or horse carriage (T15, T23) is used.

In farm T4 (tied-up system), feeds are distributed manually.

It has to be noted that for transporting the concentrated feeds, hay bales and silage, a tractor is available in most farms. In farms T7, T8, T9 (loose-keeping), feed is distributed from a tractor trailer by fork into the manger. In farms with 160 cows or more (from farm T10) a feed-mixing and distributing car is applied.

Daily dung removal is performed by using a barrow in farm T4 (tied-up system), and the bales for littering are transported by tractor to the shed from where the workers distribute the litter by forks. In loose-keeping, daily dung removal is done by a sliding system, in stalls with deep litter, litter is removed twice or more (as necessary) times a year with an excavator. The daily amount of manure is temporarily stored in 32 farms (on trays or in pools), while it is transported directly to dung yards from 3 farms. For littering, the large bales are most frequently transported to the stalls by tractors and then it is distributed by forks. In farms T11 and T15, the workers distribute the straw by forks from a trailer moving along the middle of the stall. In farms T21 and T33, an equipment chops the straw and then it blows in the litter to the cows.

Transportation is done by own vehicles at most farms.

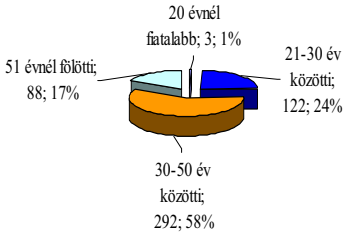
Summing up the above, it can be stated about large farms that:

- their location, setup and equipment enables a modern dairy production.
- setting up and providing the material conditions (tools, working conditions, harmonized work tasks, supply of the workplace, work schedule) are the bases of quality production and favourable work efficiency.
- in order to improve competitiveness material and staff conditions should be enhanced.

The labour supply of the studied dairy farms

The age of the workers at the studied farms is illustrated by Figure 3. Since the qualification of farmers influences the quality of raw milk, I have also studied this based upon the data of questionnaires filled in by 505 workers (76% of the total number of workers).

Figure 3: **The distribution of workers according to age (people, %)**



Above the age of 51: 88, 17%

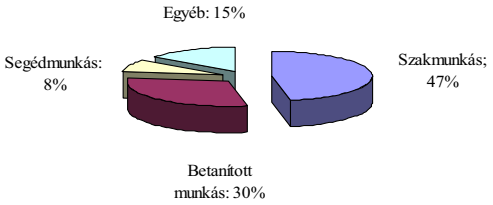
Younger than 20: 3, 1%

Between the age of 21 and 30: 122, 24%

Between the age of 30 and 50: 292, 58%

Source: Own examinations

Figure 4**: The distribution of physical workers at the studied farms according to their professional qualification**



Unskilled worker: 8%

Other: 15%

Skilled worker: 47%

Semi-skilled worker: 30%

Source: Own examinations

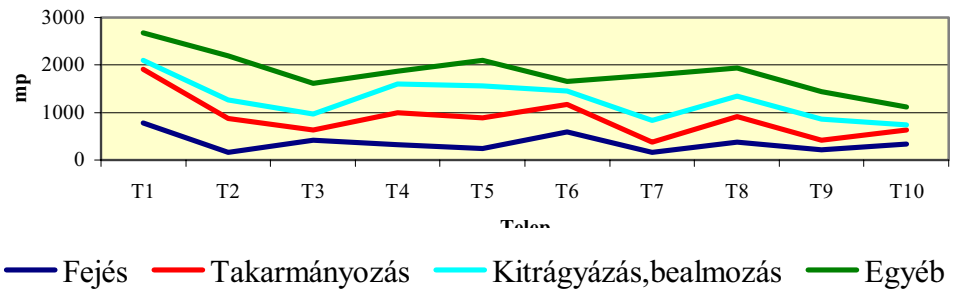
As demonstrated by Figure 3, the major proportion of the workers (58%) is between the age of 30 and 50. The ratio of workers above the age of 51 is also significant (17%).

Work at animal farms is not attractive enough for young people.Due to the early start of work, the unfavourable working conditions (risk of accidents, infections, manure and smells) and the relatively low wages, it is hard to find an appropriate worker for certain positions. As it is presented by Figure 4, about 50% of the workers at the farms are skilled workers.

Organization of work processes

Figure 5 illustrates that the most efficient farm regarding the work processes of milking (157 s) and feeding (198 s) is T9 In dung removal and littering**,** the most effective farm was T10 with 111 s. When all the working processes are considered, it is farm T10 which uses the lowest work time.

Figure 5: Real work time per working process per day per cow in small-scale dairy farms (s)



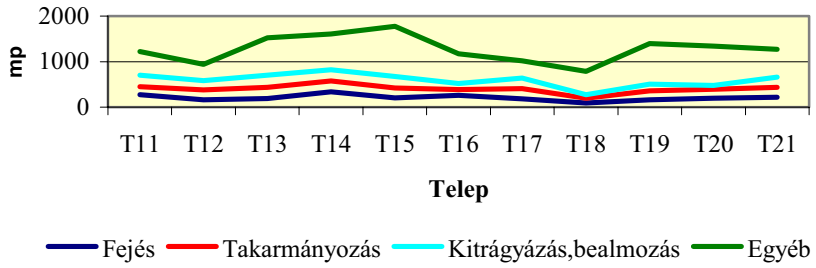
Milking Feeding Dung removal, Littering, Others

Source: Own examinations

The real work time per cow for all the processes of milking varies between 157 and 774 s. Accordingly, it can be stated that there are considerable reserves regarding this operation. The real work time per working process per day per cow in medium dairy farms (s) is presented in Figure 6.

The best figures of milking (90 s), feeding (100 s) and dung removal- littering (79 s) were all measured at farm T18. This farm uses considerably less time for all the processes than the other farms. At farm T13 especially bad figures were obtained.

Figure 6: Real work time per working process per day per cow in medium dairy farms (s)

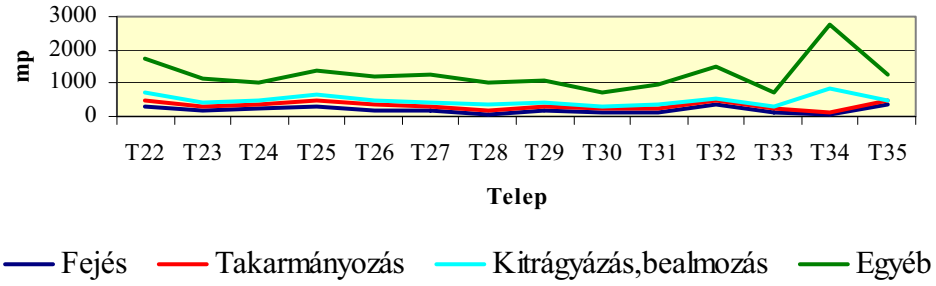


Milking Feeding Dung removal, Littering Others

Source: Own examinations

Considering the above, it can be stated that there is a need for rationalization also at the farms of cluster no. 2, in order to improve efficacy. Figure 7 presents the results of the same examinations as above for large-scale dairy farms.

Figure 7: Real work time per working process per day per cow in large-scale dairy farms (s)



Milking Feeding Dung removal, Littering, Others

Source: Own examinations

In the respect of milking (67 s) and feeding (67 s), the best farm was T 34, while for dung-removal-littering, the best figure was obtained for farm T33 (39 s).

I have made a comparative analysis to assess how many seconds can be spared at the different work operations at the studied farms, if the figures of the best farm serve as a basis.

Work efficiency indices of the model

Based on the data of the examinations, a model can be set up (Table 5) for each cluster including the best work efficiency indices.

Table 5

Work efficiency indices in the clusters of the model

Work efficiency indices	Cluster No. 1.	Cluster No. 2.	Cluster No. 3.
Number of cows per physical worker	41,67	41,67	41,67
Number of working hours for one cow per year	57,60	57,60	55,65
Number of working hours for 100 l milk	0,65	0,65	0,65
Working time for milking per cow per day (s)	157	94	67
Working time for feeding per cow per day (s)	198	100	67
Working time for dung-removal and littering per cow per day (s)	111	79	39
Working time for other work operations per cow per day (s)	278	359	412

In order to achieve the best indices, modern technical equipment, good utilization of the working time and appropriate work methods are necessary in addition to employing qualified workers.

With the model made on the basis of the work time reserves per working operation (s), I illustrate the possible reduction in the number of workers in the short and the long run (Tables 6, 7 and 8).

In the studied dairy farms, the work efficiency indices should be improved, the model values per cluster determined by myself should be achieved or approached. In

order to realize this, I have made suggestions for the different farms that can be implemented in the short and the long run. The suggestions should be differentiated, because the former have no or only insignificant cost requirements. However, the implementation of the latter requires appropriate financial resources.

Table 6

Exploration and modelling of work time reserves (cluster no. 1)

Farm	Number of workers in 2004	Number of milked cows	Reserves (hours)	Possible reduction in the workforce (people)		
				S.	L.	T.
T1	4	32	4656	1	1	2
T2	5	44	4884	1	1	2
T3	4	50	3452	1	0	1
T4	5	63	5527	1	1	2
T5	7	79	8202	2	1	3
T6	7	93	6669	2	1	3
T7	8	99	8095	2	1	3
T8	9	110	10139	2	2	4
T9	7	115	6465	2	1	3
T10	6	128	4122	2	0	2

Legends: S: in the short run, L: in the long run, T: total

Source: Own examinations

Table 7

Exploration and modelling of work time reserves (cluster no. 2)

Farm	Number of workers in 2004	Number of milked cows	Reserves (hours)	Possible reduction in the workforce (people)		
				S.	L.	T.
T11	10	175	7465	2	1	3
T12	15	235	5316	1	1	2
T13	18	260	16791	4	3	7
T14	25	286	20200	4	4	8
T15	25	303	25202	7	4	11
T16	18	308	12167	1	4	5
T17	16	315	8853	3	1	4
T18	11	332	3705	2	0	2
T19	21	356	19771	4	4	8
T20	21	370	19116	5	3	8
T21	20	373	17284	5	2	7

Legends: S: in the short run, L: in the long run, T: total

Source: Own examinations

Table 8

Exploration and modelling of work time reserves (cluster no. 3)

Farm	Number of workers in 2004	Number of milked cows	Reserves (hours)	Possible reduction in the workforce (people)		
				S.	L.	T.
T22	32	430	36483	11	4	15
T23	27	438	18855	3	5	8
T24	19	448	14873	5	1	6
T25	26	455	27070	7	4	11
T26	24	458	22429	5	4	9
T27	22	467	23804	4	6	10
T28	20	474	15490	4	2	6
T29	32	487	19414	6	2	8
T30	18	533	5897	1	1	2
T31	28	544	15850	3	4	7
T32	38	590	41123	13	4	17
T33	24	615	7091	2	1	3
T34	41	822	9642	3	1	4
T35	51	901	14387	3	3	6

Legends: S: in the short run, L: in the long run, T: total

Source: Own examinations

After revealing the reserves of work time, I have calculated again the work efficiency indices, which are much favourable than the former ones. These parameters indicate that after a rationalization, the profitability of milk production can increase which may create a chance for further operation of dairy farms (Table 9-10-11).

Table 9

Work efficiency indices after the reduction of the number of workers (cluster no. 1)

Farm	Number of cows per physical worker		Number of working hours per cow per year		Number of working hours per 100 l milk	
	Before rationalization	After rationalization	Before rationalization	After rationalization	Before rationalization	After rationalization
T1	12,75	25,50	170,00	85,00	1,92	0,96
T2	12,00	20,00	163,33	98,00	2,97	1,78
T3	16,00	18,67	146,43	125,51	1,96	1,68
T4	17,00	28,33	140,94	84,56	3,58	2,15
T5	17,57	30,75	136,59	78,05	2,25	1,29
T6	20,00	32,50	120,00	73,85	1,63	1,00
T7	17,33	26,00	138,46	92,31	4,91	3,27
T8	15,11	27,20	158,82	88,24	2,10	1,17
T9	15,14	26,50	158,49	90,57	2,93	1,67
T10	41,67	62,50	57,60	38,40	0,65	0,43

Source: Own examinations

Table 10

Work efficiency indices after the reduction of the number of workers (cluster no. 2)

Farm	Number of cows per physical worker		Number of working hours per cow per year		Number of working hours per 100 l milk	
	Before rationalization	After rationalization	Before rationalization	After rationalization	Before rationalization	After rationalization
T11	18,60	26,57	116,26	81,38	1,96	1,37
T12	19,67	22,69	76,12	65,97	1,33	1,15
T13	18,17	29,73	122,63	74,94	1,98	1,21
T14	14,28	21,00	130,33	88,62	1,47	1,00
T15	15,63	28,37	142,58	78,57	1,91	1,05
T16	25,39	35,15	80,31	58,00	1,14	0,82
T17	23,56	31,42	73,66	55,24	1,01	0,76
T18	37,91	46,33	63,31	51,80	0,91	0,75
T19	20,86	33,69	115,07	71,24	1,57	0,97
T20	23,19	37,46	103,45	64,04	1,23	0,76
T21	31,00	47,69	77,44	50,33	0,91	0,59

Source: Own examinations

Table 11

Work efficiency indices after the reduction of the number of workers (cluster no. 3)

Farm	Number of cows per physical worker		Number of working hours per cow per year		Number of working hours per 100 l milk	
	Before rationalization	After rationalization	Before rationalization	After rationalization	Before rationalization	After rationalization
T22	16,72	31,47	139,82	74,28	2,05	1,09
T23	20,67	29,37	90,67	63,81	1,49	1,05
T24	30,00	43,85	79,96	54,71	1,15	0,78
T25	22,27	38,60	108,85	62,80	1,46	0,84
T26	22,92	36,67	103,09	64,43	1,66	1,04
T27	24,23	44,42	110,92	60,50	1,57	0,86
T28	28,95	41,36	82,69	57,89	1,06	0,74
T29	19,71	25,88	87,10	66,36	1,13	0,86
T30	37,67	42,38	55,65	49,46	0,70	0,63
T31	22,11	29,48	84,42	63,32	1,30	0,98
T32	18,61	33,67	127,50	70,46	2,05	1,13
T33	28,38	31,76	65,87	58,86	1,10	0,98
T34	23,22	25,73	92,88	83,82	1,62	1,46
T35	21,41	24,27	107,78	95,10	1,85	1,63

Source: Own examinations

System of motivation

In the small (family) farms, the owners apply a monthly salary supplemented by a sliding wage and also other forms of benefits are used (a 13th month salary, visit to professional exhibitions, picnic, feasts).

In some farms with a number of cows higher then 300, another form of motivation is practiced, they organize banquettes once or twice a year. However, this is not organized exclusively for the workers of the dairy farm, workers from other units of the farm also attend it, therefore, it does not have such a strong motivating effect as a smaller party would have.

Summing up, it can be stated that the system of motivation applied in the large-scale farms is limited to the formerly successful task wage the base of which is the amount and quality of the produced milk.

Social atmosphere at the workplace

The assessment was done by using questionnaires. I prepared the questionnaire used, the questions were related to the fourth and fifth points of the system developed by SZENDRŐ and SZÍJJÁRTÓ (1979) on motivation at the workplace and social atmosphere at the workplace, respectively. I studied the relationship between the workers and the manager and the level of satisfaction regarding possibilities of professional development, promotion and independence. The relationship between the worker and the manager has a significant influence on the atmosphere of the workplace. The different points given for the different statements of the questionnaire on work satisfaction indicate those fields where the satisfaction of the workers is the greatest and those fields where improvements are necessary, that is where there are reserves. The 505 workers who filled in the questionnaire are most satisfied with the management control, the social facilities, the supply or working clothes and, which is of special importance, with the independence of workers. The workers are most dissatisfied with cultural possibilities, the transport of workers to and from work, the canteen (there is no canteen at many places) and the training possibilities.

Summary:

Regarding the large-scale dairy farms, it can be stated that their location, setup and equipment enables a modern dairy production. Setting up and providing the material conditions (tools, working conditions, harmonized work tasks, supply of the workplace, work schedule) are the bases of quality production and favourable work efficiency.

In several farms, not the most modern methods are used in feeding (donkey carriage, horse carriage, tractor trailer). A higher level of the human factors (education,

practice, personal relationships, economic relationships) also improves the efficacy of production. I have concluded that the professional qualification of the key workers in a dairy farm (milker, feeding worker, calving worker, calf raiser, repairman) has a significant impact on the profitability of production.

My studies have revealed that work at dairy farms is not attractive for young people, which was indicated by the ratio of youth among the workers.

I suggest working out such a wage regulation, which takes into consideration the ratio of salaries with special regards to the workers in the most important positions. Task wages can be recommended at those farms where the workers are still paid time-wages.

Moral recognition has a significant effect on the mood of the collective and the social atmosphere, therefore, its introduction would be useful in large-scale farms. On the other hand, in small farms the wage system working well in large farms could be introduced.

Since the qualification of the workers has a great effect on the improvement of efficacy, I suggest the support of the further education of workers.

The satisfaction of qualified workers should be increased in order to further improve efficacy indices.

Work at dairy farms should be made more attractive for young people, therefore, changes in the work schedule (later start) can be recommended.

By assessing the workdays and by analytical examinations of the work processes, I determined the working hours for the most important work operations. In this way, I have worked out such a method using the Kovaljov system which enables a significant improvement of work efficiency. Therefore, I suggest to spread the method extensively.

4. NOVEL RESULTS OF THE THESIS

1. My studies have proved that those small farms which could not meet the staff and material requirements of raw milk production ceased to do dairy farming.
2. I suggest for those small farmers who would like to continue milk production to form milk co-operatives, since in this way they can more easily satisfy the strict quality requirements (purchase of modern milking machines, establishment of a cooling section and a scullery, modernization of milk collecting stations).

3. By cluster analysis, I divided the studied dairy farms into three groups based on the number of cows and work efficiency figures. The groups were:

Group no. 1 (40-160 cows), small dairy farms

Group no. 2 (161-500 cows) medium dairy farms

Group no. 3. (501-1126 cows) large dairy farms

4. By assessing the workdays, by analytical examinations of the work processes and by using video techniques, I determined the working hours for the most important work operations (milking, feeding, dung removal- littering, others).

5. By improving the Kovaljov method, I determined the annual worktime reserves per each farm for all clusters based on the lowest amount of work hours used for the different types of work.

6. By using the above data, I planned the rationalization of the studied farms and determined the possible reduction of the number of workers, which results in a great improvement of work efficiency. Therefore, I suggest to spread the method extensively.

7. Since the Kovaljov method can only be applied under similar working conditions, I made suggestions for the different cluster groups to establish similar staff and material conditions in the short and the long run as the best farms have.

The implementation of the short term suggestions does not require significant financial inputs, since the profitability of production can be improved by enhancing working conditions, increasing workers' satisfaction or by changing the applied working methods, that is by the rationalization of work organization.

The long term suggestions can be realized if the appropriate financial sources will become available for the dairy farms.

My statements and suggestions based on my research results can be applied in the studied farms. If they are performed, then work efficiency can be improved significantly.

5. APPLICABILITY OF THE RESULTS IN THE PRACTICE

- In several settlements, the number of farmers is continuously decreasing as they cannot meet the increasingly strict quality requirements. Consequently, the amount of milk sold per day is also reducing. If the farmers will not try to produce extra quality milk in the future either, it will result in the closure of milk

collecting stations. In order to avoid this, milk co-operatives would need to be established by the co-operation of farmers. In this case, the professional relationship between and common interest of the dairy farmers would be collaterals of a continuous production of good quality milk.

- Since the farmers do not have a cooler, the cooling of milk is not solved in most of the farms, although, in addition to filtration, it is a major factor in milk quality. Therefore, it is very important that the milk should be taken to the milk collecting station as soon as possible.
- The small, medium and large dairy farms could increase the profitability of production without significant financial inputs, if they implement my short term recommendations.

  A further improvement of the farms' operation will result, if my long term recommendations are implemented when the necessary financial sources become available.
- If the the best indices per cluster included in my thesis will be known by the experts of the farms, they can study from the best (benchmarking).
- When establishing a new dairy farm or developing an existing one, an economical operation is ensured, if the owner implements the recommendations of the model.

Of course, these model data require modern technical equipment, a good utilization of working time, the application of appropriate working methods and employment of qualified workers.

6. PUBLICATIONS RELATED TO THE THESIS

Articles in scientific journals:

1. Vántus, A.: (2002) A vidékfejlesztés és a minőségi nyerstej-előállítás összefüggései. Acta Agraria Debreceniensis, 111-113.
2. Vántus, A.: (2002) A kisüzemi szarvasmarhatartás vidékfejlesztési vonatkozásai Hajdú-Bihar megyében. Acta Agraria Debreceniensis, 114-117.
3. Vántus, A.: (2003) Tehenészeti telepek munkahelyi szervezettségének vizsgálata Acta Agraria Debreceniensis, Különszám, 293-296.
4. Vántus, A.: (2006) A munkatermelékenység alakulása különböző típusú és méretű tehenészeti telepeken Hajdú–Bihar megyében Acta Agraria Debreceniensis, 19. 62-67.
5. Kovács, S. – Vántus, A.: (2006) A nyerstej minőségének és a fejőberendezés típusának összefüggései Tejgazdaság (befogadó-nyilatkozat)(megjelenés alatt)

Presentations in foreign language at scientific conferences:

1. Nagy, T. – Vántus, A. – Terjék, L.: (2000) Investigation of the influence of factors on the productivity of labour at small and large scale animal farms Aktuálne problémy agrárneho trhu, Zborník Nitra, 178-181.
2. Nagy, T. – Vántus, A.: (2001) Exploration of reserves in work organization at small and large scale cattle farms. International Scientific Days, Nitra, 59-63.
3. Kemecsei, Á. – Vántus, A.: (2001) Analysis of fresh milk quality and production conditions in small-scale dairy farms. 1st International conference for young researchers Gödöllő, 173-177.
4. Nagy, T. – Vántus, A. – Kemecsei, Á.: (2002) Work rationalization on dairy farms. Medzinarodné vedecké dni, Nitra, I. zväzok, 247-250.
5. Pakurár, M. – Vántus, A.: (2002) Quality managament of milk production at small-scale dairy farms. International Conference Agricultural and Food Sciences, Processes and Technologies, Sibiu, 370-374.
6. Pakurár, M. – Vántus, A.: (2003) The quality of produced raw milk at large and small-scale dairy farms. Integrated Systems for Agri – Food Production International Conference, Timisoara, 221-224.
7. Vántus, A. – Kovács, S. – Pakurár, M.: (2005) Milking management at dairy farms AVA-2 konferencia, Debrecen, CD
8. Pakurár M – Vántus A. – Kovács S.: (2005) Evaluation of the relationships between milk quality and udder cleaning methods using Kaplan – Meier analysis

Integrated Systems for Agri – Food Production International Conference, Timisoara, 125-130.

Presentations in Hungarian at scientific conferences:

1. Nagy, T. – Terjék L. – Vántus A.: (2000) A minőség változásának hatása az árbevételre. Az élelmiszergazdaság fejlesztésének lehetőségei. XXVIII. Óvári Tudományos Napok, Mosonmagyaróvár, 125-130.
2. Vántus A.: (2000) A tejtermelés munkafolyamatának vizsgálata a kisüzemi tehenészetekben A térségfejlesztés vezetési és munkaszervezési összefüggései Nemzetközi tanácskozás II. Debrecen, 160-163.
3. Nagy, T. – Terjék, L. – Vántus, A.: (2000) Szaktanácsadás: Vidékfejlesztés A térségfejlesztés vezetési és munkaszervezési összefüggései Nemzetközi Tanácskozás II. Debrecen, 123-127.
4. Nagy, T. – Vántus, A. – Terjék, L.: (2001) A szaktanácsadás keretében tartott fejési bemutatók tapasztalatai Hajdú-Bihar megyében. Innováció, a tudomány és a gyakorlat egysége az ezredforduló agráriumában, Gödöllő, 197-201.
5. Nagy, T. – Terjék, L. – Vántus, A.: (2001) A kisüzemi szarvasmarhatartás és a vidékfejlesztés kapcsolata, XLIII. Georgikon Napok, Keszthely, 103-108.
6. Vántus, A. – Buzás, F.E.: (2002) Modellvizsgálatok tejtermelő családi gazdaságok költség és munkahatékonyságának elemzéséhez. A mezőgazdasági termelés és erőforrás hasznosítás ökonómiája. VIII. Nemzetközi Agrárökonómiai Tudományos Napok, Gyöngyös, 97-102.
7. Nagy, T. – Vántus, A. – Kemecsei, Á.: (2002) A rekonstrukció hatása a tehenészeti telepek munkaszervezésére. Innováció a tudomány és a gyakorlat egysége az ezredforduló agráriumában. Debrecen, 77-82.
8. Nagy, T. – Vántus, A. – Kemecsei, Á.: (2002) Néhány tehenészeti telep munkahelyi szervezettsége. XXIX. Óvári Tudományos Napok Agrártermelés- Életminőség Agrárökonómiai Szekció Mosonmagyaróvár, CD
9. Vántus, A.: (2003) A munkahelyi szervezettség hatása a szarvasmarhatartó telepek munkatermelékenységére. AVA konferencia Debrecen, CD
10. Vántus, A.: (2003) Munkaszervezés Hajdú – Bihar megye néhány tehenészeti telepén. EU – konform mezőgazdaság és élelmiszerbiztonság. Gödöllő – Debrecen, I. kötet 456-461.
11. Vántus, A.: (2003) Hajdú – Bihar megye kisüzemi tejtermelése az Európai Unióhoz való csatlakozás küszöbén. XLV. Georgikon Napok „Új stratégiák az agrárgazdaságban” „EU - csatlakozás, 2004.” Keszthely, CD

12. Vántus, A.: (2004) A nyerstej-minőségi előírások szigorításának hatása a tejtermelő tehenészetekre IX. NATN Gyöngyös, CD
13. Nagy, T. – Vántus, A.: (2004) Az új tejminősítési rendszer hatása a kis – és nagyüzemekben előállított nyerstej minőségére és értékesítési átlagárára. Innováció, a tudomány és a gyakorlat egysége az ezredforduló agráriumában. Agrárgazdasági modellek a XXI. század mezőgazdaságában Konferencia Vidékfejlesztés és ökonómia szekció Debrecen, CD
14. Nagy, T. – Vántus, A.: (2004) Munkakooperáció, műveleti integráció „Kooperációtól a globalizációig" Tudományos ülés Dr. Lakatos Dénes nyugdíjba vonulása alkalmából Debrecen, 119-124.
15. Vántus, A. – Kovács, S.: (2004) A tehenészetekben alkalmazott fejési mód, valamint a fejési rendszerek összefüggései, és hatásuk a nyerstej mennyiségére és minőségére XLVI. Georgikon Napok „Új kihívások, új lehetőségek a mezőgazdaságban" Keszthely, CD
16. Kovács S. – Vántus A.: (2005) Tehenészeti telepek munkaszervezésének statisztikai elemzése „Közép–Európa mezőgazdasága – lehetőségek és kockázatok" XLVII. Georgikon Napok és 15. ÖGA találkozó Keszthely, CD
17. Vántus A. – Kovács S.: (2006) Tehenészeti telepek munkatermelékenysége különböző tartási módok esetén A térségfejlesztés vezetési és szervezési összefüggései Tudományos Ülés Debrecen, 255-260.

Posters:

1. Vántus, A. – Pakurár, M.: (2002) Rationalization of organization at large-scale and small-scale dairy farms. 2nd International Conference for Young Researcers of Economics SZIE Gödöllő, Volume I. 358-361.
2. Vántus, A.: (2003) A kisüzemi és a nagyüzemi fejési technológiák összehasonlítása XLV. Georgikon Napok „Új stratégiák az agrárgazdaságban" „EU – csatlakozás, 2004." Keszthely, CD
3. Vántus, A. – Terjék, L.: (2005) Hajdú- Bihar megye néhány tehenészeti telepének munkavédelmi helyzetértékelése AVA-2 konferencia, Debrecen, CD
4. Vántus A. – Kovács S.: (2005) A nagyüzemi tejtermelés munkaszervezési összefüggései „Közép–Európa mezőgazdasága – lehetőségek és kockázatok" XLVII. Georgikon Napok és 15. ÖGA találkozó Keszthely, CD
5. Terjék L. – Vántus A.: (2005) A munkakörnyezet munkavédelmi szempontú vizsgálatának lehetőségei a mezőgazdaságban „Közép–Európa mezőgazdasága – lehetőségek és kockázatok" XLVII. Georgikon Napok és 15. ÖGA találkozó Keszthely, CD