Szent István University

Theses of the doctoral (PhD) dissertation

THE ECONOMIC RELATIONS OF THE LAYING HEN SECTOR IN DIFFERENT KEEPING TECHNOLOGIES

Virág Szabó

Gödöllő

2017

The Doctoral School

name: Doctoral School of Managemenet and Business Administration

research field: management and business administration

Head of the School:	**Dr. József Lehota** professor, Doctor of Science (MTA) Szent István University Faculty of Economics and Social Sciences Institute of Business Studies
Supervisor:	**Dr. László Villányi** Professor Emeritus Szent István University Faculty of Economics and Social Sciences Institute of Regional Economics and Rural Development
Associate supervisor:	**Dr. János Kozák** Professor Emeritus Szent István University Doctoral and Habilitation Council

....	....
Approval of Head of the School	Approval of Supervisor

....

Approval of Associate supervisor

1. WORK BACKGROUND, EXPECTED OBJECTIVES

1.1. Timeliness of the topic

The egg is our essential food source, but its consumption has been decreasing continuously in Hungary since 1990. Consumption per capita fell by 27%, that is 78 pieces between 2004 and 2013. The size of our chicken stock has been fluctuating since our Union accession, and oscillates around 32 million. Within the aviary, however, the proportion of laying hens decreased. While almost half of the stock, 47% were laying hens in 2004, the stock of laying hens was only 38%, that is approximately of 12 million in 2015. The number of laying hens therefore decreased by 20% between 2004 and 2015 (KSH, Central Statistical Office, 2016). BTT (2013) explained the reason of egg production decrease with the fact that customs tariffs ended with Union accession, so Union surplus would come freely to the Hungarian market in case of overproduction, consequently purchase prices decreased. Low purchase prices and high feed prices make the situation of producers more difficult, who in turn try to restrain introductions or bring chicken slaughter forward (Csorbai et al., 2011a).

The environmental and animal protection aspects of sustainable development came to the fore in the past one and a half decades, and all the more attention is paid to natural keeping (Gundel and Ladocsi, 2009). The multiple reform of the Common Agricultural Policy adds up to this, which – in the framework of mutual compliance – makes the use of different subsidies dependent on conditions such as environmental values, preserving the health of animals and plants and that serve the welfare of animals (Bodó et al., 2010). Putting rules related to ever stricter production requirements into practice implies considerable extra cost for the producers. The European Council (1999) determined already in its 1999/74/EC directive that keeping laying hens in unimproved cages would be prohibited from 1 January 2012. According to the directive, from 1 January 2012, it is forbidden to keep laying hens in traditional cages. At least 750 cm^2 of cage space has to be provided for laying hens in the improved cages instead of the previous 550 $cm^{2,}$ and cages have to be furnished in a way to include a nest, litter they can peck and scratch, as well as a sitting perch at least 15 cm long for each hen.

Although twelve and a half years passed between the publication of the directive and its implementation deadline, only 14 member states carried out the cage change as of 1 January 2012. 13 countries did not comply with the provisions by the set deadline, among them Hungary (European Parliament's Intergroup on the Welfare and Conservation of Animals, 2013). According to Aliczki (2012), the member states violating the provision did not change the cages on time because it required considerable investment. The producers who could not carry out the cage change until 1 January 2012, got a respite from the European Commission until 31 July 2012 with the condition that eggs produced in traditional cages would be used only for industrial purposes. According to the European Union of Wholesale with Eggs, Egg Products, Poultry and Game, production in improved cages makes the prime costs of Union producers 12% more expensive, which means competitive disadvantage compared to imported eggs arriving from outside the Union, to which the EU animal welfare provisions do not apply (Kállay, 2015). Consequently, the producers consider animal welfare provisions to be competitive disadvantage, while a part of them prefers alternative technologies and is willing to comply with animal welfare requirements that are even stricter than improved cages.

27% of the laying hen stock of the EU produced with deep-litter methods in 2016, 14% in free range, and 4% with an organic system (EEPA, 2016). According to the EU Group of the International Federation of Organic Agriculture (IFOAM EU Group), the market share of organic eggs[1] increases year by year in Austria, Belgium, Finland, France, Germany and the Netherlands, 11-22% of the total retail egg sales were eggs coming from organic farming in 2014 (Meredith and Willer, 2016). Based on the survey made by Molnár and Szőllősi (2015), 51% of 777 respondents does not check production mode, but 49% does when buying eggs. 54% of those who check this information buy free-range eggs, 14% buy deep-litter ones, and 4% organic eggs. All this indicates that an ever increasing number of consumers pays attention to the production system the egg is coming from.

1.2. Raising the subject

It is all the more difficult for the actors to hold their ground on the global market of caged egg production, that is why I believe it is important that the producers be able to judge their own competitivity, and bring their economic decisions based on this. However, the issue is raised whether the move towards alternative technologies indeed creates the opportunity of competitive management, so the aim of my doctoral research is the analysis of the economic relations of plants producing in different keeping technologies. There was no example in previous studies of a detailed economic comparison of the cage and deep-litter system from a national database in Hungary, so the cost-benefit analysis of these systems from Union accession to 2014 will probably lead to new scientific results. Of national keeping systems, we have least information on the free range and organic systems. This is a consequence primarily of the fact that the proportion of such farms is reduced compared to the total number of farms, and the producers target such a small market gap which responds sensitively to the

[1] Based on corresponding legal provisions, the produces and food produced in organic farms are designated as „ecological", „eco", „biological", „bio" and „organic" (Hungarian Federation of Associations for Organic Farming, 2011).

changes that come about in market relations. This is typical mostly of organic farms, as their number does not even reach twenty in Hungary, and only those can persist in the long term which have a constant and stable customer base. The three-year research scholarship of the Hungarian Research Institute of Organic Agriculture provided indispensable help to map this segment of the sector, as data collection would not have been successful without the personal contact of the producers at different points of the country.

1.3. The set goals

I defined the following goals while structuring the dissertation:

The goals of literature processing:

- The summary of the sustainability and animal welfare issues of the laying hen keeping technologies applied in the European Union.
- The comparison of the production indicators of the individual keeping methods.
- The analysis of the egg production and foreign trade relations of the European Union.
- The presentation of the Hungarian laying hen sector and its position within the European Union.
- The examination of the effect the compulsory cage change had on EU and Hungarian egg production, as well as on the proportion of alternative systems.
- The examination of the cost-increasing factors of the different keeping systems and the examination of the improved cage system in the EU and Hungary.
- Identifying the sales and consumption characteristics of the eggs coming from alternative systems in Hungary.

The objectives related to secondary research:

1. **objective** (C1): The examination of the concentrated character of the Hungarian laying hen sector.
2. **objective** (C2): The analysis of the economic relations of the cage and deep-litter systems.
3. **objective** (C3): Identifying the Hungarian situation and development opportunities of organic laying hen keeping.

2. MATERIALS AND METHODOLOGY

2.1. Research hypotheses

Partly with the help of elaborated literature, I lay down the following research hypotheses:

1. **hypothesis** (H1): The concentrated character of the laying hen sector grew between 2012 and 2016.
2. **hypothesis** (H2): Producers use little self-produced feed in both the cage and deep-litter system, so its effect on prime costs cannot be demonstrated.
3. **hypothesis** (H3): Labour input per hen is bigger in the case of the deep-litter method, therefore the personal costs per hen are higher in this case.
4. **hypothesis** (H4): Due to the low purchase price of the egg, the producers can increase their income primarily by cutting costs.
5. **hypothesis** (H5): The specific income of organic eggs is higher than that of cage and deep-litter ones. Still, the significant growth of the organic hen stock is not to be expected.

2.2. Defining data sources

C1: The examination of the concentrated character of the Hungarian laying hen sector.

I examined the concentrated character of the laying hen sector based on the data registered by NÉBIH (2016a) and on the farm-level data of the Farm Accountancy Data Network. NÉBIH registered 562 farms in 2012, 627 in 2014, and 935 in 2016. 91 laying hen farms took part in the Farm Accountancy Data Network in Hungary between 2004 and 2014, of these 49 produced in a cage, and 42 with a deep-litter system.

C2: The analysis of the economic relations of the cage and the deep-litter systems.

I carried out the economic analysis of the cage and deep-litter systems also based on the data of the Farm Accountancy Data Network. No farm of the 49 cage system producers figured each year in the database. More than half of the farms provided data in one, two or three years *(Figure 1)*. Among deep-litter laying hen system users, there were more producers who figured in the database for only one, two or three years *(Figure 2)*.

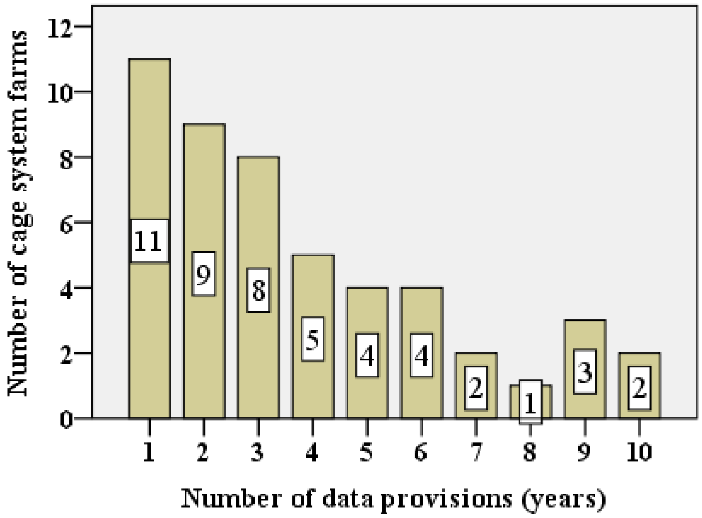


Figure 1: The distribution of cage system farms according to the number of years they provided data between 2004 and 2014

Source: Own calculation based on the data of the Farm Accountancy Data Network

As the range of producers changed in both systems from year to year, no analysis could be elaborated that would have the same farmers each year. Data filtering was also made difficult by the fact that data came from different farm sizes as the range of data providers changed every year, so – with the exclusion of the largest and smallest farms - the number of farms that could have been analysed would have been reduced to one or two in certain years *(Figure 3).*

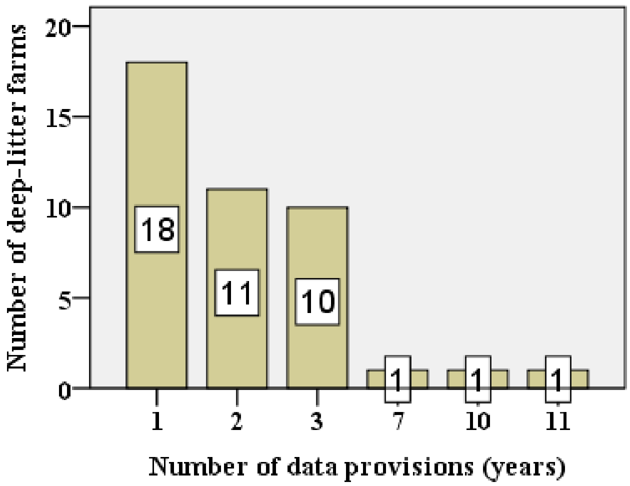


Figure 2: The distribution of deep-litter farms according to the number of years they provided data between 2004 and 2014

Source: Own calculation based on the data of the Farm Accountancy Data Network

The proportion of cage and deep-litter farms started to level out after 2012, in the years prior to 2012 it was the producers preferring the cage system that rather participated in data provision *(Figure 3).*

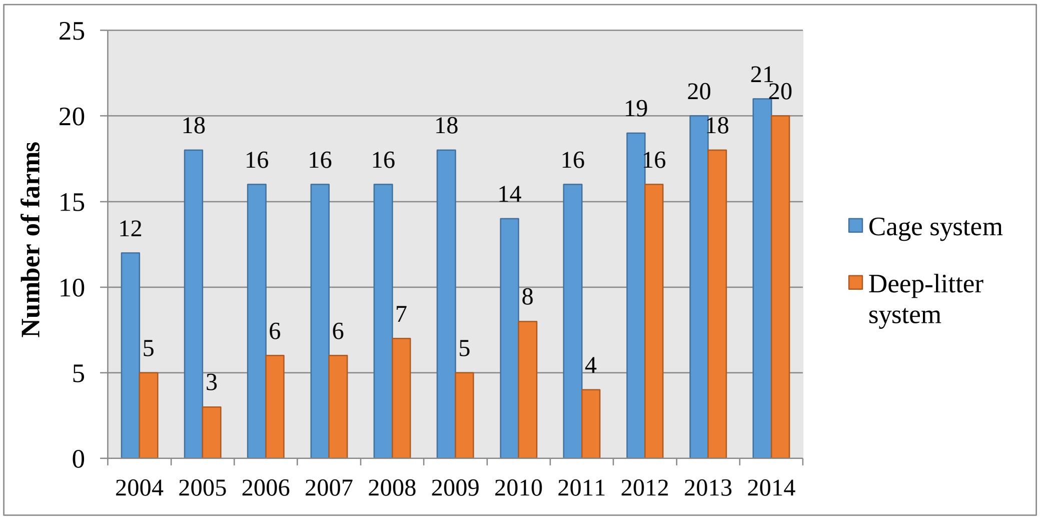


Figure 3: The number of responses that arrived per year (2004-2014)

Source: Own calculation based on the data of the Farm Accountancy Data Network

The size of the cage stocks was alternating between 6.911 and 17.653 laying hens, while the stock size of deep-litter farms was between 451 and 960 laying hens *(Table 1).* This means that the deep-litter stocks were smaller in the average than the ones using the cage system. Due to a Central Transdanubian producer, the deep-litter stock was outstandingly high in 2004 and 2006, but this producer did not provide any data in the other years. Deviation is a lot higher in the case of the cage producers, as among the deep-litter ones there were only two farms whose stock exceeded 10.000 hens.

Table 1: Average laying hen stock of the farms and their deviation (2004-2014)

Year	**Cage**		**Deep-litter**	
	Number of hens	Deviation	Number of hens	Deviation
2004	15 042,63	34 574,75	27 070,26	59336,98
2005	17 652,73	30 748,19	451,01	402,48
2006	9 919,68	13 833,64	25 216,29	53297,42
2007	8 152,54	13 076,60	959,78	712,59
2008	8 284,91	14 044,36	814,51	721,81
2009	6 910,91	12 805,74	873,94	554,02
2010	19 406,60	51 282,99	815,62	854,29
2011	16 922,83	33 408,63	551,80	367,03
2012	13 991,77	30 507,67	543,21	701,86
2013	13 603,58	29 744,59	576,13	749,90
2014	13 602,19	27 775,23	705,22	913,09

Source: Own calculation based on the data of the Farm Accountancy Data Network

20% of the cage producers had less than 350 laying hens, 10% had between 351 and 1.000, and 43% had between 1.000 and 10.000. 26,5% of the farms kept more than 10.000 hens *(Table 2).*

Table 2: Distribution of cage farms based on farm size and capacity (2004-2014)

Farm size categories based on farm capacity (hens)	Number of farms	Distribution of farms according to size (%)	Size of total capacity (hens)	Distribution of the farms according to total capacity (%)
Less than 350	10	20,41	1678	0,22
351-1 000	5	10,20	3358	0,44
1 001-10 000	21	42,86	67 164	8,74
10 001-25 000	5	10,20	71 055	9,24
25 001-50 000	4	8,16	131 200	17,06
50 001-100 000	1	2,04	54 319	7,06
Over 100 000	3	6,12	440 087	57,24
Total	49	100,00	768 861	100,00

Source: Own calculation based on the data of the Farm Accountancy Data Network

55% of deep-litter farms produced in a farm size of less than 350 hens, while these farms possessed less than 2% of total capacity. 14% of the farms produced with between 351 and 1.000 laying hens, while 26% had between 1.000 and 10.000 of them. There is one farm each in the database in the category between 10.000 and 25.000 laying hens and in the one above 25.000 laying hens *(Table 3).*

Table 3: Distribution of deep-litter farms based on farm size and capacity (2004-2014)

Farm size categories based on farm capacity (hens)	Number of farms	Distribution of farms according to size (%)	Size of total capacity (hens)	Distribution of the farms according to total capacity (%)
Less than 350	23	54,76	3 085,46	1,78
351-1 000	6	14,29	4 077,35	2,35
1 001-10 000	11	26,19	18 851,21	10,87
10 001-25 000	1	2,38	14 038	8,10
Over 25 000	1	2,38	133 342	76,90
Total	42	100,00	173 394,01	100,00

Source: Own calculation based on the data of the Farm Accountancy Data Network

C3: Identifying the Hungarian situation and development opportunities of organic laying hen keeping.

The population of organic laying hen keeping farms was made up of the producers figuring in the registers of the Hungarian Research Institute of Organic Agriculture (2016) and NÉBIH (2016a). I also contacted the certifiying organizations to include further farms into research, but they did not reveal any data on producers due to the protection of personal data. During the three-year research period, there were altogether twenty organic laying hen farmers in the mentioned databases. I contacted the producers on the phone or personally at the Csörsz utca organic produce market. I managed to get in touch with thirteen out of twenty procuers. I met six of the producers who collaborated in the research on their farm after getting in touch. More than half of the producers kept less than 350 laying hens, the stock size was between 350 and 1.000 laying hens in four farms, and there was one farm where hens were kept in a big number *(Table 4).*

Table 4: The distribution of organic farmers according to farm size

Farm size (hens)	Number of farms	Average laying hen stock (hens)
Less than 350	7	85
350-1 000	4	420
Over 1 000	1	18 000

Source: Data from own collection

Apart from the producers, I contacted several other stakeholders of the organic sector, such as traders, co-workers of gene preservation institutes and certifying institutes, as well as experts versed in the subject of research institutes and interest representation bodies. Interviews were made with the actors of altogether ten sectors. The primary selection method for the interviewees was to choose actors of the organic sector that are committed to organic farming and do a lot to promote it in Hungary. Both producers and sectoral actors took part in the research anonymously.

2.3. Applied methods

C1: The examination of the concentrated character of the Hungarian laying hen sector.

I used the **Lorenz curve** to represent concentration, and the **Gini index** to determine the amount of concentration.

C2: The analysis of the economic relations of the cage and the deep-litter systems.

Cost-benefit analysis: when processing the data of the Farm Accountancy Data Network, my primary goal was to reveal the cost-benefit differences of the individual keeping technologies. I used the methodology of AKI (2013) when examining the cost-benefit correlation.

Applied statistical tests: Kolmogorov–Smirnov-test, F-test, two-sample t-test, Welch-test, Mann–Whitney-test. I used the statistical tests to compare the annual averages calculated during the cost-benefit analysis. I examined two independent samples in each case. With the help of the Kolmogorov–Smirnov-test, I checked whether the examined changing values are of normal distribution. I applied the non-parametric Mann–Whitney-test, which is the non-parametric equivalent of the two-sample t-test in the case of a variable of abnormal distribution. I used parametric tests in the case of a variable of Gaussian distribution and checked the identity of the variances with the F-test first. If the variance of the two samples did not differ significantly, with the help of the two-sample t-test I examined whether the difference of their averages was significant. If the variance of the two samples differed significantly, I applied the Welch-test. I carried out the statistical tests with the GraphPad InStat 3 statistical programme.

Correlation and regression calculation: I revealed the relations and the parameters typical of the correlations between the following variables with the help of a correlation and regression calculation.

- feed costs and prime costs (HUF/egg);
- prime costs and average sales price (HUF/egg);
- prime costs and specific income (HUF/egg);
- average sales price and specific income (HUF/egg).

I demonstrated the closeness of the correlations with the help of the Pearson correlation coefficient, and the direction and amount of the correlations with the regression coefficient. I checked the best equation matching with the analysis of the confidence interval of the Pearson correlation coefficient and the determination coefficient. The calculations were done with the SPSS statistical programme.

Profitability indices: I used the following indices to examine the profitability of the cage and deep-litter systems:

- Profitability or income level proportional to production value
- Cost-proportional profitability or profitability rate
- Direct cost-proportional profitability

C3: Identifying the Hungarian situation and development opportunities of organic laying hen keeping.

I made structured interviews with producers, using a standardized questionnaire. The open and closed questions of the questionnaire were grouped into four topics. First, I surveyed the stock size of the farms, the varieties used and the characteristics of the buildings of the laying hens. The second topic included questions related to animal nutrition, the third part included costs, and in the last chapter of the questionnaire I inquired about sales and market conditions. In order to process the quantitative data of the questionnaires, I followed the methodology used for the analysis of the cage and deep-litter plants (AKI, 2013). The producers were not willing to answer issues related to their income, so the data were primarily suitable for cost analysis.

I made semi-structured interviews with sectoral actors, as I did not set the questions in advance, only the subjects. During the interviews, I inquired about the same topics as in the questionnaires prepared for the producers. Conclusions on the sector as a whole have thus been deduced from the producers' answers to open questions and from all the views expressed by sectoral actors. My primary goal was to define the reasons behind the obstacles hindering the development of organic laying hens. I systematized the thoughts of producers and product line actors using a cause-effect diagram (Cause and Effect, Ishikawa – also known as fishbowl diagram). The 5M method (Kövesi and Topár, 2006) was used to categorize direct causes and indirect causes leading to direct ones. 5M consists of five predefined groups: Environment (Millieu), Material, Method and Measurement. The group containing most reasons contains most 'root causes' hindering development, which should be developed primarily to improve the situation of sectoral producers. The cause-effect diagram was made with the help of the MINITAB statistical software.

3. RESULTS

3.1. The examination of the concentrated character of the Hungarian laying hen sector

The Lorenz curve indicates the high concentration of the laying hen sector in each examined year *(Figure 4)*. Although the number of laying hen farms increases yearly according to the NÉBIH (2016a) data, tha amount of concentration did not decrease in the sector. In each examined year, about 10% of each farm concentrated more than 80% of the complete national capacity.

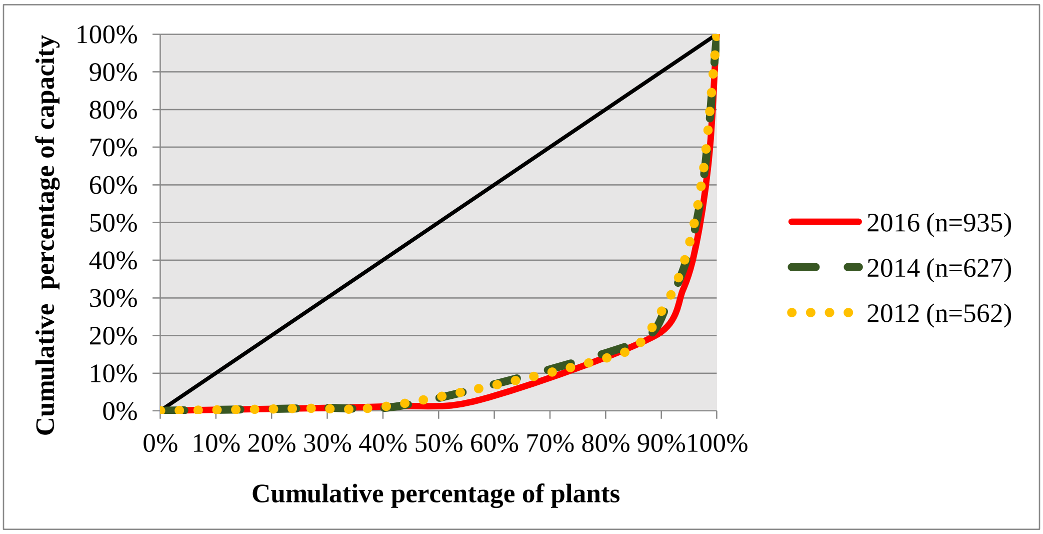


Figure 4: Lorenz curve of national laying hen farms (2012-2016)

Source: Own calculation based on NÉBIH (2016a) data

The Gini-index shows high concentration each year, and based on the index it can be stated that the amount of concentration grew in the examined years *(Table 5)*.

Table 5: The values of the Gini-index in 2012, 2014 and 2016 in the laying hen sector

Gini-index	Laying hen sector
2012	0,73
2014	0,74
2016	0,78

Source: Own calculation based on NÉBIH (2016a) data

3.2. The analysis of the economic relations of the cage and the deep-litter systems

3.2.1. Examining the correlation between feed costs and prime costs

When examining the data of the Farm Accountancy Data Network, I found that the prime cost of the egg depends greatly on the level of feed costs, so I found it necessary to examine it further. As according to Kalmár (2008b: p. 166), "purchased feed is usually more expensive than self-produced feed", I examined how much the ratio of self-produced and purchased feed in each keeping system is *(Table 6)*. The total feed costs per chicken were 18% higher in the case of the deep-litter system. The rate of own feed consumption is higher for cage system producers in terms of the average of the examined years, which is mainly due to the fact that in 2004 and 2005 their own feed costs accounted for 87% and 64% of the total feed costs. However, this was only 28% on average between 2006 and 2010, and less than 10% from 2012 on. For deep-litter producers, the highest value of their own feed costs was 23%, but remained below 10% in six years out of the eleven years examined.

Table 6: The distribution of own and purchased feed costs per hen in different keeping systems (2004-2014)

Year	Cage		Deep-litter	
	Own feed per hen (%)	Purchased feed per hen (%)	Own feed per hen (%)	Purchased feed per hen (%)
2004	86,87	13,13	16,63	83,37
2005	63,83	36,17	8,44	91,56
2006	25,01	74,99	0,17	99,83
2007	23,11	76,89	22,77	77,23
2008	35,70	64,30	7,37	92,63
2009	27,07	72,93	20,95	79,05
2010	29,39	70,61	3,43	96,57
2011	10,36	89,64	7,11	92,89
2012	8,12	91,88	7,17	92,83
2013	8,86	91,14	13,75	86,25
2014	4,55	95,45	11,20	88,80
Average	**29,35**	**70,65**	**10,82**	**89,18**

Source: Own calculation based on the data of the Farm Accountancy Data Network

Although according to Kalmár (2008b), the own production of feed implies lower costs, cage system producers have been steadily reducing their share during the examined years and in more than 90% of the cases, purchased feed is used in production since 2011. This can be traced back to the fact that harmony between plant breeding and livestock breeding has deteriorated (Udovecz, 2004). For deep-litter system producers, the proportion of feed purchased on average also accounts for 90% of all feed costs, so it can be clearly stated that all feed costs are determined by the cost of purchased feed. As in both keeping systems feed costs make up more than 50% of prime costs, I examined to what extent the change in the feed cost per egg affects egg prime costs. First, I examined the correlation of the two variables in the cage system. I used correlation calculation to prove that there is a statistically verifiable correlation between feed costs and prime costs. The Pearson correlation coefficient showed strong positive correlation (r=0,775). According to the value of the determinant coefficient (r^2=0,601), the regression equation accounts for 60,1% of the total distribution, that is the change in prime costs affects feed costs to 60,1%. Other calculations resulted in only minimally better results, meaning that the use of more complex models was statistically not justified. According to the regression line, if the feed cost per egg per liter is increased by 1 HUF, prime costs are expected to increase costs on average by 1,142 HUF *(Figure 5).*

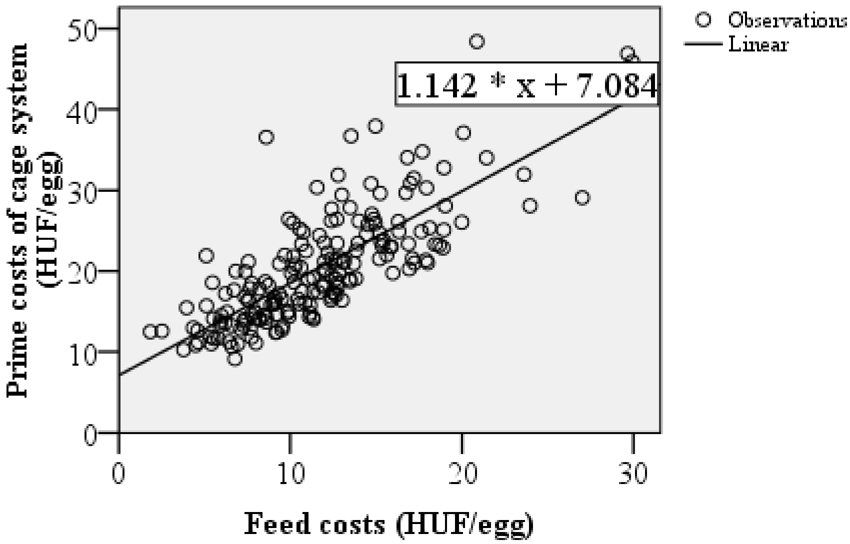


Figure 5: The equation of feed costs and own costs in cage system keeping

Source: Own calculation based on the data of the Farm Accountancy Data Network

In the case of deep-litter keeping, I also examined how the prime costs of deep-litter eggs change in accordance with the cost of feed per egg. I confirmed with the help of correlation calculation prior to regression analysis that there is a strong positive link between the prime cost of deep-litter eggs and feed costs (r=0,755). The regression equation explains 57% of total distribution (r^2=0,570), which means the change of feed costs affects the change of the prime costs of deep-litter eggs up to 57%. Based on the parameters of the equation, it can be affirmed that prime costs in deep-litter keeping change on the average by 1,338 HUF if feed costs per egg increase by 1 HUF *(Figure 6).*

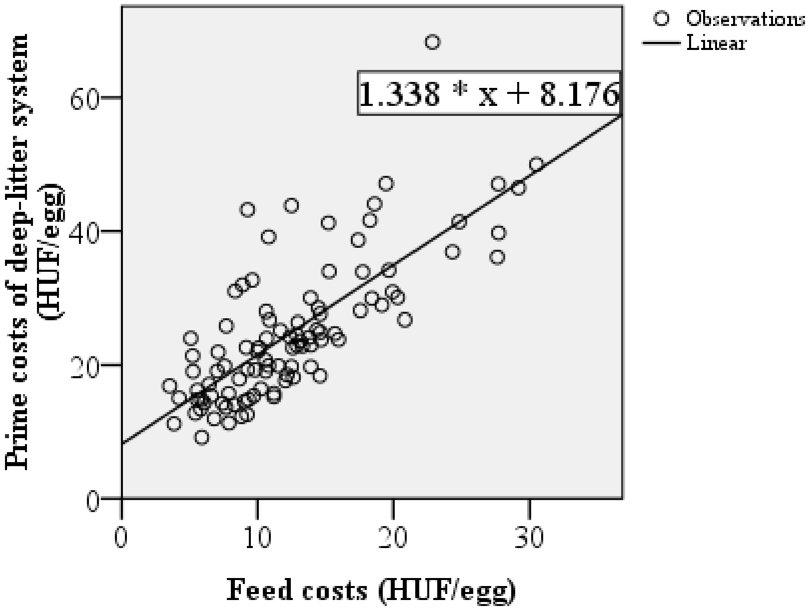


Figure 6: The regression analysis of feed costs and prime costs in the case of deep-litter system

Source: Own calculation based on the data of the Farm Accountancy Data Network

The equation is steeper in the case of deep-litter keeping as in the cage system, but the confidence interval belonging to the two equations covers one another, so there is no significant difference between the two inclinations. No statistically confirmable link could be proven between own feed and prime costs either in the case of the cage or the deep-litter system, **therefore it cannot be confirmed that the usage of own feed would affect prime costs.**

3.2.2. Full-time equivalent (FTE) and personal costs per hen

When examining personal costs, I found out that contrary to literature data, the work costs of producing deep-litter eggs was higher only in four years out of the examined eleven *(Figure 7)*. Compared to the previous years, in 2013 and 2014, the work costs per deep-litter egg did not increase significantly because egg production per hen decreased to a huge extent. According to Damme's (2011)[2] data measured in Germany, compared to traditional caged keeping, FTE is twice as high in aviaries, three times as high in the deep-litter system and four times as high in the free range system. As he did not demonstrate this kind of work cost per egg, I calculated the number of work hours per hen and also the salary cost per work hour *(Table 7)*.

[2] Referred to by: Horn (2013)

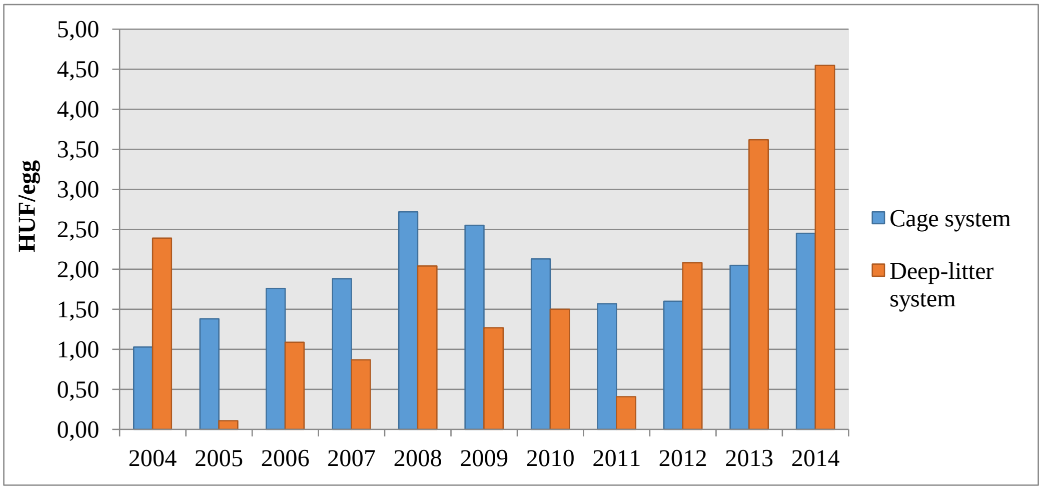


Figure 7: Personal costs per egg in individual keeping systems

Source: Own calculation based on the data of the Farm Accountancy Data Network

In accordance with Damme's (2011) calculation, I found that FTE was three times higher in the deep-litter system per hen, which means the statements found in literature were confirmed. A yearly average of 33 minutes is dedicated to a hen in the cage system, while in the deep-litter system it is 91 minutes *(Table 7).* These values differ significantly from the German data, as in that case the yearly work time spent on a hen is 5 minutes in traditional cages, 10 minutes in aviaries, 16 minutes in the case of the deep-litter system, and 22 minutes if it is the free range system.

Table 7: Work hour per hen, salary costs per work hour and its taxes (2004-2014)

Year	**Work hour per hen**		**Average salary cost per work hour (HUF/hour)**		**Salary costs paid per work hour and its taxes (HUF/hour)**	
	Cage system	Deep-litter	Cage system	Deep-litter	Cage system	Deep-litter
2004	0,53	0,76	370,17	894,41	486,60	993,44
2005	0,54	2,43	477,95	0,00	609,29	15,20
2006	0,65	0,30	513,74	564,20	651,90	765,83
2007	0,57	1,45	592,98	118,16	738,56	155,97
2008	0,84	2,07	550,11	210,61	718,16	297,84
2009	0,77	1,54	576,54	189,75	747,43	251,95
2010	0,40	1,58	890,07	241,85	1 149,94	307,15
2011	0,43	1,30	752,88	72,64	974,53	91,90
2012	0,42	1,65	780,89	272,07	987,45	346,75
2013	0,45	1,86	817,68	321,79	1 028,46	409,48
2014	0,51	1,81	870,47	388,75	1 107,91	489,71

Source: Own calculation based on the data of the Farm Accountancy Data Network

When analysing costs, I found that personal costs per egg increased on the average 0,5 HUF in 2013 and 2014 compared to traditional caged keeping. Apart from the increase in salaries, the reason for the growth of personal costs was also the higher need of FTE. Compared to the average of previous years, between 2010 and 2012 the number of work hours per hen decreased, the reason of which can be more efficient production, but this tendency came to a halt with the introduction of improved cages, as the number of hens per space unit decreased. FTE per hen is three times higher in the deep-litter system, but this cannot de demonstrated either in net or gross salary costs. When examining this background, I divided all the work hours in both systems according to the number of work hours for the regularly employed people, occasional workforce and family work *(Figure 8 and 9).*

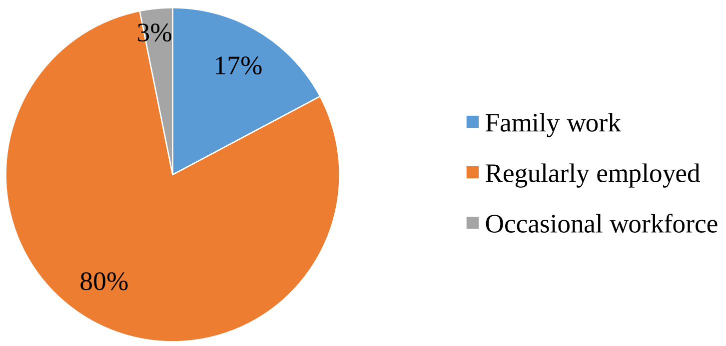


Figure 8: The distribution of work hours in the caged system (2004-2014)

Source: Own calculation based on the data of the Farm Accountancy Data Network

The proportion of family work is twice higher in the deep-litter system, 36% of the total working hours is carried out by family members. As the average size of deep-litter producers is smaller than that of cage system producers, therefore in spite of a bigger work need, the stocks can be provided for by less staff. Apart from this, producers do not include salary costs for the work of family members, and primary producers often – especially if stocks are smaller – carry out their agricultural activity as a secondary job, therefore they do not pay themselves salaries or contribution. The lower personal costs of the deep-litter system are therefore due to the fact that the cost of family work does not appear in the costs for paid working hours. I did not have the opportunity to compare collective and individual farms, as the company form of the farms does not appear in the database at my disposal.

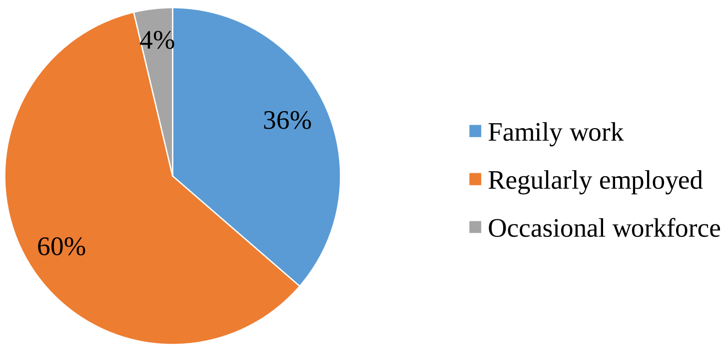


Figure 9: The distribution of work hours in the deep-litter system (2004-2014)

Source: Own calculation based on the data of the Farm Accountancy Data Network

3.2.3. Average prime costs and the average sales price of the cage and deep-litter egg depending on farm size

When comparing the two keeping systems, it can be stated that prime costs were identical in both keeping systems in the case of farms smaller than 350, so the keeping system did not affect costs in these farms *(Table 8)*. The differences in prime costs were highest among the plants between 350-1.000, as cage system producers produced the egg 8 HUF cheaper in this size category. In the case of the stocks between 1.000 and 10.000, the production cost of the deep-litter egg was 2,32 HUF more expensive, while with stocks between 10.000 and 25.000, the extra expense was of 3,61 HUF. No data arrived from deep-litter system producers for the next two farm sizes, so the next category was producers above 100.000, but the data of only one farm were available here, where the prime costs of deep-litter eggs was 3,32 HUF higher. Above 350, deep-litter producers could decrease their costs by an average 4 HUF, above 1.000 it was further 4 HUF. The difference was of 0,5 HUF in the case of the farms between 1.000 and 10.000, as well as 10.000 and 25.000, so no further cost decrease could be demonstrated here, but the farm above 100.000 decreased its costs by further 4,5 HUF.

Table 8: Average prime costs and the average sales price of the cage and deep-litter egg depending on farm size (2004-2014)

Plant size (hen)	Average laying hen stock (hen)		Average prime cost (HUF/egg)		Average sales price (HUF/egg)	
	Cage	Deep-litter	Cage	Deep-litter	Cage	Deep-litter
Under 350	167,83	134,15	29,96	29,90	28,34	28,10
350-1 000	671,57	679,56	18,26	26,20	21,19	24,04
1 001-10 000	3 198,27	1 713,75	19,58	21,90	19,66	23,81
10 001-25 000	13 086,00	14 038,00	18,97	22,58	21,45	19,58
25 001-50 000	32 800,00	-	14,38	-	15,99	-
50 001-100 000	54 319,11	-	13,65	-	17,24	-
Above 100 000	158 326,00	133 341,70	14,01	17,36	15,87	13,69

Source: Own calculation based on the data of the Farm Accountancy Data Network

Based on the average sales prices corresponding to each farm category it can be stated that both keeping systems sold eggs at the highest prices in the case of farms below 350. In the case of cage system producers, the sales price also decreased significantly in two steps, similarly to prime costs. The first bigger decrease came about in the case of producers above 350, and the second in the case of farms above 25.000, which could sell their eggs only at half the price as farms under 350 hens. This is due to the fact that while smaller farms sell directly to the consumers, larger producers are exposed to the prices set by multinational commercial chains, as a higher amount of merchandise can be sold on the market only via them. The same tendency is also typical of deep-litter producers, with the difference that the second big plummeting of the average sales price does not come about in the case of producers above 25.000, but already with stocks of more than 10.000 *(Table 8)*.

3.2.4. The correlation between prime costs, average sales price and specific income in the case of the cage and the deep-litter system

Next I examined how specific income changes in accordance with the changes that come about in the prime costs of cage system eggs. Based on the Pearson correlation coefficient I found that there is a medium strong negative correlation (r=-0,638) between the two variables. The regression line of the linear model explains 40,7% of the total distribution.

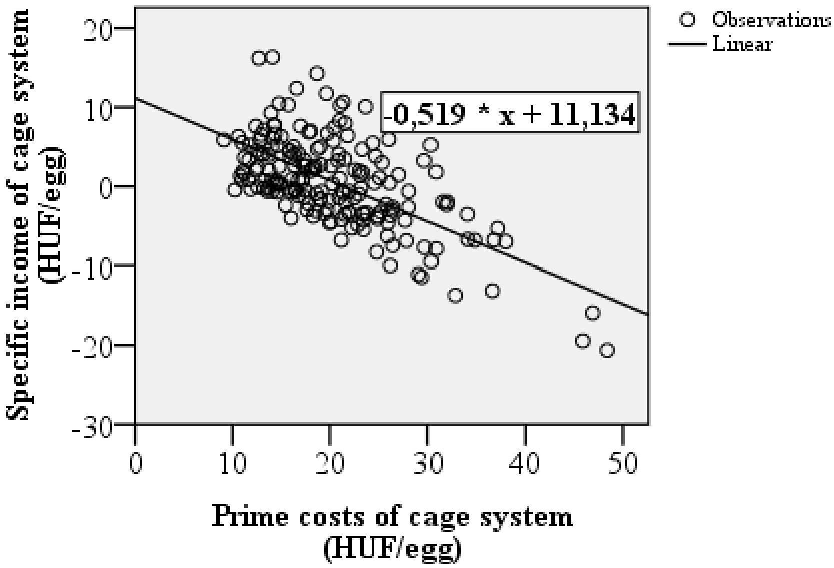


Figure 10: The correlation of the prime cost and the specific income of cage system eggs

Source: Own calculation based on the data of the Farm Accountancy Data Network

Based on the regression equation, it can be stated that provided the prime cost of cage system eggs increases by 1 HUF, its specific income per egg is expected to decrease by an average 0,519 HUF *(Figure 10).*

Therefore the specific income of the cage system egg is highly affected by prime costs. Next I examined the correlation between the average sales price and specific income. According to the Pearson correlation coefficient, there is a weak correlation between the sales price and specific income (r=0,223). The determination coefficient only accounts for 5% of total distribution, so I found that the change of the sales price does not have a significant role in the change of the specific income of the cage system egg.

Examining the correlation between the prime cost of the cage system egg and its sales price, it can be stated that based on the Pearson correlation coefficient the medium strong positive correlation (r=0,609) can statistically be confirmed. The regression line accounts for 37% of total distribution, so the line fits less into the set of points than in the case of previous equations. Based on the regression equation, it can be stated that provided the prime cost of the cage system egg increases by 1 HUF, its sales price is expected to grow by an average 0,481 HUF *(Figure 11).*

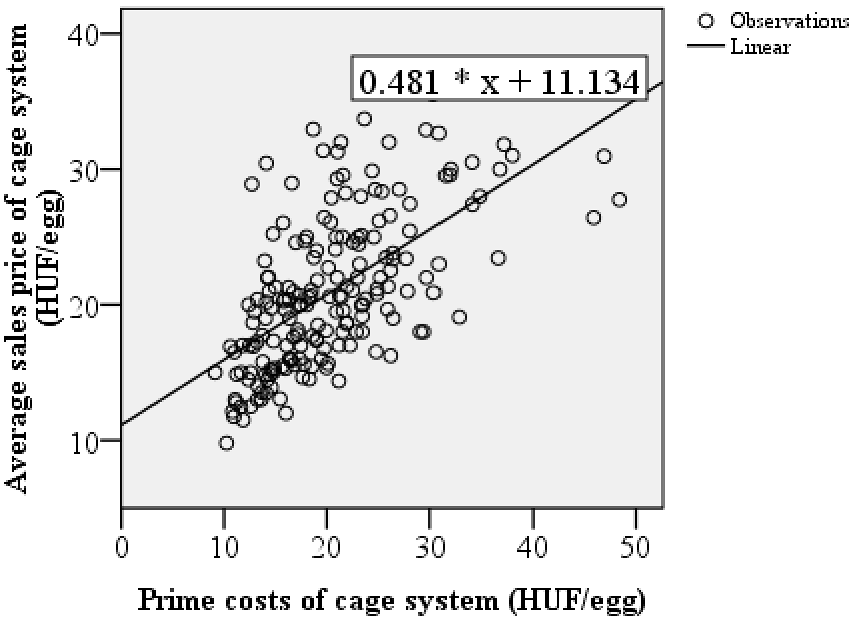


Figure 11: The regression equation of the prime costs of cage system eggs and their sales price

Source: Own calculation based on the data of the Farm Accountancy Data Network

This means that 1 HUF extra cost of the farm producing with the same efficiency is followed by a 0,48 HUF increase. On the whole it can be stated that specific income is determined by costs rather than sales price. The sales price increases together with the increase of the costs, but to a lesser extent than prime costs, so producers can only increase their profit if they cut costs.

The Pearson correlation coefficient indicated a strong negative correlation (r=-0,813) between the prime costs of deep-litter eggs and their specific income. The regression line accounts for 66% of the total distribution. According to the estimate of the equation, if the prime cost of the deep-litter egg increases by 1 HUF, then its specific income is expected to decrease by an average of 0,763 HUF *(Figure 12).*

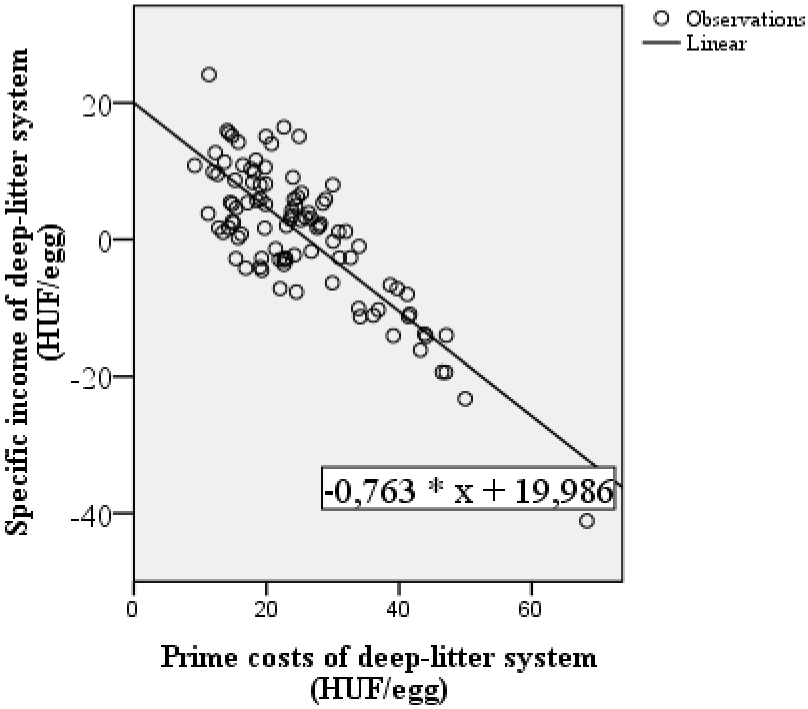


Figure 12: The regression equation of the prime costs of deep-litter eggs and their specific income

Source: Own calculation based on the data of the Farm Accountancy Data Network

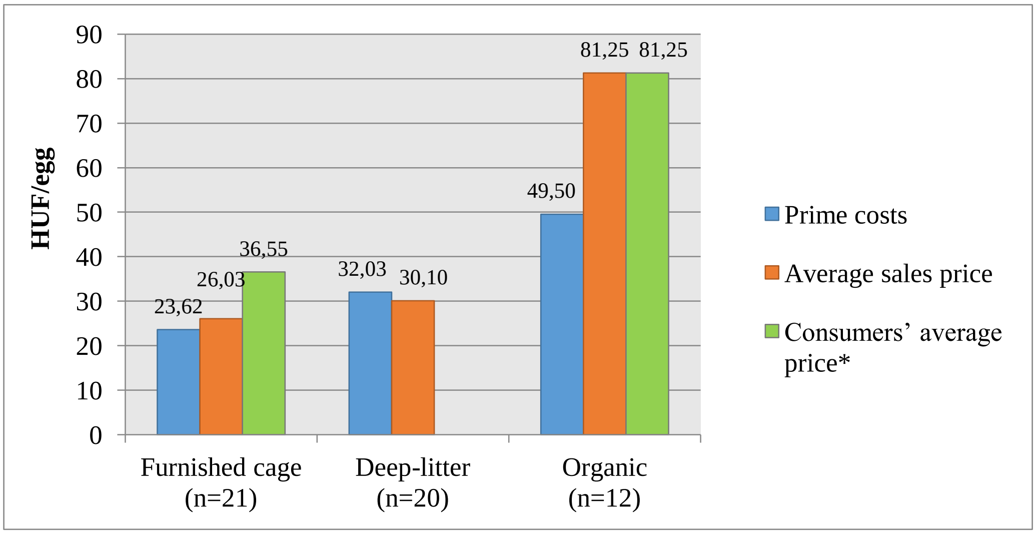
Similarly to the cage system, in the case of the deep-litter system I also found a weak correlation (r=0,212) between the specific income of the egg and its sales price. The regression line only accounts for 4,5% of total distribution, so I found that the change of the sales price did not play a determining role in the change of the specific income of deep-litter eggs.

Based on the Pearson correlation coefficient, there is a medium positive correlation (r=0,389) between the sales price of deep-litter eggs and their prime costs. The regression line, however, only accounts for 15,8% of total distribution, which means the regression estimate provides an inaccurate value, it is unable to estimate the value of the changing variable. So the change of the prime costs of deep-litter eggs plays a small role in the determination of the sales price. This result can be explained by the fact that the data have a wide distribution.

3.3. Identifying the Hungarian situation and development opportunities of organic laying hen keeping

3.3.1. The specific income of the furnished cage-system, deep-litter and organic eggs

Next I analysed the differences between the specific income of the eggs produced in the cage, deep-litter and organic systems *(Figure 13).* 70% of the interviewed producers sell the eggs on the Csörsz utca organic market, so I calculated the average sales price of organic eggs based on the prices indicated by the producers and on the producers' prices of the Csörsz utca organic market (Hungarian Association of Federations for Organic Farming, 2016).



*Observation: * The average consumers' price of deep-litter eggs is not collected by statistical databases.*

Figure 13: The prime costs and average sales price of the furnished cage, deep-litter and organic eggs (2014)

Source: Own calculation based on the data of the Farm Accountancy Data Network, the Hungarian Federation of Associations for Organic Farming (2016), KSH (2016) and self-collected data

The average specific income of improved cage eggs was of 2,41 HUF in 2014. There were huge differences in the efficiency of the deep-litter producers that were part of the Farm Accountancy Data Network in 2014, the average production costs surpassed average sales prices. There are no separate statistical data on the consumers' prices of deep-litter eggs. The average price of organic eggs was of 81,25 HUF at Csörsz utca, which means producers could reach a specific income of 31,75 HUF per organic egg. As most producers sell their own eggs directly to the consumers, the producers' and consumers' average prices are identical. With regard to the sale of organic eggs, the producers remarked that the highest average sales price can be achieved at the Csörsz utca organic market, that is why producers travel to Budapest from various parts of the country to sell. One needs to add to the higher specific income of the organic egg that according to Takács and Takács-György (2002) the extra income that can be achieved in the initial period of the transition to organic farming compensates for yield loss, and there is a possibility for eventual development, therefore the increase of the quantity of the produced merchandise can begin, but parallelly the amount of extra income is expected to decrease. This is not a problem until farm concentration does not happen, which increases the value of capital assets.

3.3.2. The factors hindering the development of organic hen keeping

After analysing the data of the farms, I divided the answers of the producers and of the sectoral actors into five categories (5M method) and represented them on a cause-and-effect diagram with respect to the reasons that can hinder organic laying hen keeping in Hungary. The factors that meant the input materials of the farm were classified into the '**Material**' group. The respondents mentioned two major problems in this group. One is the problem of choosing the varieties. Organic farming prefers local varieties, while native varieties cannot compete with laying hen hybrids, because their production results fall behind. The other issue of key importance is the acquisition of organic feed. Animal density per hectare is low in Hungary, so no soil-plant-animal-soil biological cycle comes about, which would make up the basis of organic farming. Apart from this, 80-90% of organic feed is exported. As there is no harmony between organic plant production and animal husbandry, the acquisition of organic feed in bigger quantities is difficult and expensive. One of the pivotal points is the lack of GMO-free soya. According to the data of ÖMKi (2016), the crop land of organic soya surpassed 1.200 ha in 2016, but even so hardly exceeded 2% of the share of organic plough land, while e.g. in Austria the proportion of organic soya is almost ten times higher than in Hungary.

The category labelled as **'Man'** includes the reasons directly related to the human factor. Organic farming is one of the most innovative fields of agrarian economy, but producers often insist on traditional farming methods, and do not develop the applied technology. The strong effect of subsidies is also felt in Hungary, which means the number of the producers joining the control system rockets in a given subsidy period, but the farms joining because of the subsidy cannot stay in the system in the long term based entirely only on their own financial sources, so the number of producers decreases once the subsidies are no longer provided. The lack of knowledge of the consumers is another problem. Most consumers do not know what makes organic hen keeping different from the free range system, they can only see that it costs considerably more. The „snob effect" is strongly present at the Budapest Csörsz utca market, but consumers do not pay the high extra price at countryside markets.

The next category is **'Measurement'**. A basic problem is that few data are available on production results, which hinders research and development and the enlargement of consumers' knowledge. Measuring the performance of organic farmers accurately is a problem in itself, because the measurement of results requires a different methodological approach than traditional farming. A professional counselling network is missing that would help the farmers in responding to emerging issues, such as solving animal health problems in organic laying hen keeping above a certain size. The confirmation and control of organic farmers is part of Measurement. This is one of the basic pillars of quality control, but at the same time compliance with the requirement of controls means an exaggerated administrative burden to many farmers.

The **'Method'** group is made up of the fact that intense/semi-intense technologies (with a bigger stock, deep-litter or aviary system) is missing from organic laying hen keeping in Hungary. Only one farm or another keeping a larger laying hen stock, which requires a different technology than keeping hens in small numbers. Protection against parasites and animal diseases is problematic in several thousand-strong stocks due to limited protection product use. Interventions carried out at inappropriate times can have serious financial implications, which puts production at risk. Due to the small animal stock, market relations cannot be established either, because continuous product offer would be needed, which is missing because of the mentioned reasons.

The cause-and-effect diagram indicated that the most important obstacle of development, in other words the 'root cause' is to be found in the external '**Environmental**' ('Millieu') problems affecting the whole sector, because producers and sectoral actors listed most reasons in this group. One of the most important reasons is that neither vertical nor horizontal relations work appropriately in the sector. Feedstock production is carried out throughout organic laying hen keeping, so sectoral income is limited almost exclusively to the sale of shelled eggs and chicken meat. No higher added value products are present on the market, such as pasta made of organic eggs, mayonnaise or ham made of organic chicken, breaded products, etc. The lack of processing capacity therefore hinders the growth of farming sizes. There is solvent demand at the Csörsz utca organic market, but the same cannot be affirmed about the countryside markets. Market abuse makes the situation of honest producers more difficult and results in general loss of trust from the consumers' side. There is no stable supportive environment in the sector, so this support cannot be integrated into the market prices in the long term. As Hungarian consumers are basically price-sensitive, the group of consumers that is willing to pay twice or three times the price of a cage egg for an organic one is not expected to grow in the future either. The analysis reveals that the factors of the individual groups are related and affect one another, therefore it is not enough to solve production problems to develop the sector, the product line processes need to be evaluated in a complex way.

3.4. The confirmation and refutation of the research hypotheses

1. ***hypothesis*** *(H1): the concentrated character of the laying hen sector grew between 2012 and 2016.*

Based on the Gini-index I showed that the concentrated character of the laying hen sector increased between 2012 and 2016, therefore **I consider my H1 hypothesis to be confirmed.**

2. ***hypothesis*** *(H2): Producers use little self-produced feed in both the cage and deep-litter system, so its effect on prime costs cannot be demonstrated.*

The use of self-produced feed decreased significantly in the case of cage-system keeping since Union accession, and in the case of deep-litter keeping its proportion stayed low throughout. I confirmed via correlation and regression calculation that there is a significant, close positive correlation between feed costs and prime costs, while no statistically proven correlation can be demonstrated between self-produced feed and prime costs, so **I consider my H2 hypothesis to be confirmed.**

3. ***hypothesis*** *(H3): Labour input per hen is bigger in the case of the deep-litter method, therefore the personal costs per hen are higher in this case.*

FTE per hen is three times higher in the case of deep-litter keeping, but this cannot be shown in salary costs per hen in terms of the sample, because due to the smaller average farm size of the deep-litter system 36% of the total working hours is carried out by the family. The rate of family work was two times higher in deep-litter keeping than in the case of the cage system. So the lower personal costs of the deep-litter system is due to the fact that the costs of family work do not appear in the costs paid for one working hour. I did not have the opportunity to compare social and individual farms, because the company form of the farms was not included in the database I had access to. So my **H3 hypothesis was confirmed only partly for this reason.**

4. ***hypothesis*** *(H4): Due to the low purchase price of the egg, the producers can increase their income primarily by cutting costs.*

I showed a significant and close negative correlation between the prime costs and specific income of eggs both in the case of caged and deep-litter keeping, while I only found weak correlation between the average sales price and its specific income. This confirms that the average sales prices change at such a slow pace that the effect of price change on specific income is not significant, so my **H4 hypothesis** is **confirmed.**

5. ***hypothesis*** *(H5): The specific income of organic eggs is higher than that of cage and deep-litter ones. Still, the significant growth of the organic hen stock is not to be expected.*

Based on the quantitative processing of the structured interviews carried out with the producers, I found that the specific income of the organic egg was higher than that of the cage and deep-litter egg. I could compare specific incomes for one year, at the same time my goal was to present the size of the difference of the prime costs and average sales price of cage, deep-litter and organic eggs. Based on the cause-and-effect diagram made with the help of the answers the producers and sectoral actors provided, I found that in spite of the higher specific income of organic eggs the significant growth of the organic laying hen stock is not to be expected in the future either, because apart from the difficulties of production, several ’environmental’ factors hinder the establishment of farms with larger stocks. Based on all these, **I consider my H5 hypothesis to be confirmed.**

3.5. New and novel scientific results

1. I confirmed that the concentrated character of production grew between 2012 and 2016 (the Gini-index increased from 0,73 in 2012 to 0,78 in 2016) in the Hungarian laying hen sector.

2. I demonstrated that prime costs were almost identical in the case of cage and deep-litter keeping in the case of stocks smaller than 350 laying hens between 2004 and 2014 – in the cage system it was 29,96 HUF/egg, in the deep-litter system it was 29,90 HUF/egg, so costs were not affected by keeping system in this farm size.

3. I confirmed with scientific methods that there is a significant and close positive correlation between feed costs and prime costs in the case of the cage system (r=0,775) and in deep-litter keeping (r=0,755) alike, at the same time no statistically provable correlation can be demonstrated between self-produced feed and prime costs.

4. I confirmed that there is no significant correlation compared to the cage system between the triple (91 minutes/hen a year) FTE of the deep-litter system and the size of salary costs, due to the smaller size and farming style of the producers typically using the deep-litter technology.

5. I confirmed with scientific methods that there is significant and close negative correlation between the prime costs and the specific income of eggs in the case of the cage system (r=–0,638) and deep-litter keeping (r=–0,813) alike, while there is only weak correlation (r=0,223; r=0,212) between the average sales price and specific income of the egg.

4. CONCLUSIONS AND RECOMMENDATIONS

World egg production increases 2-3% a year, EU emission, however, grew by merely 0,28% between 2004 and 2013. Due to the introduction of animal welfare measures, the proportion of the cage system decreased continuously in the Union between 2009 and 2012, and the rate of alternative solutions grew. In 2016, 44% of the EU laying hen stock was already producing according to an alternative (deep-litter, free-range, organic) system. Compliance with animal welfare provisions also leads to an increase in costs, which means competitive disadvantage compared to the countries that have more lenient or no animal welfare provisions than in the European Union. The cost increase can be counterbalanced by improving production indicators, that is why the improvement of genetical abilities continues to be important (longer persistence, bigger egg yield), specific feed use and reducing animal mortality. The improvement of production results can also be observed in the case of alternative systems, which means that the differences measured between the cage and alternative technologies are becoming all the smaller.

As a consequence of cage replacements, the proportion of the deep-litter systems increased in Hungary (30% in 2012), but was driven into the background in 2016 (20%) and 78% of production is still carried out in improved cages. The investments spent on cage replacement increased the amount of outgivings significantly, so adaptation caused Hungarian producers difficulties. The differences in efficiency experienced in the previous years grew and the concentrated character of the sector kept increasing. The natural efficiency indicators of Hungarian production fall behind the results of the largest and most efficient egg producing EU countries both in terms of specific feed use and mortality. My correlation analysis indicates that feed cost influences prime costs both for the cage (r=0,775) and the deep-litter system (r=0,755), and as it is primarily prime costs and not sales price that has a decisive effect on specific income, competitivity can mostly be increased by reducing prime costs. One of the largest egg exporters to Hungary, Poland produces with a lower prime cost level – also due to better natural efficiency indicators – which gave it competitive advantage on the egg market.

The suppression of the proportion of the black market is also of key importance in Hungary, steps were taken for this reason, such as the introduction of the Electronic Trade and Transport Control System or the reduction of egg VAT from 27% to 5%. These measures can contribute to the suppression of egg market fraud and to the creation of true market competition. An important condition for the survival of the smaller producers is the higher obtainable price when selling directly to the consumer. Hungarian producers prefer placing the consumption of national products into the foreground, which precedes animal welfare or aviary floor system choice in terms of buyers' preference. More than 40% of the total amount of produced eggs gets to the consumers via the direct sales chains, meaning that the short supply chains have an important role.

Based on consumption statistics, however, consumers pay 18% more for free range eggs, and 12% more for organic eggs, so they do not pay for the cost increase alternative systems imply. All this leads to the prediction that the proportion of free range or organic systems will - due to the lack of solvent demand - not grow significantly in Hungary in the future either, while local markets and different alternative sales channels provide opportunities for smaller producers using the deep-litter system to sell eggs at a higher price. Integrating free range and organic eggs into processed food (mayonnaise, pasta) could boost these sectors, while it is also worthwhile considering in the future how the extra cost of animal welfare could be shared between the producer, the vendor and the consumer.

Bibliography

AKI (2013): A főbb mezőgazdasági ágazatok költség- és jövedelemhelyzete. https://www.aki.gov.hu/publikaciok/publikacio/a:579/a_fobb_mezogazdasagi_agazatok_koltseg__es_jovedelemhelyzete Date of download: 2016.02.10.

Aliczki K. (2012): A tojótyúkketrecek cseréjének várható hatása Magyarország tojástermelésére. Agrárgazdasági Kutató Intézet, Budapest, 2012. 50 p.

Bodó, W. – Ceylan, Ö. – Csekő, A. – Földessy, A. – Kitley, G. – Lovász, G. – Palmberg, B. (2010): Agricultural support. pp. 224-227. In: Palmberg, B. - Földessy, A. - Lovász, G. (Szerk.) *Handbook on EU Funds 2007-2013*. 2nd edition. Európa Média Non-Profit Ltd., 327 p.

BTT (2013): A hazai tojáspiac védelmében. Magyar Mezőgazdaság, 68 (46) pp. 29-31.

Csorbai A. – Földi P. – Kuli B. – Látits M. – Molnár Gy. (2011a): A magyar baromfiágazat helyzete 2010-ben. *Baromfiágazat*, 11 (1) pp. 6-17.

EEPA (2016): European Egg Processors Association, EU Statistics. http://www.eepa.info/Statistics.aspx Date of download: 2016.06.10.

Európai Tanács (1999): 1999/74/EK irányelv (1999. július 19.) a tojótyúkok védelmére vonatkozó minimumkövetelmények megállapításáról.

European Parliament's Intergroup on the Welfare and Conservation of Animals (2013): Laying hens. http://www.animalwelfareintergroup.eu/issues/laying-hens/ Date of download: 2016.05.09.

EUWEP (2015): Roles and targets of EUWEP/EEPTA – what we have achieved and tasks ahead. 14th Egg Symposium, Kecskemét, Hungary. 9th October 2015. [Presentation]

Gundel J. – Ladocsi T. (2009): Természetes táplálékaink - az őshonos állatok húsa. pp. 355-368 In: Majoros P. (Szerk.): *Kultúraközi párbeszéd az üzleti világban*. Tudományos évkönyv, 2008. Budapest, Kiadó: Budapesti Gazdasági Főiskola Rektori Hivatala, 400 p.

Horn P. (2013): Korunk fő fejlődési tendenciái az élelmiszertermelésben, különös tekintettel az állati termékekre. *Gazdálkodás*, 57 (6) pp. 523-524.

Hungarian Federation of Associations for Organic Farming (2011): Az ökológiai gazdálkodás helye, szerepe a magyar agrár- és vidékfejlesztési stratégiában 2011-2020. Tervezet. Budapest, 2011. 5 p.

Hungarian Federation of Associations for Organic Farming (2016): Ökotermelők. Nyilvános termelői lista. http://www.biokultura.org/hu/okotermelo Date of download: 2016.07.18.

Kállay B. (2015): Válságba kerülhet az európai tojásipar. *Agrárium7*. http://agrarium7.hu/cikkek/440-valsagba-kerulhet-az-europai-tojasipar Date of download: 2016.11.15.

Kalmár S. (2008b): A takarmánygazdálkodás szervezése és ökonómiája. pp. 163-174. In: Nábrádi A. – Pupos T. – Takácsné György K. (Szerk.): *Üzemtan II.* Budapest: Szaktudás Kiadó Ház, 377 p.

Kövesi J. – Topár J. (2006): A minőség-menedzsment alapjai. Budapesti Műszaki és Gazdaságtudományi Egyetem. Üzleti Tudományok Intézet – Menedzsment és Vállalatgazdaságtani Tanszék. Budapest: Typotex Kiadó, 2006. 252 p.

KSH (2016): Központi Statisztikai Hivatal adatai. http://www.ksh.hu/mezogazdasag Date of download: 2016.03.10.

Meredith, S. – Willer, H. (2016): Organic in Europe: Prospects and developments. IFOAM EU Group and FiBL, Brussels, Belgium, 2016. 85 p.

Molnár Sz. – Szőllősi L. (2015): Fogyasztási és vásárlási szokások Magyarországon. *Baromfiágazat,* 15 (3) pp. 60-68.

NÉBIH (2016a): Nyilvántartott tojótyúktartó telepek. https://www.nebih.gov.hu/szakteruletek/szakteruletek/aai/kozerdeku_aai/kotelezoen_nyilvantartott/tojotyuktelepek.html Date of download: 2016.08.02.

ÖMKi (2016): Szakmai napok az ökológiai gazdálkodásról és az ökológiai szójatermesztésről. http://www.biokutatas.hu/esemenyek/2016-ii/2016-szeptember-1-szakmai-napok-az-okologiai-gazdalkodasrol-es-az-okologiai-szojatermesztesrol Date of download: 2016.12.10.

Takács, I. – Takács-György, K. (2002): Modeling of the connection between the Ecological Farming and Farm Sizes under Hungarian Conditions. 13th International Farm Management Congress, Wageningen, The Netherlands, July 7-12, 2002. p. 16.

Udovecz G. (2004): A hazai állattenyésztés helyzete és fejlődési esélyei. *Gazdálkodás*, 48 (3) pp. 1-12.

5. LIST OF PUBLICATIONS RELATED TO THE DISSERTATION

Articles in scientific journals in English

Nagyné Pércsi, K. – **Szabó, V.** (2014): Analysis the farm-level diversification and market position of the Hungarian organic products. Studia Mundi-Economica. Vol 1. No. 1. Szent István Egyetemi Kiadó, Gödöllő, 2014. pp. 109-119. ISSN 2415-9395

Szabó, V. (2014): Barriers of development of domestic organic animal farming. Journal of Central European Green Innovation. 2. évf., 2. szám, Károly Róbert Főiskola, Gyöngyös, 2014. pp. 129-137. HU ISSN 2064-3004

Nagyné Pércsi, K. – **Szabó, V.** (2013): Problems of cooperation in the Hungarian agriculture. Economic Science for Rural Development. Production and Cooperation in Agriculture. Finance and Taxes. No. 30. Latvia University of Agriculture, Jelgava, 2013. pp. 159-163. ISSN 1691-3078

Szabó, V. – Nagyné Pércsi, K. (2013): The constraints of the market access in case of the Hungarian organic animal products. Annals of the Polish Association of Agricultural and Agribusiness Economists. Vol. XV. No. 6. Wieś Jutra Sp. z o. o., Warszava-Poznan-Rzeszow, 2013. pp. 295-301. ISSN 1508-3535

Szabó, V. – Szabó, A. K. (2013): Challenges of the distribution of the Hungarian organic products. EPISTEME Czasopiśmie Naukowo-Kulturalne. Volume I. Number 18., Stowarzyszenie Twórców Nauki i Kultury EPISTEME, Krakow, 2013. pp. 443-452. ISSN 1895-4421

Articles in scientific journals in Hungarian

Szabó V. (2016): Alternatív baromfi tartásrendszerek és az illeszkedő fajták. Alternative poultry keeping systems and the species which can be used. PRO SCIENTIA RURALIS. A Pro Agricultura Hargitae Universitas Alapítvány folyóirata. 2016. 1. évf. 1. szám pp. 159-173. ISSN 2457-9068

Presentations published in conference proceedings in English

Ritter, K. – **Szabó, V.** – Nagyné Pércsi, K. (2014): Rural Restructuring and the Role of Agriculture in Rural Areas of Hungary after Post-Socialist Transformation. In: Barbora Babjaková, Anna Bandlerová, David L. Brown, Andrzej Kaleta, Laszlo J. Kulcsar, Joachim Singelmann (szerk.): Social & Economic Transformations Affecting Rural People and Communities in Central & Eastern Europe Since 1990. Nitra, September 2–3, 2013. Slovak University of Agriculture in Nitra – Slovakia, 2014. pp. 86-96. ISBN: 978 80-552-1259-3

Nagyné Pércsi, K. – **Szabó, V.** (2013): Hungarian examples of the sustainable agriculture. In: Káposzta J (szerk.) Multifunctionality and Regional Development. 503 p. Szent István University, Gödöllő, 2013. október 3-5. CD kiadvány, pp. 251-257. ISBN:978-963-269-376-7

Szabó, V. – Nagyné Pércsi, K. (2012): Sustainability of farming in the Hungarian chicken sector In: Bélyácz Iván, Fogarasi József, Szabó Katalin, Szász Erzsébet (szerk.) Knowledge and sustainable economic development. 714 p. Oradea, Románia, 2011. október 27-29., Partium Kiadó, Oradea, 2012. pp. 337-344. ISBN:978-606-8156-30-9

Nagyné Pércsi, K. – **Szabó, V.** (2012): Challenges of the Hungarian organic pig and poultry farming. In: Bélyácz Iván, Fogarasi József, Szabó Katalin, Szász Erzsébet (szerk.) Knowledge and sustainable economic development. 714 p. Oradea, Románia, 2011. október 27-29., Partium Kiadó, Oradea, 2012. pp. 319-328. ISBN:978-606-8156-30-9

Szabó, V. (2012): Case study on poultry products as a self sufficient lifestyle in small villages. In: Innovative personel training for the labor market in terms of continuing education. Materials of the scientific-practical conference. Ural State University of Economics, Ekaterinburg, Oroszország, 2012. január 20-22. pp. 18-24. УДК 378.016, ББК 74.58

Szabó, V. – Nagyné Pércsi, K. (2011): Opportunities for alternative poultry keeping methods in rural areas. In: Villányi L, Káposzta J, Nagy H (szerk.) Development prospects of rural areas: Lagging behind in the CEE region. 282 p. Szent István University - Faculty of Economic and Social Sciences, Gödöllő, 2011. május 24-27. pp. 164-170. ISBN:978-963-269-234-0

Szabó, V. –Nagyné Pércsi, K. (2011): Opportunity of eco-innovation in small poultry keeping enterprises. In: Tov Assogbavi, Vasa László, Nagy Henriette (szerk.) Global Management Conference, Proceeding. Szent István University, Gödöllő, 2011. május 4-7. CD kiadvány, pp. 84-87. ISBN:978-963-269-233-3

Nagyné Pércsi, K. – **Szabó, V.** (2010): Challenges in the domestic organic poultry keeping. In: Magda Sándor, Dinya lászló (szerk.) XII. Nemzetközi Tudományos Napok: Fenntartható versenyképesség válság idején. 1218 p. Károly Róbert Főiskola, Gyöngyös, 2010. március 25-26. CD kiadvány, pp. 1058-1065. ISBN:978-963-9941-09-0

Presentations published in conference proceedings in Hungarian

Szabó V. – Nagyné Pércsi K. (2013): A hazai ökológiai állattartás versenyképességének vizsgálata. In: Hegyi Judit (szerk.) „Hensch Árpád" nyomdokain: a Gazdálkodásban publikált PhD hallgatók és kutatók III. Országos tudományos konferenciája. Nyugat-magyarországi Egyetem Mezőgazdaság- és Élelmiszertudományi Kar, Mosonmagyaróvár, 2013. április 25., CD kiadvány, pp. 1-12. ISBN:978-963-334-108-7

Szabó V. – Nagyné Pércsi K. (2011): Őshonos csirkefajták termelésbe állításának gazdasági vizsgálata. In: Andrássy Adél (szerk.) "Hitel, Világ, Stádium" Nemzetközi Tudományos Konferencia a Magyar Tudomány Ünnepe

alkalmából. NYME Közgazdaságtudományi Kar Sopron, 2010. november 3. Sopron, 2011. CD kiadvány, pp. 1-9. ISBN:978-963-9883-73-4

Szabó V. (2010): Az ökológiai gazdálkodás feltételrendszere hazánkban. In: Ferencz Á (szerk.) Erdei Ferenc V. Tudományos Konferencia: Globális kihívások, lokális megoldások. 1490 p. Kecskeméti Főiskola Kertészeti Főiskolai Kar, Kecskemét, 2009.szeptember 3-4. Kecskemét: 2010. pp. 1406-1410. ISBN: 978-963-7294-79-2

Szabó V. (2010): Állatjóléti követelmények felértékelődése a fenntartható baromfitenyésztés szolgálatában. In: Lukács Gábor, Sűrű Béla (szerk.) "Gazdaságosság és/vagy biodiverzitás" 52. Georgikon napok. Pannon Egyetem, Georgikon Kar, Keszthely, 2010. szeptember 30.-október 1. pp. 1-10. ISBN:978-963-9639-39-3

Szabó V. - Nagyné Pércsi K. (2010): Állatjóléti követelmények felértékelődése a hazai baromfitartásban. In: Magda Sándor, Dinya lászló (szerk.) XII. Nemzetközi Tudományos Napok: Fenntartható versenyképesség válság idején 1218 p. Károly Róbert Főiskola, Gyöngyös, 2010 március 25-26. CD kiadvány, pp. 1117-1124. ISBN:978-963-9941-09-0

Szabó V. (2010): BOldog CSIrke, avagy célpontban az új tartástechnológia. In: Andrássy Adél (szerk.) "Gazdaság és társadalom" nemzetközi tudományos konferencia tanulmánykötete: konferencia a Magyar Tudomány Ünnepe alkalmából. NYME Közgazdaságtudományi Kar, Sopron, 2009. november 3. Sopron, 2010. CD kiadvány, pp. 1-19. ISBN:978-963-9871-30-4

Szabó V. (2009): Broiler kontra ökobaromfi a hazai piacokon. In: Krizsán József (szerk.) XV. Nemzetközi Környezetvédelmi és Vidékfejlesztési Diákkonferencia. Szolnoki Főiskola Műszaki és Mezőgazdasági Fakultás, Mezőtúr, 2009. július 1-3. p. 61. ISBN:978-963-06-3726-8

Abstracts published in conference proceedings in Hungarian

Szabó A. K. – **Szabó V.** (2013): Az ellátási lánc hosszának hatása a magyar bioélelmiszerek jövedelmezőségére a hazai és nemzetközi piacokon. In: Takács Márton (szerk.) IV. Szakkör Konferencia: Szakkollégiumok Konferenciája a Környezet- és Természetvédelemért. SZIE Környezetvédelmi (Zöld) Szakkollégium, Gödöllő, 2013. április 22. CD kiadvány, p. 21. ISBN:978-963-269-346-0

Szabó V. – Szabó A. K. (2013): A bioélelmiszerek szerepe a fenntartható mezőgazdaságban. In: Takács Márton (szerk.) IV. Szakkör Konferencia: Szakkollégiumok Konferenciája a Környezet- és Természetvédelemért. SZIE Környezetvédelmi (Zöld) Szakkollégium, Gödöllő, 2013. április 22. p. 39. CD kiadvány, ISBN:978-963-269-346-0

Book chapters in English

Szabó, V. (2010): Cost and income situation in the alternative poultry breeding technologies. In: Marzena Rydzewska-Wlodarczyk - Iwona Majchrzak (szerk.) Rachunkowosc a praktyka gospodarcza. West Pomeranian University of Technology, Szczecin, 2010 pp. 133-144. ISBN: 83-88057-85-5

Nagyné Pércsi, K. – **Szabó, V.** (2009): The main characteristics and problems of the organic poultry breeding in Hungary. In: Káposzta József (szerk.) New elements and research in spatial economy. Research Institute of J. Selye University, Komárno, 2009. pp. 87-96. ISBN:978-80-89234-72-1

Book chapters in Hungarian

Szabó V. – Szabó A. K. (2013): A multifunkcionális mezőgazdaság, mint térségi innováció. In: Bálint Csaba (szerk.): Vidékfejlesztési Szakkollégium. Agrár-és vidékfejlesztési tanulmányok. SZIE Vidékfejlesztési Szakkollégium, Gödöllő, 2013. pp. 19-26. ISBN: 978-963-269-367-5

Szabó V. – Urbánné Malomsoki M. - Nagyné Pércsi K. (2013): Alternatív mezőgazdasági vállalkozások szerepe a térségi fejlődésben. In: Lukovics Miklós - Savanya Péter (szerk.): Új hangsúlyok a területi fejlődésben. JATEPress, Szeged, 2013. pp. 154-167. ISBN: 978-963-306-247-0

Szabó V. (2010): A szalmonellózis elleni védekezés szabályai. In: F Kárpáti Kinga (szerk.) Magyar gazda Európában, 26. kiegészítő kötet. Raabe Kiadó, Budapest, 2010 június. pp. 1-18. ISBN:963-9600-03-2

Szabó V. (2010): Állatjóléti támogatások igénybevételének szabályai. In: F. Kárpát Kinga (szerk.) Magyar gazda Európában: 25. kiegészítő kötet, 2010. április. Raabe Kiadó, Budapest, 2010. pp. 1-14. ISBN:963-9600-03-2

Szabó V. (2009): Az ökológiai gazdálkodás megújult feltételrendszere. In: Nagyné Pércsi Kinga (szerk.) Magyar gazda Európában: 24. kiegészítő kötet, 2009. december. Raabe Kiadó, Budapest, 2009. pp. 1-22. ISBN:963-9600-03-2

Other publications

Szabó V. (2017): Az ökológiai gazdálkodásra való átállás szabályozása. AGRÁR ÉLET MAGAZIN: Input Gépesítés Logisztika. IV. évf. 1. szám, 2017. pp. 24-25. ISSN 2064-4345

Szabó V. (2015)**:** Házi jellegű vagy csak annak látszik? Mitől kézműves egy termék? Haszon AGRÁR. IX. évf. 1. szám, 2015. pp. 62-64. ISSN 1788-5922

Szabó V. – Pércsi K. (2014): Az élelmiszerjelölés új szabályai: kötelező lesz a sertés-, juh-, kecske- és a baromfihús eredetjelölése is. AGRÁR ÉLET MAGAZIN: Input Gépesítés Logisztika I. évf. 6. szám, 2014. pp. 14-15. ISSN 2064-4345

Pércsi K. – **Szabó V.** (2014): Az ökogazdálkodók piacra jutási lehetősége: a kistermelői értékesítés szabályai. AGRÁR ÉLET MAGAZIN: Input Gépesítés Logisztika I. évf. 5. szám, 2014. pp. 18-20. ISSN 2064-4345

Szabó V. – Nagyné Pércsi K. (2010): Gazdasági kontra jóléti mutatók a baromfitartásban. ŐSTERMELŐ Gazdálkodók lapja. XIV. évfolyam 4. szám, 2010. pp. 103-105. HU ISSN 1418-088X

Szabó V. – Nagyné Pércsi K. (2010): Biobaromfi tartás termelési paraméterei, értékesítési lehetőségei. ŐSTERMELŐ Gazdálkodók lapja. XIV. évfolyam 4. szám, 2010. p. 120. HU ISSN 1418-088X