The effects of vertical integration on profitability of pig production – Polish experience

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Abstract: *The study presents principles of integration of processing plants with agricultural sector producers in Poland, based on the dairy and meat industries[1]. In this aspect the goal of integration was presented along with its principles and popularity, both in the period of centrally planned economy and free market economy. At present processing plants in Poland with an increasing frequency develop cooperation with raw material producers on the basis of supply contracts. The highest degree of integration between meat plants and farmers is found in case of white meat producers.*
On the basis of pig production the effect of vertical integration on the profitability of this type of production in Poland in the period 2001 - 2006 was thoroughly analyzed and assessed, with special emphasis on benefits for these agricultural sector producers. For this purpose the study presents results of analyses conducted on a group of 60 pig producers producing minimum 200 fatteners annually. The analysis showed that an increase in the scale of production and the degree of integration of the farm with the buyer of its products contribute significantly to a reduction of unit production costs and an increase of prices and thus an increase in the unit profit from sold products. In this way those farms – characterized by a better economic standing in case of a downturn in the economy - are at a lower risk of bankruptcy.

Keywords: *vertical integration, farms in Poland, pigs for slaughter, supply chain.*

Introduction

Changes taking place in the last few years in Polish economy have created a new situation for all participants of the market, including also plants of the agri-food sector and farmers. Previously unknown producers' groups have been established and the importance of vertical integration has been growing. However, it is a novel type of integration, differing from processes taking place in centrally planned economy in the voluntary character of participation in this process and free choice of the buyer. Currently among a majority of producers of animals for slaughter, the buyer is selected mainly on the basis of economic criteria, i.e. the price, bonuses, terms of payment, reliability, etc., and not benefits or privileges granted by the administration. Also meat processing plants are increasingly interested in the development of integration relationships, since increasing requirements of the consumers in terms of the quality and price of offered products force them to adopt more rational behavior. This is manifested in the fact that these enterprises, in order to provide necessary quantities of good quality raw material, extend and expand the contracting system.

Moreover, processing companies are predisposed to serve the role of integrators and perform the organizing functions in relation to their raw material base (Baker 1989). An appropriate raw material makes it possible to produce products with superior quality and higher processing rates, from which a processor may obtain higher added value (Bojnec et al. 2005).

The aim and scope of the study

In view of the above, two aims were realized within this study. Firstly, principles of integration of processing plants with agricultural producers in Poland are presented on the basis of the dairy and meat industries. For this purpose the analysis presented the aim of integration, its principles and popularity in the period of centrally planned economy as well as free market economy.

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Secondly, on the basis of pig production, the effect of vertical integration on the profitability of this type of production in Poland in the years 2001 – 2006 was analyzed and assessed. First of all the emphasis was put on benefits for agricultural sector producers in Poland, based on the market of pigs for slaughter. For this purpose the study presents results of analyses conducted on a group of 60 pig producers producing at least 200 fatteners annually.

Characteristics of analyzed farms

Characteristics of analyzed farms are given in Table 1. On average analyzed farms ran production on the area of 77.15 ha UR on medium quality soils. Farms were characterized by very high stocking rates (107 DJP/100 ha UR), with pigs predominating. The direction of animal production had a strong effect on the cropping pattern, in which cereals amounted to 78.96%. In farms with an area up to 50 ha UR, in which stocking rates were higher than the average for a given community (186 - 256 DJP/100 ha UR), the share of cereals in the cropping pattern increased to approx. 85%.

Table 1. Characteristics of analyzed farms

Group of farms*			UR (ha)	Cereals including maize for grain (%)	No. of sold fatteners (head/farm)
total	**total**		**77.15**	**78.96**	**1413.77**
	200-500	A	25.59	81.57	337.53
	501-1000	B	37.68	80.22	702.87
	1001-2000	C	59.54	83.41	1291.20
	over 2000	D	185.80	76.98	3323.47
Non-integrated I	**total**		**114.79**	**75.21**	**1337.85**
	200-500	A	25.19	78.35	304.80
	501-1000	B	60.71	80.24	683.00
	1001-2000	C	76.70	79.63	1396.00
	over 2000	D	296.55	72.77	2967.60
Integrated II	**total**		**46.56**	**85.54**	**1406.05**
	200-500	A	27.42	85.56	371.00
	501-1000	B	29.70	82.31	692.40
	1001-2000	C	58.82	84.97	1280.40
	over 2000	D	70.30	87.34	3280.40
With highest integration degree III	**total**		**70.11**	**80.72**	**1497.40**
	200-500	A	24.16	80.10	336.80
	501-1000	B	22.65	77.18	733.20
	1001-2000	C	43.10	88.74	1197.20
	over 2000	D	190.55	79.60	3722.40

*Division into groups explained in the Methods chapter
Source: Authors' study.

Applied research methods

Original data for analysis were collected using the standardized interview in 60 farms located in the Wielkopolska province, producing annually over 200 fatteners and in which pig production was the primary direction of commercial production. The economic situation of analyzed farms and relations found on these farms are typical of farms nationwide. The selection of farms from this province may be explained by its almost 30% share in pig production in Poland. Farms were divided following 2 criteria (Table 2):

a) According to the scale of production – into farms selling: 200 - 500 fatteners (A); 500 - 1000 fatteners (B); 1000 - 2000 fatteners (C) and over 2 000 fatteners (D),

b) According to the degree of integration into the following categories of farms:

I. non-integrated, i.e. selling fatteners to many buyers and not having any supply contracts

II. integrated, having a supply contract

III. farms with the highest degree of integration, which apart from the signed contract used extension services, feeds, breeding material, etc. supplied by the integrator.

Table 2. A diagram for the division of samples according to the scale of annual production and the rate of integration with meat plants

Farms' division Group of farms		Degree of farms' integration with meat plant		
		I	**II**	**III**
Scale of production	**A** - 200-500	5	5	5
	B - 501-1000	5	5	5
	C - 1001-2000	5	5	5
	D - pow.2000	5	5	5

Source: Authors' study.

In Poland most producers of fatteners use cereals produced on their own farm. However, the scale of production and the size of farms result in considerably varied importance of farm fodder, thus it was assumed that the cost of fodder production on the farm is the equivalent of the price for their potential purchase. This makes it possible to determine more precisely the effect of integration on economic results, since the effect of having their own fodder resources was not included in the analysis.

In the conducted analysis the applied weight of fatteners was their live weight.

Data presented in absolute values have limited value for pure science, since they first of all illustrate the scale of a given phenomenon. Also excessive numbers of indexes used in the assessment of economic and financial standing of enterprises result in a situation when collected results do not show clearly the actual standing of the enterprise as a whole. For this reason, apart from information on the volume of obtained profits from production of 1 kg fatteners, the discriminatory analysis will also be conducted.

Table 3. The discrimination method as a simplified method to assess financial standing of an enterprise.

Formula of an index	value	Weight	Weighted index
(gross result + depreciation) / total liabilities		1.50	
Gross revenue / total liabilities		0.08	
Gross result / assets		10.00	
Gross result / gross revenue		5.00	
Gross revenue / assets		0.10	
Sum of weighted indexes (W)	x	x	

Source: Mączyńska, E., 1994. *Ocena kondycji przedsiębiorstwa*, Życie gospodarcze no. 38/1994

The essence of the discriminatory method consists in function (W), presented in the form of five indexes, which according to the discrimination principle, determine mainly the economic and financial standing of enterprises (Table 3).

The sum of five weighted indexes (W) defines the standing of an enterprise. As it results from Table 4, enterprises threatened with bankruptcy are those which receive a negative sum of scores (W), while enterprises with a very good financial standing are those which receive two and more points.

Table 4. The scale of ratings for standing of enterprises.

Sum of weighted indexes (W)	Rating
W <0	Enterprise threatened with bankruptcy
W = 0	Very weak enterprise
0 < W < 1	Enterprise with a poor rating
1 < W < 2	Enterprise with good financial standing
W ≥2	Enterprise with very good financial standing

Source: Mączyńska, E., 1994. *Ocena kondycji przedsiębiorstwa*, Życie gospodarcze no. 38/1994

Results

Vertical integration in Poland before and after 1989

Until 1989, in the period of centrally planned economy in Poland, the entire animal production was subjected to obligatory contracting. It most frequently consisted in signing a contract with a village leader or another representative of the government administration appointed by the local authorities, to supply a specific number of animals, planned for sale with at least 3 months' notice. It was required to provide information on the type of sold animals and expected average weight. The farmer was given a document, on the basis of which he could sell a specific number of animals in a given month. If in a given month he wanted e.g. to sell fatteners every week, he had to receive 4 contracting certificates. Animals could be sold only in purchasing stations, to which the farmer had to deliver the animals himself. The location of the farm determined the affiliation to a specific purchasing station. Purchase was realized on specific days of the week (2 - 3 times a week). State-purchasing prices were binding for specific weight ranges of animals. Farmers were never held liable for not meeting their supply contracts. Regionalization was also binding for meat plants, which purchased material from a region specified by central authorities. The plant had to purchase all contracted slaughter animals, irrespective of their own needs.

Implementation of free market economy resulted in a situation when the entire system of obligatory contracting collapsed. Many privately owned meat enterprises were established and started to gain an increasing share of the market (Pepliński, 2005). They purchased slaughter animals paying several grosz more than state-owned plants. Many years later a large proportion of those enterprises did not survive in the situation of market competition. After several years of chaos on the market in the late 1990's meat plants started to be established, which in order to ensure raw material in the years of its shortage started to persuade farmers to sign supply contracts. Mainly small meat plants were pioneers in this respect, which after privatization were bought by foreign investors. In the beginning of the 21st century supply contracts started to be used more frequently also by Polish owners. At present most slaughter material, both of white and red meat, is collected in Poland on the basis of supply contracts. Most frequently contracts contain the obligation of the seller to sell a specific number of animals – most often within a given calendar year or individual quarters, while the buyer is obliged to purchase the above mentioned number of animals. An incentive for farmers to enter such a contract is the bonus for each animal or kg of sold animals and possibly additional bonuses for the number of sold animals, e.g. more than 1 000 fatteners. A specific selling price is usually not given in contracts, being rather defined as price ex plant and additionally 0.10 PLN/kg (Pepliński et al., 2002). Sometimes contracts contain quality attributes, the obligation to apply certain technologies or their elements, keeping conditions, the source of young animals (piglets, chicks), feeds, etc. The degree of integration between meat plants and farmers is higher in case of white meat producers.

Vertical integration in case of dairy industry looks slightly different. Most dairies are cooperatives and their owners are present or former milk suppliers. In the period of centrally planned economy every dairy cooperative had a specifically defined area of operation from which it purchased milk. Every supplier automatically became a member of the cooperative, paying the membership fee. It was deducted from the payment for their milk. Even after the transformation of the political and economic system no considerable changes have been introduced. Most of the market belongs to dairies which continue to be cooperatives. Only the principles of market operation have changed, since there are no territorial limitations and every enterprise may purchase milk from anybody of their own choosing. However, the rule that each supplier has to be a member of the cooperative is still binding. One farmer may not be a member of two cooperatives, thus when he decides to change the cooperative he receives his shares back. However, he is also obliged to pay appropriate shares to the new cooperative. Cooperatives do not sign supply contracts with farmers as supplying milk to the cooperative is obligatory for each cooperative member and this obligation is stipulated in the statutes of the cooperative (Kożuch et al., 2007). If a cooperative needs funds for development from its members, most commonly capital is collected by deducting a certain amount of money e.g. PLN 0.10 from the price of every liter of milk sold to the cooperative in a time period specified in the resolution. Thus bigger suppliers pay more for the development of their cooperative.

The process of consolidation is also observed in the Polish dairy sector. The need to reduce costs and search for new markets result in a situation when there are numerous mergers and takeovers in the Polish dairy sector. If this process occurs between cooperatives, then most often the entity taking over a cooperative takes the responsibilities and obligations of the entity being taken over, i.e. the former

members of the cooperative being taken over will become members of the new cooperative with an unchanged amount of their membership share.

Producers' groups play a marginal role in Poland. They develop primarily in the fruit and vegetable production and pig production sectors. First of all small these groups are formed by producers with no bargaining position with buyers of their products. Bigger producers, which after joining forces could be a match for processing enterprises in negotiations, are very reluctant to enter vertical integration. Processing plants are not really interested in the formation of such groups and they do not enter into cooperation with independent producers' groups. Instead, they create producers' groups around their own meat plants, having full control over these groups and profiting additionally from administering the group and acting as brokers supplying feeds, fertilizers and other means of agricultural production. Due to the weakness of independent producers' groups at present they do not have a chance to seize the initiative in terms of forward integration relationships and taking over the processors' margins.

The effect of integration on profitability of pig production

Pig production in Poland to a considerable degree determines the profitability of agriculture as a whole, as sale of pigs for slaughter constitutes approx. ¼ commercial production of Polish farms (GUS, 2007).

Data collected in the course of the study are presented in Table 5 and Graphs 1 - 3.

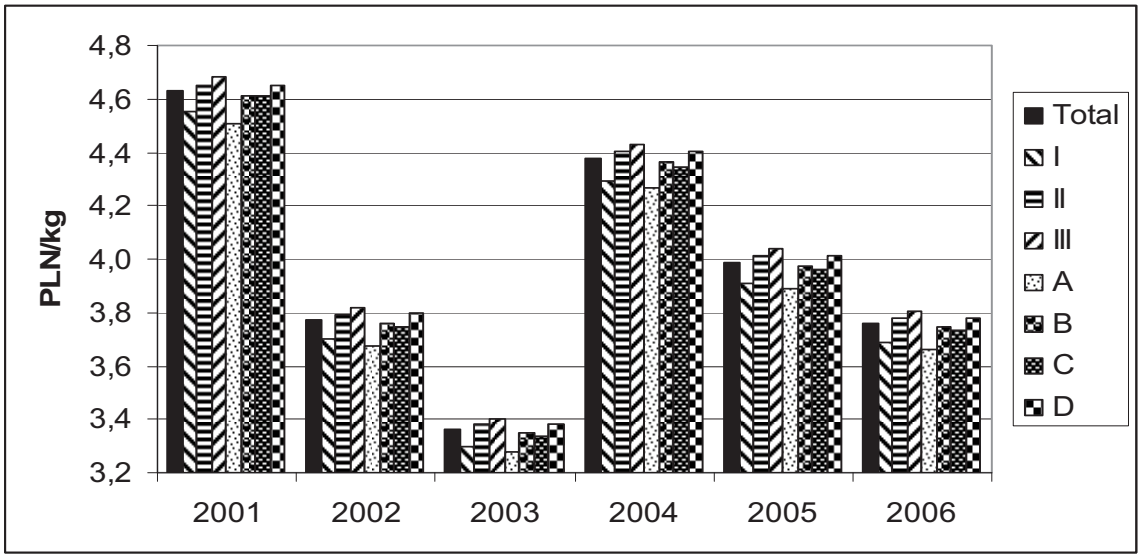
Table 5. Prices, costs and profits from pig production in analyzed farms in 2001 - 2006 (PLN/kg)

Listed items		Group							
		Total	I	II	III	A	B	C	D
2001	Price	4.63	4.55	4.65	4.68	4.51	4.61	4.61	4.65
	Cost	3.61	3.87	3.52	3.46	4.03	3.66	3.76	3.49
	Profit	1.02	0.68	1.13	1.22	0.48	0.95	0.85	1.16
2002	Price	3.77	3.70	3.79	3.82	3.68	3.76	3.74	3.80
	Cost	3.11	3.31	3.06	2.98	3.55	3.18	3.20	3.01
	Profit	0.66	0.39	0.73	0.84	0.13	0.58	0.54	0.78
2003	Price	3.36	3.29	3.38	3.40	3.28	3.35	3.34	3.38
	Cost	3.23	3.41	3.19	3.10	3.76	3.33	3.31	3.11
	Profit	0.13	-0.11	0.19	0.30	-0.49	0.02	0.03	0.27
2004	Price	4.38	4.29	4.40	4.43	4.27	4.36	4.34	4.40
	Cost	3.58	3.81	3.52	3.42	4.05	3.66	3.68	3.47
	Profit	0.80	0.48	0.88	1.01	0.22	0.70	0.66	0.94
2005	Price	3.99	3.91	4.01	4.04	3.89	3.98	3.96	4.01
	Cost	3.24	3.46	3.19	3.10	3.74	3.33	3.33	3.14
	Profit	0.74	0.45	0.82	0.93	0.14	0.65	0.63	0.87
2006	Price	3.76	3.68	3.78	3.80	3.66	3.75	3.73	3.78
	Cost	3.39	3.58	3.35	3.25	3.99	3.51	3.47	3.27
	Profit	0.37	0.10	0.43	0.55	-0.33	0.23	0.26	0.51

Source: Authors' study

Graph 1 shows that the highest selling prices for slaughter animals were paid to interviewed farmers in 2001. The average price for slaughter animals was 4.63 PLN/kg. Slightly lower prices were paid to farmers in 2004 (4.38 PLN/kg).

The lowest selling prices for slaughter pigs were recorded in 2003, amounting to 3.36 PLN/kg, and in 2006, i.e. 3.76 PLN/kg. The difference between the lowest and highest price was as much as 37.8%. The highest prices were paid to farmers with the highest degree of integration of their farms, i.e. group III (4.68 PLN/kg in 2001 and 3.40 PLN/kg in 2003) and farms with the biggest scale of production (4.65 PLN/kg in 2001 and 3.38 PLN/kg in 2003).

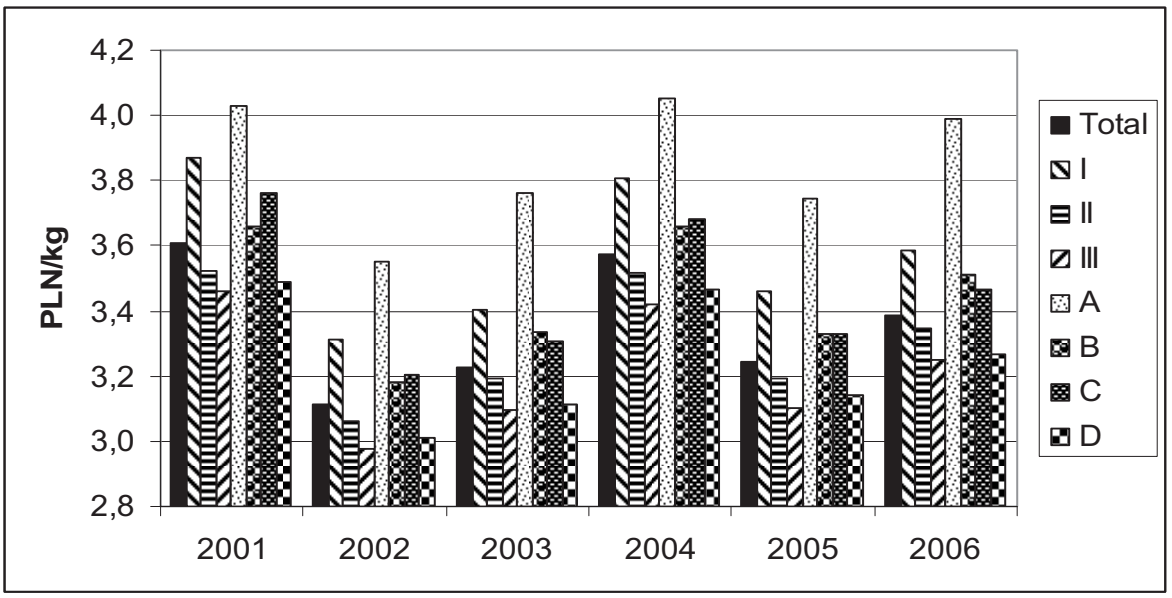


Source: Calculations by the authors

Figure 1. Average selling prices in analyzed farms in the years 2001 - 2006 (PLN/kg).

The opposite situation was found for non-integrated farms and the smallest farms, which were paid selling prices by around 15 grosz less for 1 kg fatteners. In case of farms from groups AI and DIII the difference in the selling price was as much as 0.25 PLN/kg in favour of the latter.

Graph 2 indicates that the highest costs of pig production were incurred by farmers in the years in which they were paid the highest selling prices, i.e. in 2001 and 2004. On average for the entire analyzed population they were 3.61 PLN/kg in 2001 and 3.58 PLN/kg fatteners in 2004, respectively.

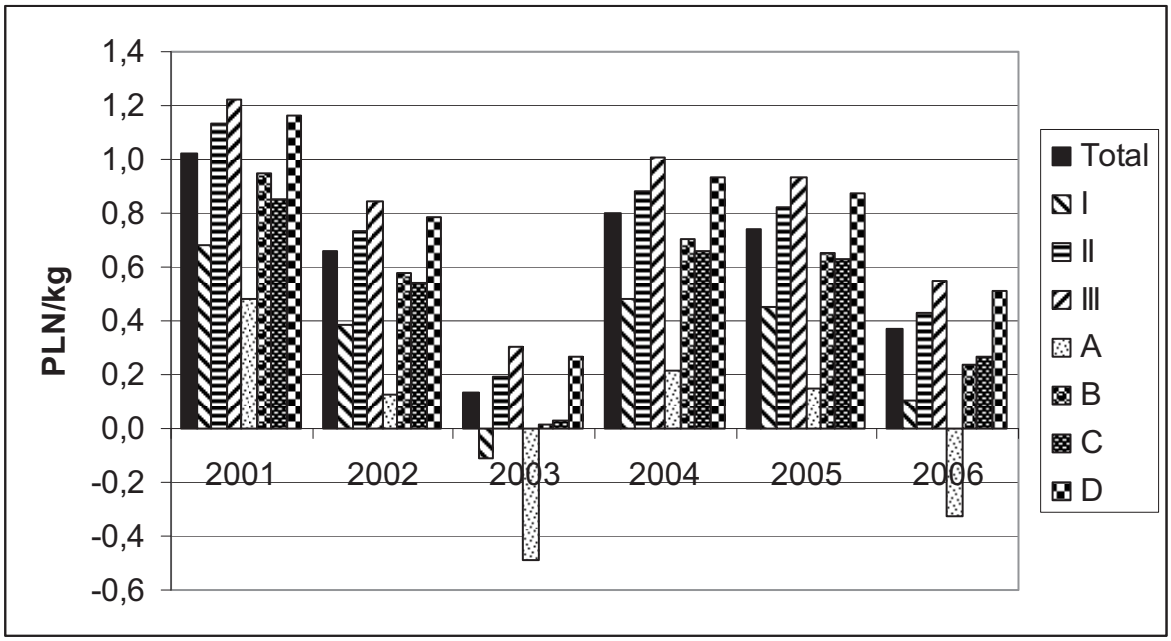


Source: Authors' study

Figure 2. Average costs of fattener production in analyzed farms in 2001 - 2006 (PLN/kg).

The lowest production costs were recorded in 2002, when the average cost of production in the analyzed population dropped to 3.11 PLN/kg. In 2003 and in 2005 the average cost was 3.23 and 3.24 PLN/kg, respectively. The difference in costs between individual groups of farms was much bigger, ranging from 0.31 PLN/kg in 2003 to 0.41 PLN/kg in 2001 in case of non-integrated farms (I) and those with the highest degree of integration (III). In case of the smallest farms (A) and the biggest

farms (D) this difference was even bigger, amounting to as much as 0.72 PLN/kg in 2006. Such a considerable variation in costs was determined by unit costs of used feeds (in analyzed farms they amounted to almost 60%) and the feed conversion rates. A consequence of paid prices and incurred costs are profits of producers. They were highest in 2001 and 2004, when for the entire analyzed population they were 1.02 PLN/kg and 0.80 PLN/kg, respectively. The lowest profits were recorded by analyzed farms in 2003 and 2006, when average profits were 0.13 and 0.37 PLN/kg, respectively. The highest profits were obviously reported by the biggest farms and those with the highest degree of integration, where unit profit in 2001 was 1.16 and 1.22 PLN/kg, respectively, while in 2003 it was 0.27 and 0.30 PLN/kg, respectively. The poorest economic results were recorded by the smallest and non-integrated farms, as in 2001 they earned only 0.48 PLN/kg and 0.68 PLN/kg, respectively, whereas in 2003 they incurred losses amounting to 0.49 PLN/kg and 0.11 PLN/kg, respectively. Also in 2006 the smallest farms as the only group incurred losses of 0.33 PLN/kg sold fatteners.



Source: Authors' study

Figure 3. Average profits from fattener production recorded by analyzed farms in 2001 - 2006 (PLN/kg).

The analysis shows that an increase in the scale of production and the degree of integration of a farm with the buyer of its products significantly contributes to a reduction of unit production costs and thus – to an increase in unit profit from sold products (Fig. 4). However, with an increase in the degree of integration the rate of profit increase decreases, which indicates that with an increasing degree of integration of farms with meat plants the power of the economic incentive decreases. Nevertheless, increasing competition results in a situation when farmers focus on complete integration, since only this factor may ensure stability in their business. This direction of integration will lead to the formation of whole supply chains within individual agricultural products, such as milk, sugar, flour or vegetable oil. Thus it may be assumed that in the near future, similarly as in case of other sectors of economy, the actual competition in the agri-food sector will take place between entire supply chains and not between individual farms (Christopher, 2000). In view of the above, these farms have bigger chances for survival which - aiming at strong integration not only with buyers of their products, but also with suppliers of means of production - will become elements of such supply chains.

Results of discriminatory analysis in the investigated population in the best year (2001) are given in Table 6, while those for the worst year (2003) in Table 7. It results from Table 6 that thanks to a boom in the pig market financial standing of analyzed farms was very good in case of 49 out of 60 entities, while in case of 3 agricultural enterprises they would have been facing bankruptcy if they had been forced to pay full costs of their own labour. This pertains especially to farms with a low scale of production. The best financial standing was found for integrated farms from groups II and III, from which 17 entities each had very good financial standing. High profitability of pig production resulted in a situation when some enterprises, despite high indebtedness, were able to handle the debt without

problems and have very good financial standing. An increasing scale of production also had a positive effect on improved financial standing.

Similar results in terms of trends may be seen in Table 7. Also in this case the best economic standing was found for the biggest farms and farms with the highest degree of integration; however, problems with repayment of their liabilities were experienced not only by the smallest farms, but also the biggest. Over 1/3 non-integrated farms were facing financial problems and the best index of discrimination exceeding 2.0 was recorded only for 40 farms.

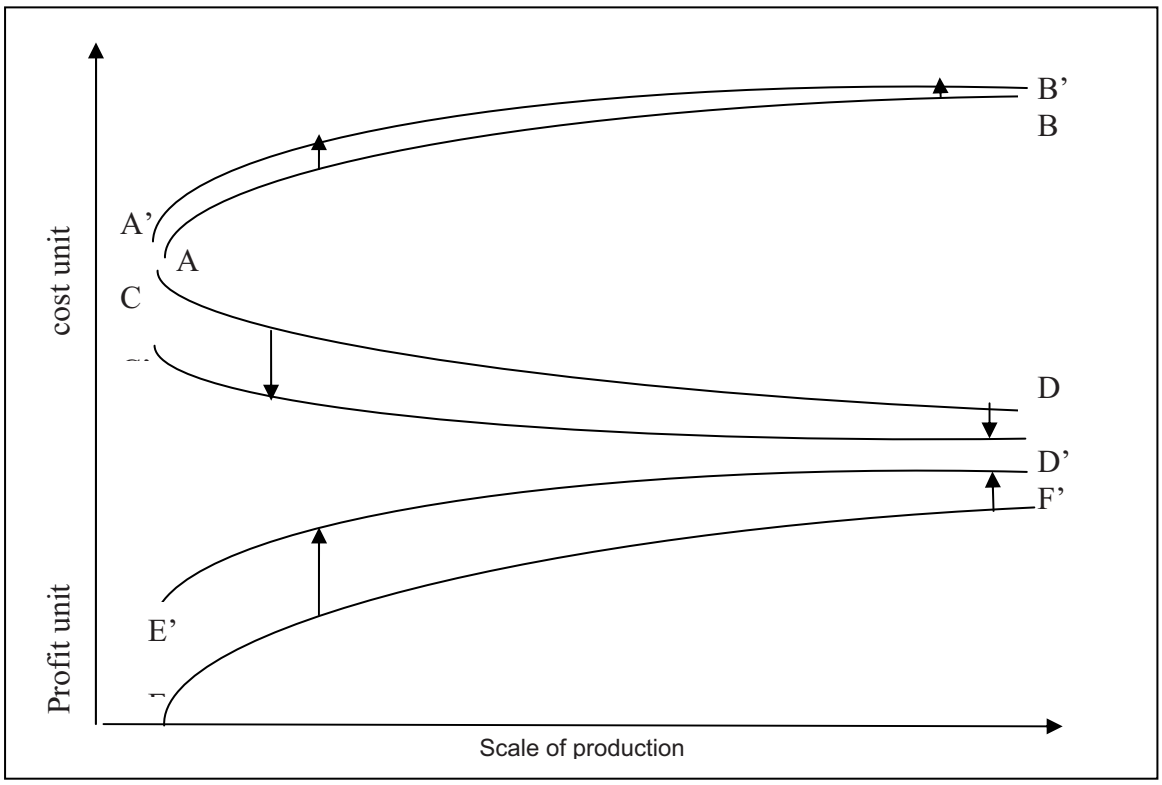


Figure 4. A relationship of the scale of production and the degree of integration of a farm with an agri-food enterprise (the integrator) with prices paid to producers, unit production cost and revenue from one unit of product.

AB – price paid to non-integrated producers,
A'B' – price paid to integrated producers,
CD – unit production cost of non-integrated producers,
C'D' – unit production cost of integrated producers,
EF – revenue from one unit of non-integrated product,
E'F' – revenue from one unit of integrated product.

Source: Authors' study and Pepliński B., et al., 2004. *Integracja pionowa a opłacalność produkcji żywca wieprzowego.* Monograph. Roczniki AR w Poznaniu.

Table 6. Financial standing of analyzed farms in 2001 based on simplified discriminatory analysis

Group of farms	Total	I	II	III	A	B	C	D
W < 0	3	2	0	1	3	0	0	0
W = 0	0	0	0	0	0	0	0	0
0 < W < 1	2	1	1	0	1	0	0	1
1 <W < 2	6	2	2	2	2	1	1	2
W ≥ 2	49	15	17	17	9	14	14	12

Source: Authors' study

Table 7. Financial standing of analyzed farms in 2003 based on simplified discriminatory analysis

Group of farms	Total	I	II	III	A	B	C	D
W < 0	14	7	4	3	8	2	2	2
W = 0	0	0	0	0	0	0	0	0
0 < W < 1	2	0	1	1	1	0	1	0
1 <W < 2	4	3	0	1	0	1	1	2
W ≥ 2	40	10	15	15	6	12	11	11

Source: Authors' study

Conclusions

The dominant form of integration in Poland consists in horizontal integration links. The importance of producers' groups is gradually increasing in fruit, vegetable and pig production sectors. In the latter case meat plants frequently initiate the formation of such groups, which considerably reduces benefits for agricultural enterprises.

Studies indicate that entering horizontal integration links on the part of pig farms is profitable for these farms as they receive higher sale prices as well as record lower production costs, mainly due to the increasing specialization, access to professional knowledge and good quality materials (feeds, piglets, breeding material) arranged by meat plants. An increasing scale of production results in gradually decreasing unit profits, resulting from enhanced integration rates. This limits the interest of bigger farmers in horizontal integration, although on the other hand they become increasingly willing to arrange a permanent and reliable sale channel for their fatteners. A consequence of higher profits recorded by the most strongly integrated entities is their better financial standing. Non-integrated farms were characterized by the poorest economic standing.

References

Baker J, 1989. *Agricultural Marketing*. Oxford University Press.

Bojnec S., Majkovic D., Turk J. 2005. *Trade types in Slovenian primary and processed agricultural trade.* XI International Congress of European Association of Agricultural Economists: "The Future of Rural Europe in the Global Agri-Food System" Copenhagen, Denmark.

Christopher, M., 2000. *Logistyka i zarządzanie łańcuchem dostaw [Logistics and management of supply chain]*, Warszawa, PCDL.

Kożuch, A., Mirończuk, A., 2007. *Podstawy ekonomiki agrobiznesu [Introduction to agri-business economics],* Warszawa, WSiP.

Mączyńska, E., 1994., *Ocena kondycji przedsiębiorstwa [Assessment of standing of an enterprise]*, Życie gospodarcze nr 38.

Pelpliński, B., Majchrzycki, D., 2002. *Dopłaty do ceny żywca wieprzowego jako instrument integracji pionowej [Subsidies to prices for pigs for slaughter as an instrument of vertical integration],* SERiA, Bydgoszcz, vol. IV, book 3, 146-150.

Pelpliński, B., Wajszczuk, K., Wielicki, W. (2004): *Integracja pionowa a opłacalność produkcji żywca wieprzowego [Vertical integration and profitability of pig production],* Monograph, Roczniki AR w Poznaniu.

Pepliński, B. (2005): *The influences of vertical integration and scale of production on profitability of pig production.* XI International Congress of European Association of Agricultural Economists: "The Future of Rural Europe in the Global Agri-Food System" Copenhagen, Denmark, [online] URL: http:// www.eaae2005.dk/scientificprogramme.htm

GUS (2007): Statistical year book