

## INVESTMENTS IN AGRICULTURE – CASE OF POLAND

Zofia Koloszko-Chomentowska<sup>1</sup>, Leszek Sieczko<sup>2</sup>

<sup>1</sup>Białystok University of Technology, Poland; <sup>2</sup>Warsaw University of Life Sciences – SGGW, Poland  
z.koloszko@pb.edu.pl, leszek\_sieczko@sggw.pl

**Abstract.** This paper analyzes the value of investments and their impact on fixed-asset reproduction in agricultural holdings depending on the profile of production. The time of analysis spanned the years 2009 and 2014, and data originated from the FADN system. The analysis accounts for the value and structure of assets as well as changes over time, net investment values, the fixed-asset turnover ratio and debt ratio. Improvement of the fixed assets to total assets ratio occurred in all holdings, which contributed to improving their competitiveness. Growth effects did not occur in all holdings, however. Only pig holdings were characterized by the capability of reproducing assets. In other holding types, despite investment in fixed assets, the net investment value and asset reproduction rate were negative. The results of management are certainly dependent on economic circumstances, and these were variable. Regardless of the results obtained, undertaken investment activity should be evaluated positively, as it indicates that current variability of production conditions is not a limitation in long-term planning of an agricultural holding's development.

**Keywords:** agricultural holdings, fixed assets, investments, modernization.

### Introduction

The development of agriculture is related to the introduction of modern technologies into the production process. The agricultural holding is the basic organizational unit in agriculture, and as an entity operating in the economy, it faces competition. Agricultural holdings undertake modernization as part of their adaptation to a variable market environment. Modernization is linked to investments, and is conducive to improving production efficiency and creating competitive advantages. Innovations, in a broad sense, are a factor that initiates modernization. They lead to so-called creative destruction, which results in modernization of production facilities and improvement of the quality of goods and services. Innovations are linked to investments. This is significant from the perspective of rational farm management [1]. However investments require large financial outlays, and not every holding can afford such undertakings. State funds stimulate the process of farms' modernization. These include both funds from the EU budget and domestic funds, which mainly consist of preferential credit programs. This instrument enjoys the greatest interest among farmers [2]. State funds allow for faster absorption of new technologies. This is confirmed by the results of studies conducted in India, where government subsidies contributed to the growth of investment in agriculture and reduced rural poverty [3].

Since Poland entered the EU, farmers' investment activity has intensified. Investment outlays in Polish agriculture increased from PLN 2398M in 2005 to PLN 6083M in 2015 [4]. Investments vary in nature, but they usually contribute to growth of the fixed assets to total assets ratio of agricultural holdings. Machinery and equipment had a relatively large share in total assets (31.4 % growth). This is the result of facilitated access to EU funds for investment [5]. Studies indicate that growth effects did not occur in all holdings, despite support with public funds [6-8]. Larger, economically stronger holdings were the most active in reconstructing fixed assets. These analyses usually concern assessment of changes in investment values over time. The influence of investment on fixed asset reproduction capabilities of holdings with different production profiles is less well-identified. Answering the question of whether investment processes contributed to fixed asset reproduction in agricultural holdings and whether they were dependent on the type of production was set as the goal of this work.

### Materials and methods

The research problem was addressed on the basis of data found in the FADN system. This analysis covers the years 2009-2014, because it was intended to investigate whether farmers' investment decisions are dependent on economic conditions. Changes in the fixed assets to total assets ratio are the result of investment activity. Analysis accounted for the value and structure of assets as well as changes over time. Selected methods of financial analysis were also applied [9]. One method of evaluating fixed asset reproduction and development of farms is the fixed asset reproduction rate.

This index indicates the type of reproduction occurring on the farm (simple, expanded, narrowed). It was calculated according to the formula:  $(\text{net investments}/\text{fixed assets}) \times 100 \%$ , which, according to FADN, takes on the form:  $(\text{SE521}/\text{SE441}) \times 100 \%$ . The value of land was omitted from the value of fixed assets for the purposes of calculating this index. This approach is result of the fact that land is not subject to depreciation according to the principles applicable to other fixed assets.

Farms' capabilities of development are dependent, above all, on the level of agricultural income, which is why analysis was supplemented with investigation of the dependency between the value of holding income and the net value of investment, using the coefficient of determination. The level of foreign capital was characterized by the debt ratio ( $DR = \text{SE485} \times 100 \%/ \text{SE436}$ ). Analyses were conducted in the following types of agricultural holdings: field crops, dairy cows, pigs and mixed. These are the most common profiles of agricultural production in Poland.

## Results and discussion

Significant improvement of farms' fixed assets to total assets ratio took place in the years 2009-2014. This ratio was dependent on production profile (Table 1). In the studied period, the value of total assets was from 21 % in mixed holdings to 56.1 % in dairy cow holdings. Differences were lower with regard to agricultural land areas, since changes in land resources also took place during this period. In all holding types, the surface area of agricultural land increased, and the largest growth was observed in field crop holdings – by 5.5 ha. The value of fixed assets per 1 ha of agricultural land indicates the degree to which holdings are technically equipped and is used to compare holdings. From this point of view, pig holdings achieve the best results, as their fixed assets per 1 ha was 11.1 % higher than in dairy cow holdings in 2014. The differences were greater still in comparison with the other types, e.g. compared to field crop holdings, the difference was 67 %. This situation is understandable, animal production demands more capital and requires greater involvement of fixed assets.

The share of fixed assets in total assets was very high in all holding groups, within the 88-90 % range. Such a structure of production assets is evaluated negatively, mainly due to its negative influence on property reproduction capabilities, however it is typical of many agricultural holdings [7; 10]. The differences do not only lie in values of assets, but also in their structure. The share of individual fixed asset components depends on the production profile. In the case of holdings specializing in field crops, land has the greatest share in the structure of fixed assets (62 % in 2009 and 66 % in 2014), which results from the nature of plant production. However it should be noted that the share of land is relatively high in all holding types. This is related to agricultural policy; the value of land has increased several-fold since subsidies for agricultural land were introduced. The phenomenon of increasing land prices have been observed since Poland entered the EU, and there is currently talk of "land hunger" in Poland.

In holdings specializing in animal production, buildings as well as machinery and equipment have the greatest share in fixed assets. Animal production (dairy cows and pigs) is very demanding in terms of the appropriate production infrastructure, which consumes much capital. This concerns buildings for livestock and their equipment. Because of this, such holdings are characterized by a higher fixed assets to land area ratio than other holdings. In terms of assets to AWU ratio, pig holdings were distinct, in which this ratio was 23.4 % greater than in milk holdings in 2014 and as much as 75.6 % higher than in unspecialised holdings. The value of current assets increased in all holding groups. This is probably the result of increased demand among agricultural holdings for current production assets as well as of the increase in such assets' prices.

Farmers' interest in buying machinery and equipment is indicative of production asset reconstruction processes. This is linked to investment and modernization, as expressed by the growth of gross investment value. The data presented in table 2 shows that production asset reconstruction capabilities are very diverse and have not changed over time. The net value of investment (gross value of investment corrected by the value of depreciation) provides information about actual property reproduction processes. From this point of view, only holdings specializing in pig production were capable of reproducing fixed assets, however their capabilities were very limited. Although, the net value of investment was positive, it only exceeded the value of depreciation slightly. Other holding groups were not capable of reproducing production assets. Despite the significant improvement of the degree to which farms are equipped with machinery and equipment in recent years, fixed asset

reproduction processes did not yet occur. Such phenomena are indicative of a poor level of technical assets on farms in previous years. There was much neglect involved, Polish agriculture relied on worn out equipment for many years.

Table 1

## Value of assets of agricultural holdings

Specification	Fieldcrops	Milk	Pigs	Mixed
<b>2009</b>				
Total fixed assets, PLN	524 519	536 062	641 626	430 943
including:				
- land, %	62.3	52.3	41.5	58.0
- farm buildings, %	19.5	24.0	33.2	25.8
- machinery, %	17.7	17.3	18.1	14.0
- breeding livestock, %	0.5	6.4	1.2	2.2
Value of machinery, PLN·ha <sup>-1</sup>	3 898	5 326	6 392	3 697
Current assets, PLN·ha <sup>-1</sup>	2 927	2 723	5 299	3 094
Fixed assets, (PLN·ha <sup>-1</sup>	22 132	30 808	39 606	26 438
Fixed assets, (EUR·ha <sup>-1</sup>	5 233	7 284	9 364	6 251
Total assets, PLN·ha <sup>-1</sup>	25 059	33 531	44 905	29 532
Total assets, EUR·ha <sup>-1</sup>	5 925	7 928	10 617	6 982
Total assets, PLN·AWU <sup>-1</sup>	340 144	330 939	429 187	300 299
Total assets, EUR·AWU <sup>-1</sup>	80 422	78 245	10 147	71 001
<b>2014</b>				
Total fixed assets, PLN	747 323	819 037	867 314	511 908
including:				
- land, %	66.0	50.0	50.6	57.4
- farm buildings, %	16.5	22.2	30.1	25.8
- machinery, %	17.3	20.4	17.8	14.8
- breeding livestock	0.2	7.4	1.5	2.0
Value of machinery, PLN·ha <sup>-1</sup>	4 419	7 853	7 612	4 416
Current assets, PLN·ha <sup>-1</sup>	3 430	4 271	6 142	4 135
Fixed assets, PLN·ha <sup>-1</sup>	25 593	38 453	42 725	29 936
Fixed assets, EUR·ha <sup>-1</sup>	6 126	9 204	10 227	7 166
Total assets, PLN·ha <sup>-1</sup>	29 023	42 724	48 867	34 071
Total assets, EUR·ha <sup>-1</sup>	6 947	10 227	11 697	8 155
Total assets, PLN·AWU <sup>-1</sup>	539 799	505 566	625 083	355 902
Total assets, EUR·AWU <sup>-1</sup>	129 213	121 018	149 627	85 193

Source: own calculations

Changes in fixed assets have an influence on the costs of agricultural activity. Above all, this pertains to costs of maintaining buildings and machinery. They are accounted for as general costs. The cost of depreciation is also important from the perspective of total costs. This is not a financial cost, only a functional cost, and the farmer does not account for these costs in practice. From a methodological point of view, this is the cost of agricultural production. In 2009, general costs made up 12.6 % of the structure of production costs in pig holdings up to 24.9 % in field crop holdings. In 2014, these values were not subject to large changes (Table 3). The value of general costs increased by 45.2 % on average. These costs burdened pig holdings to the greatest extent. The main component of general costs was energy and costs of maintaining buildings and machinery. These costs burdened pig holdings to the greatest extent, and general costs per 1 ha of agricultural land were EUR 285.47 in 2009 and EUR 310.10 in 2014. Engine fuels and electricity are accounted for in the value of energy, so it is the cost of maintaining fixed assets. If agricultural holdings' fixed assets to total assets ratio increases, so too does their energy consumption, and in 2014, energy costs and costs of maintaining machinery and buildings made up from 69.5 to 80.6 % of general costs (from EUR 741.78 to EUR 1295.48 per ha). Costs of maintaining machinery and buildings and energy consumption are also relatively high in mixed holdings. In this case, we are probably dealing with so-called overinvestment.

Purchased fixed assets are not full utilized due to the smaller scale of activity, while generating maintenance costs.

Table 2

## Value of investment

Specification	Fieldcrops	Milk	Pigs	Mixed
<b>2009</b>				
Gross investment, PLN	16 861	12 241	21 698	7 471
Depreciation, PLN	16 971	15 039	19 259	12 444
Net investment, PLN	-111	-2 798	2 439	-4 973
Rate of fixed assets reinvestment	-0.0005	-0.011	0.0075	-0.027
Total debt ratio	0.071	0.047	0.079	0.038
<b>2014</b>				
Gross investment, PLN	20 185	23 039	27 983	10 259
Depreciation, PLN	21 374	24 166	26 115	15 712
Net investment, PLN	-1 189	-1 127	1 868	-5 453
Rate of fixed assets reinvestment	-0.0047	-0.0027	0.0044	-0.025
Total debt ratio	0.079	0.049	0.066	0.041

Source: own calculations

Table 3

## Costs of production

Specification	Fieldcrops	Milk	Pigs	Mixed
<b>2009</b>				
Total costs, PLN	85 759	64 838	194 832	64 627
1 specific, direct costs, PLN	37 019	31 443	144 736	33 201
2 total farming overheads, PLN	21 382	16 264	25 000	14 726
- machinery and building costs, %	25.5	32.6	29.9	29.6
- energy, %	43.0	39.4	48.4	41.9
- services, %	18.1	14.8	8.1	14.3
- other, %	13.4	13.2	13.6	14.2
3 depreciation, PLN	16 971	15 039	19 259	12 444
4 external factors, (PLN	10 386	2 092	5 837	4 257
Total farming overheads, PLN·ha <sup>-1</sup>	902.19	934.71	1 543.21	903.43
Machinery, building and energy costs, PLN·ha <sup>-1</sup>	618.73	627.53	1 207.41	640.01
Machinery, building and energy costs, EUR·ha <sup>-1</sup>	146.29	159.01	285.47	152.74
<b>2014</b>				
Total costs, PLN	115 991	113 898	22 794	90 020
1 specific, direct costs, PLN	49 678	57 639	160 871	44 712
2 total farming overheads, PLN	31 141	27 558	29 379	21 837
- machinery and building costs, %	23.7	30.4	29.4	26.9
- energy, %	45.8	44.9	51.2	43.6
- services, %	16.0	12.5	10.1	15.0
- other, %	14.5	12.2	13.6	14.5
3 depreciation, PLN	21 374	24 166	26 115	15 712
4 external factors, PLN	13 798	4 535	6 428	7 758
Total farming overheads, PLN·ha <sup>-1</sup>	1 066.47	1 293.80	1 447.24	1 277.02
Machinery, building and energy costs, PLN·ha <sup>-1</sup>	741.78	974.32	1 295.48	758.32
Machinery, building and energy costs, EUR·ha <sup>-1</sup>	177.56	233.22	310.10	181.52

Source: own calculations

Investment in an agricultural holding serves, above all, to modernize production and improve technical and economic efficiency, improving effectiveness of operation in general. Therefore, we can expect growth of fixed assets in the share of total assets to translate to economic effects. Various factors have an impact on investment activity. Investments serve, above all, to substitute human labour with capital. Techniques and technologies reducing labour demand but requiring high capital outlays are a consequence of this process. A significant number of agricultural holdings are not capable of financing development with own equity. Farmers' investment activity increased after entry into European structures. Funds from the EU budget facilitated the execution of many investment projects. Farmers' aversion to financing development with bank credit is a universal phenomenon found not only in Poland [12; 13]. Own equity is the main source of financing, and its share in the value of assets was very high, exceeding 90 %, while liabilities had a small share.

This indicates that a farm has strong financial foundations and is exposed to less risk from activity, but on the other hand, it also limits development capabilities of these entities. Farms using foreign funds are more open to new initiatives. Pigs and fieldcrops farms were the most in debt. The total debt ratio amounted to from 0.067 to 0.079 (Table 2). According to the literature, this ratio should fluctuate within the range of 0.57-0.67 [9]. Therefore, there are no threats related to debt payment among the studied holdings.

The statistical dependence between values of the family farm income and the net investment value was also low, the determination coefficient was equal to 0.257 (Fig. 1). It is difficult to give an unambiguous interpretation in this case, because various factors play a role in investment activity. Investments serve, above all, as a substitute of labour input that is effected by capital. Techniques and technologies reducing the demand for labour, but also requiring large capital expenditures, are the consequence of this process. It may be that the low tendency to execute investments results from a lack of workforce drainage from agriculture. In this situation, holdings are not interested in using capital-consuming technologies.

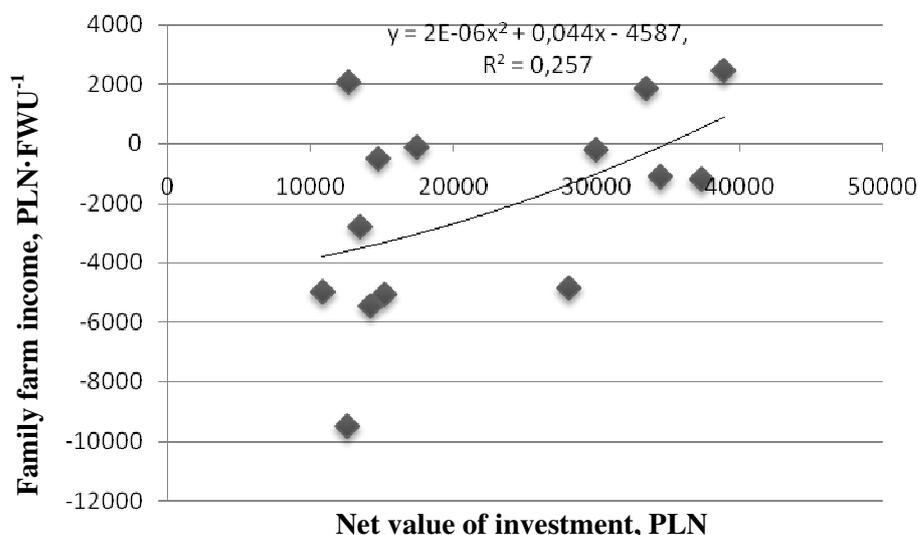


Fig. 1. Dependence between family farm income and value of investment

## Conclusions

Since Poland entered the EU, investment in Polish agriculture has intensified. This undoubtedly contributed to improving the competitiveness of agriculture. Agricultural holdings were equipped with modern machines and devices as well as highly efficient technologies. This increased production efficiency and improved product quality, leading to improvement of economic results and improvement of farming families' living conditions. This is a new quality in Polish agriculture.

Fixed assets are an important component of farms' production potential, which determines the use of other means of production. Growth of the capital saturation of land and labour is the effect of an increase of production potential. Concentration of resources in a holding leads to an increase in the amount of obtained income. The higher the income, the greater the opportunities to introduce effective innovations in the production process.

Conducted analysis indicates that investment processes are dependent on production profile. Investments were carried out in all holding groups, and the fixed assets grew as a result. Growth effects did not occur in all holdings, however. Unspecialised farms were in the most difficult situation. Scattered activity makes it difficult to achieve both the production and the economic objective. In this case, investment in fixed assets serves to reduce the labour burden.

Pig holdings exhibited the most intensive reconstruction of production assets, although the net value of investment only slightly exceeded the value of depreciation. These holdings achieved the highest income. They were also more indebted due to credit taken for the purposes of investment. Growth effects did not occur in other holding types, despite investment in fixed assets. The net value of investment and property reproduction rate were negative. The results of management are certainly dependent on economic circumstances, and these are and have always been variable. Dairy farms were particularly affected by this. Regardless of the results obtained, undertaken investment activity should be evaluated positively, as it indicates that current variability of production conditions is not a limitation in long-term planning of an agricultural holding's development.

### Acknowledgements

The research have been carried out the framework of work S/WZ/2/15 and funded by the Ministry of Science and Higher Education.

### References

1. Bórawska-Bełdycka A., Bórawski P. Wpływ majątku trwałego na wyniki ekonomiczne gospodarstw rolnych na przykładzie województwa podlaskiego (Impact of fixed assets on the economic results of farms on the example of Podlaskie voivodship). *Zagadnienia Doradztwa Rolniczego: The Issues of Agricultural Advisory Service*, no 1, 2005, pp. 43-52. (in Polish).
2. Gabrusewicz W. *Podstawy analizy finansowej (The basis of financial analysis)*. Wyd. II: Second Edit., Warszawa: PWE, 2007. 280 p. (in Polish).
3. Grzelak A. Ocena procesów inwestycyjnych w rolnictwie w Polsce w latach 2000-2011 (Evaluation of investment processes in agriculture in Poland in 2000-2011). *Journal of Agribusiness and Rural Development*, no 28(2), 2013, pp. 111-120. (in Polish).
4. Hertz T. The effect of non farm income on investment in Bulgaria family farming. *Agricultural Economics*, no 40(2), 2009, pp. 161-176.
5. Hornowski A. Działalność inwestycyjna polskich gospodarstw rolniczych korzystających z funduszy strukturalnych Unii Europejskiej w latach 2004-2013 (Investment activities of Polish farms profiting from structural UE funds in 2004-2013). *Zeszyty Naukowe SGGW Ekonomia i Organizacja Gospodarki Żywnościowej: Scientific Journal of Warsaw University of Life Sciences – Economic and Organization of Agri-Food Sector*, no 109 (2015), pp. 55-70. (in Polish).
6. Koloszko-Chomentowska Z. Przyrodnicze i organizacyjno-ekonomiczne uwarunkowania rozwoju rodzinnych gospodarstw rolnych w województwie podlaskim (Natural organizational and economic conditions for development of family farms in the Podlasie voivodeship). *Monografie i Rozprawy Naukowe: Monographs and Dissertations*, nr 41. Puławy: Instytut Uprawy Nawożenia i Gleboznawstwa Państwowy Instytut Badawczy: Institut of Soil Science and Plant Cultivation State Research Institute, 2013. 135 p. (in Polish).
7. Mykolaitiene V., Vecerskiene G., Jankauskiene K., Valanciene L. Peculiarities of tangible fixed assets accounting. *Inzinerine Ekonomika – Engineering Economics*, no 21(2), 2010, pp. 142-150.
8. Petrick M. Farm investment, credit rationing and governmentally promoted credit access in Poland: a cross-sectional analysis. *Food Policy*, no 29(3), 2004, pp.275-294.
9. Pfeifer L., Lopez-Feldman A., Taylor E. Is off-farm income reforming the farm? Evidence from Mexico. *Agricultural Economics*, no 40(2), 2009, pp. 125-138.
10. Ramakumor R. Large-scale investments in agriculture in India. *IDS Bulletin*, vol. 43(1), 2012, pp. 92-103.
11. *Rocznik Statystyczny RP: Statistical Yearbook RP*. Główny Urząd Statystyczny: Central Statistical Office, Warszawa 2016, pp. 670.(in Polish).
12. Toro-Mujica P., Garcia A., Aguilar C., Vera R., Perea J., Angon E. Economic sustainability of organic dairy sheep systems in Central Spain. *Italian Journal of Animal Science*, vol. 14(2), 2015, pp. 193-201.