

MECHANISATION COSTS IN FAMILY FARMS OF VARIED PRODUCTION

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Summary. Mechanisation costs of 30 family farms grouped according to the production orientation were presented. Three production orientations were selected: milk production, pig livestock production and plant production. It was found that plant farms incur the highest mechanisation costs amounting to 2916.0 PLN·ha⁻¹AL. Whereas, the smallest milk farms incur costs amounting to (2330.1 PLN·ha⁻¹ AL). Amortisation has the highest share in the analysed costs. Within the group of farms which produced pig livestock, fractional efficiency ratio reached the highest value and amounted to 3.40. The lowest value of this ratio was obtained in the group of plant farms, where it reached 2.31. A strong positive correlation between gross agricultural production and incurred mechanisation costs was reported.

Key words: mechanisation costs, production orientation, family farms

Introduction

Running an agricultural business consisting in agricultural production is related to varied inputs, which the most frequently are presented in physical units. For assessment of efficiency, it is necessary to express the consumption of production means in money as expenses. Mechanisation costs, which comprise of exploitation costs of own machines and costs of services carried out for the farm are one of the groups of the production costs. Exploitation costs at the wheat production constitute even 38–48% of the total production costs [Dobek, Sałagan 2011]. Such a considerable participation of these costs results in the search for organisational solutions, which would influence decrease of their amount. Numerous works concerning analyses of machines exploitation costs and their impact on efficiency and cost-effectiveness of production [Kowalik, Grześ 2006; Kocira, Kuboń 2011; Kocira, Sawa 2005; Lorencowicz 2005; Malaga-Toboła 2007; Pawlak 2010; Tomczyk 2005], prove significance and demand for reduction of these expenses. Cupiał and Lorencowicz [2012] suggest using machines for services in order to decrease the unit costs and to obtain additional income. This method of the unit costs reduction is not always possible to

carry out since demand for services in a region, where the farm functions, may be significantly lower than supply. In such case, farmers should consider the possibility of using the services instead of purchasing expensive machines, which generate high fixed costs. However, each farmer, who runs a farm, must decide himself on the form of mechanisation. Such decision may be taken only when he knows both the level as well as the structure of mechanisation costs.

Objective, scope and methodology of work

The objective of the work is to analyse mechanisation costs of production in the selected family farms with consideration of the production orientation.

The scope of work covers general characteristics of the selected farms, determination of production, analysis of mechanisation costs of farms and calculation of the fractional efficiency ratio.

Data from thirty family farms, where equipment and business activity were described in 2009, served as the material. These descriptions were made within a development project NCBiR [National Centre for Research and Development] NR 12 004306/2009. A detailed methodology of collecting data was presented in a monograph edited by Wójcicki [2009]. The analysis, which was carried out, was based on comparative methods and methods using tables and descriptions. The production orientation was determined on the basis of the income obtained from particular production branches, assuming the branch with 50% share in incomes as the main source of income. Gross replacement value of technical means of work was calculated for each farm. The mechanisation costs were divided into exploitation costs of own machines and costs of services for the farm. Exploitation costs were calculated with a balance - calculation method. Amortisation costs and storage costs were calculated. The remaining costs were determined on the basis of expenses incurred by farms. Moreover, the fractional efficiency ratio was calculated according to the following formula:

$$W_{ekm} = \frac{P_r}{K_m} \quad (1)$$

where:

- W_{ekm} – fractional efficiency ratio,
- P_r – incomes from agricultural production,
- K_m – mechanisation costs.

Income from sale of plant products and income obtained from sale of milk and pig live-stock and beef cattle were included in the agricultural production income (P_r).

Analysis of the research results

Average area of the researched farms was 27.54 ha AL and was within the range of 8.58 to 50.00 ha AL (tab. 1). Arable land occurred in all farms, whereas only one farm did not include meadows and pastures. Livestock was varied and was on the average 118.7 LSU·100 ha⁻¹ AL. One farm did not possess animals. The recommended livestock

according to the Code of Good Agricultural Practice [Duer et al. 2004] was exceeded two times in a farm of the highest number of livestock. Both, work load of people employed in a farm as well as man labour inputs per a hectare of arable lands was very varied which is proved by the value of standard deviation (tab. 1).

Table 1. A general description of farms
Tabela 1. Ogólna charakterystyka gospodarstw

Specification	Minimum value	Maximum value	Average	Standard deviation
Area [ha AL·farm ⁻¹]	8.58	50.00	27.54	10.04
Arable land [ha·farm ⁻¹]	0.06	39.00	19.26	10.61
Meadows, pastures and others [ha·farm ⁻¹]	-	22.48	8.27	5.98
Livestock [LSU·100 ha AL ⁻¹]	-	295.9	118.7	62.0
The number of the employed [man·farm ⁻¹]	2	4.0	2.6	0.8
Work load [mh·man ⁻¹]	405	3015	1507	678
Man labour inputs [mh·ha AL ⁻¹]	25.3	303.7	150.3	70.0

Source: author's own calculations;

According to the accepted methodology, farms were divided into three groups:

1. Milk production oriented – 18 farms.
2. Pig livestock production oriented – 7 farms.
3. Plant production oriented – 5 farms.

The farms producing pig livestock were characterised by the biggest average area of agricultural land and arable land (tab. 2). Due to the specificity of production, the milk production oriented farms possessed the highest number of green land in the form of meadows and pastures. In the remaining two groups, average area of meadows and pastures was at a similar level. Livestock was very diverse and in the milk production oriented farms it was within 67.2 LSU·100 ha⁻¹ AL to 295.9 LSU·100 ha⁻¹ AL. Whereas, in the farms producing pig livestock, the livestock was on the average 149.4 LSU·100 ha⁻¹ AL. Whereas, orienting farms at the plant production was related to low livestock and in this group it was only on the average 31.3 LSU·100 ha⁻¹ AL. The value of the mechanisation index, calculated as a ratio of the gross replacement value to agricultural land area, was at a similar level and amounted to 26 850 PLN·ha⁻¹ AL in the milk production farms, 34 468 PLN·ha⁻¹ AL in the pig livestock production farms and – 29 448 PLN·ha⁻¹ AL in the plant production farms. A similar level of this index (24 805 PLN·ha⁻¹ AL) was obtained by Szuk [2011], who analysed the mechanisation level in small farms in Lower Silesia. The highest number of technical infrastructure equipment of labour force expressed with the gross replacement value of technical means per one employee occurred in the group of farms which produce pig livestock (379 300 PLN·employee⁻¹) and it was over 1/3 times higher than the plant production group. Technical infrastructure equipment in particular groups was very varied, which is proved by the standard deviation value (tab. 2).

Table 2. Characteristics of particular groups of farms
 Tabela 2. Charakterystyka poszczególnych grup gospodarstw

Specification	Area of AL [ha AL-farm ⁻¹]	Arable land [ha-farm ⁻¹]	Meadows, pastures and others [ha-farm ⁻¹]	Livestock [LSU: 100 ha ⁻¹ AL]	Mechanisation index [PLN·ha ⁻¹ AL]	Technical infrastructure equipment of work force [PLN·employee ⁻¹]	Technical infrastructure equipment [PLN·man-hour ⁻¹]
Milk production farms							
Minimum value	12.10	0.06	2.35	67.2	13,238	147,800	70.67
Maximum value	50.00	38.00	22.48	295.9	57,842	539,300	400.89
Average	27.42	16.78	10.64	129.4	26,850	294,499	189.75
Standard deviation	10.58	10.33	6.10	55.0	10,986	124,049	75.31
Pig livestock production farms							
Minimum value	22.74	12.80	0.30	88.7	23,352	272,833	114.38
Maximum value	42.02	34.12	9.94	207.0	58,061	590,400	595.48
Average	31.44	26.49	4.95	149.4	34,468	379,300	259.31
Standard deviation	6.41	7.52	3.61	47.9	11,560	118,767	166.86
Plant production farms							
Minimum value	8.58	8.18	0.00	0.0	15,575	57,900	62.42
Maximum value	39.00	39.00	10.40	65.5	45,152	628,475	1271.57
Average	22.48	18.07	4.41	31.3	29,448	236,427	269.89
Standard deviation	11.58	12.56	4.31	23.8	10,623	232,080	485.75

Source: author's own calculations

In the structure of mechanisation costs, amortisation costs prevailed, which is confirmed by previous research of the author [Kocira, Sawa 2005; Kocira, Kuboń 2011], where over 40% participation of amortisation costs were reported in mechanisation costs. Moreover, Lorencowicz [2005] analysing 143 family farms, calculated the amortisation share in the exploitation costs on the level of 44%. Storage, maintenance and insurance costs constituted 20% (fig. 1). The sum of these two categories of costs are fixed costs and they constitute almost 2/3 of the total mechanisation costs. Fuels costs had the highest share from among variable costs in the structure of mechanisation costs. Share of the mechanisation services costs provided to farms was only 4%.

In the analysed groups of farms, in the structure of mechanisation costs, maintenance costs of technical means prevailed (fig. 2). The use costs constituted over 30% of the total mechanisation costs in each group, however, they did not exceed 35% in any group. Costs of mechanisation services carried out for a farm had the lowest participation in the mechanisation costs.

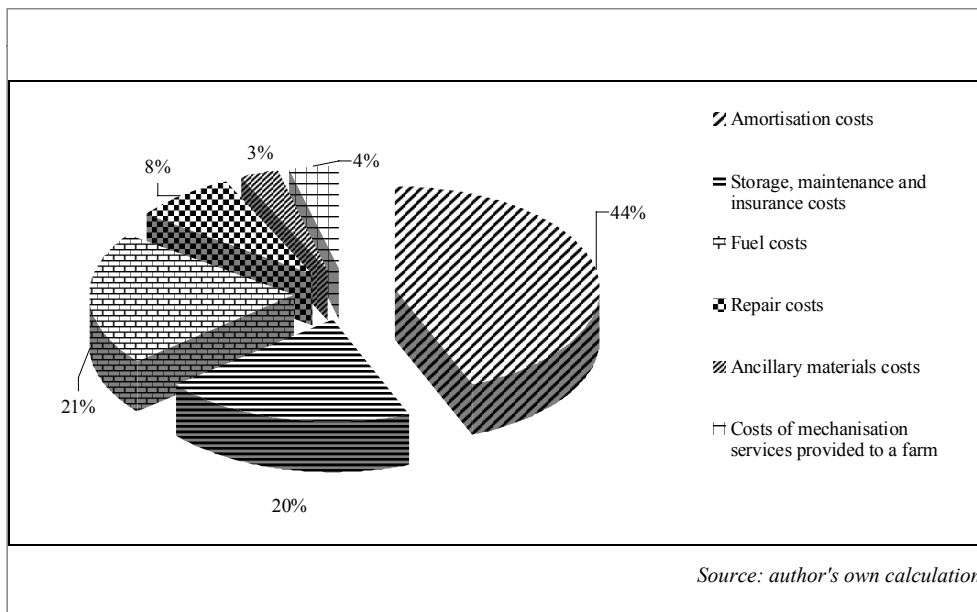


Fig. 1. The structure of production mechanisation costs in the analysed farms
 Rys. 1. Struktura kosztów mechanizacji produkcji w analizowanych gospodarstwach

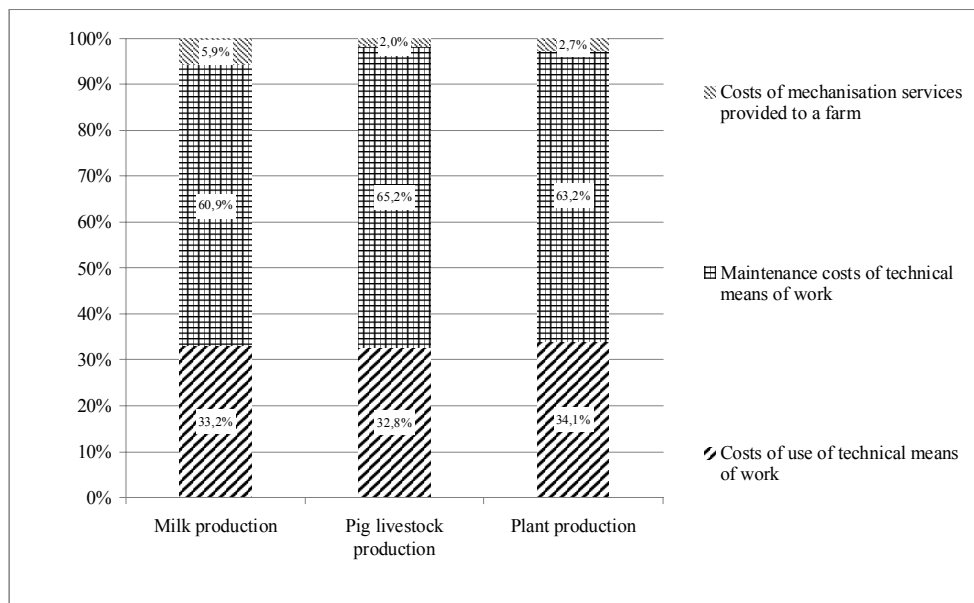


Fig. 2. Structure of mechanisation costs in the analysed farm groups
 Rys. 2. Struktura kosztów mechanizacji w analizowanych grupach gospodarstw

The plant production oriented farms incurred the highest mechanisation costs of production amounting to 2916.0 PLN·ha⁻¹ AL and were higher of almost 600 PLN·ha⁻¹ AL than costs in the milk production farms (tab. 3). Amortisation influenced such high costs (1376.4 PLN·ha⁻¹ AL). Costs of ancillary materials constituted the lowest component in the groups of milk and plant production farms. In the group of farms producing pig livestock, the costs of mechanisation services provided to a farm were the lowest out of all categories of costs both in this group as well as in the other group.

The fractional efficiency index was calculated for each group (W_{ekm}). Value of this index provides us with information on how much income from the agricultural production one zloty of the incurred mechanisation costs generated. Plant production oriented farms obtained the lowest value of this index. The pig livestock production farms obtained the highest value. The value of this index in the milk production farms was similar to the average value of all researched farms and was 2.92 (tab. 3).

Table 3. Mechanisation costs in the analysed farm groups

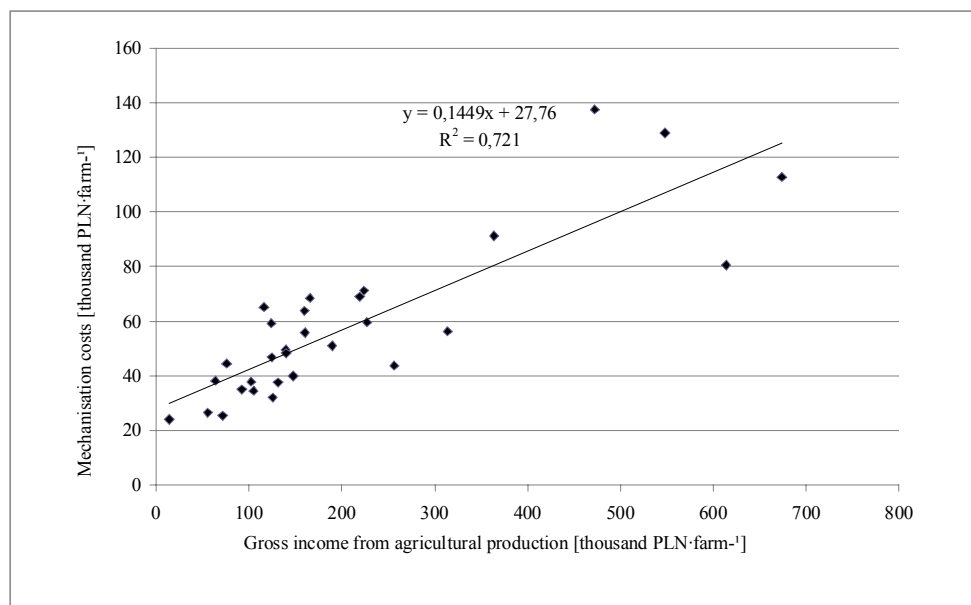
Tabela 3. Koszty mechanizacji w analizowanych grupach gospodarstw

Specification	Farms oriented to:			Average for 30 farms
	milk production	pig livestock production	plant production	
Number of farms in the group	18	7	5	-
Amortisation costs [PLN·ha ⁻¹ AL]	992.9	1276.6	1376.4	1120.7
Storage, maintenance and insurance costs [PLN·ha ⁻¹ AL]	464.4	591.3	488.5	501.5
Fuel costs [PLN·ha ⁻¹ AL]	474.7	515.7	811.1	531.4
Repair costs [PLN·ha ⁻¹ AL]	182.2	278.7	111.2	198.3
Ancillary materials costs [PLN·ha ⁻¹ AL]	78.9	80.7	50.5	75.5
Costs of mechanisation services provided to a farm [PLN·ha ⁻¹ AL]	137.0	54.7	78.3	107.1
Total [PLN·ha ⁻¹ AL]	2330.1	2797.7	2916.0	2534.4
Fractional efficiency ratio (ratio of gross income from agricultural production to mechanisation costs)	2.92	3.40	2.31	2.97

Source: author's own calculations;

Assuming a correlation scale according to Stanisiz [1998], a high positive correlation was reported (linear correlation coefficient $r = 0.849$) between gross income from the agricultural production and the mechanisation costs expressed in PLN·farm⁻¹ (fig. 3).

Mechanisation costs...



Source: author's own calculations;

Fig. 3. Gross income from agricultural production and mechanisation costs
Rys. 3. Przychody brutto z produkcji rolniczej a koszty mechanizacji

Summary

The analysis, which was carried out proved, that according to assumptions and research results of other authors, the biggest share in the structure of mechanisation costs belongs to amortisation (44%).

The highest mechanisation costs (2916.0 PLN·ha⁻¹ AL) occur in plant production farms. It is mainly influenced by two components of costs, that is amortisation and fuel costs. Analysis of the applied cultivation technologies should be carried out in order to reduce the costs. This analysis should be carried out in order to search for such modifications in the applied technologies, which would allow a decrease of costs without a negative influence.

The calculated fractional efficiency ratio allows finding that on the average PLN 2.97 of income from the agricultural production of a farm falls to each zloty of the incurred mechanisation costs. The highest value of this index (3.40) occurs in pig livestock production farms and the lowest (2.31) in plant production oriented farms.

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KOSZTY MECHANIZACJI W GOSPODARSTWACH RODZINNYCH O RÓŻNYM KIERUNKU PRODUKCJI

Streszczenie. Przedstawiono koszty mechanizacji 30 gospodarstw rodzinnych pogrupowanych według kierunku produkcji. Wyodrębniono 3 kierunki produkcji: produkcja mleka, produkcja żywca wieprzowego i produkcja roślinna. Stwierdzono, że największe koszty mechanizacji wynoszące 2916,0 PLN·ha⁻¹ UR ponoszą gospodarstwa ukierunkowane na produkcję roślinną. Najmniejsze natomiast gospodarstwa ukierunkowane na produkcję mleka (2330,1 PLN·ha⁻¹ UR). Największy udział w analizowanych kosztach ma amortyzacja. W grupie gospodarstw ukierunkowanych na produkcję żywca wieprzowego cząstkowy wskaźnik efektywności osiągnął największą wartość i wynosił 3,40. Najmniejszą wartość wskaźnik ten uzyskano w grupie gospodarstw ukierunkowanych na produkcję roślinną i wyniósł 2,31. Stwierdzono silną dodatnią korelację między przychodami brutto produkcji rolniczej a ponoszonymi kosztami mechanizacji.

Słowa kluczowe: koszty mechanizacji, kierunek produkcji, gospodarstwa rodzinne

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