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### INTENSITY OF PRODUCTION ORGANIZATION COMPARED TO THE WORK FACTOR IN FAMILY FARMS

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#### ABSTRACT

The paper presents the level of incurred labour inputs and the equipment in the form of production means in 46 family farms listed according to the intensity of production organization. The obtained results were presented with a table and description method. The analysis which was carried out proved that along with the intensity of production organization the number of physical workers increases in farms with simultaneous decrease of AL area. The investigated farms featured quite variable size of participation of capital calculated into the replacement value of mechanization means per a hectare of agricultural land. A positive average correlation between intensity of production organization and objectified work inputs and a weak correlation between intensity of production organization and human work inputs were determined.

### Introduction

Intensity of agricultural production may be determined with various indexes which explain structural and organizational conditions, environmental and agri-technical as well as economic and organizational ones. Intensity of agricultural production is determined based on two concepts, that is, intensity of organization and intensity of production. Determination of the level of intensity of production organization in farms is related to quality evaluations composed of both organizational departments of production in a farm as well as participation of production means (Kopeć, 1987).

Intensity of production is a quantity phenomenon, measured with the value of production inputs, the size of live labour inputs and objectified labour inputs per a unit of area (Manteuffel, 1979).

Labour as one of three factors of production is an essential element which influences effectiveness and competitiveness of agricultural farms (Pepliński, 1999). It is determined as a human effort put in production of a given good or service, in other words, as an organizer and creator of the production process. Number of full-time employees is a measure unit. Whereas, labour inputs are expressed in man-hour or man-day.

## The objective and the scope of research

The objective of the paper is analysis of human labour inputs and objectified labour inputs which occurs in 46 family farms set acc. to intensity of production organization.

Farms, which participated in the research project (carried out by the Institute of Technology and Natural Sciences Branch in Warsaw as a part of the program by the National Centre for Research and Development No. 1204306/2009 "Technological and ecological modernization of the selected family farms" managed by professor Wójcicki (2009), constituted material for research.

Farms were divided into four groups based on the category acc. to points of intensity of production organization presented by Kopeć. The level of human labour inputs in man-hour·ha<sup>-1</sup> AL and the level of the objectified labour inputs level in kWh·ha<sup>-1</sup> AL.

Intensity of production organization (Kopeć, 1987) was calculated acc. to the formula:

$$I_{op} = I_r + I_z = \sum p \cdot s + \sum q \cdot t \quad (1)$$

where:

- $I_{op}$  – total intensity of production organization (points),
- $I_r$  – intensity of plant production organization (points),
- $p$  – participation of sowing area of a plant in agricultural land (%),
- $s$  – coefficient of crop intensity for particular plants (points·%<sup>-1</sup>),
- $I_z$  – intensity of animal production organization (points),
- $q$  – number of LSU of particular animal species per 100 ha AL,
- $t$  – index of intensity for particular animal species per 1 LSU·100 ha<sup>-1</sup> AL.

Moreover, a calculated technical index of work infrastructure which images "infrastructure" of live labour with objectified labour. It enables assessment of the level of enterprises saturation with fixed assets (Wędzik, 2006).

$$T_{up} = MT \cdot L^{-1} \quad (2)$$

where:

- $MT$  – average value of fixed assets (thousand PLN·farm<sup>-1</sup>),
- $L$  – employment level (persons).

Stocking density was calculated based on the calculation coefficients of animal items into livestock units (LSU) (Journal of Laws 2010 no.213, item 1397). Table and description methods and basic statistical methods were used in the paper. Statistical analysis was based on the linear correlation coefficient assuming a scale acc. to Stanisiz (1998):

- $r_{xy} = 0$  – variables are not correlated,
- $0 < r_{xy} < 0.1$  – dim correlation,
- $0.1 \leq r_{xy} < 0.3$  – weak correlation,
- $0.3 \leq r_{xy} < 0.5$  – average correlation,
- $0.5 \leq r_{xy} < 0.7$  – high correlation,
- $0.7 \leq r_{xy} < 0.9$  – very high correlation,
- $0.9 \leq r_{xy} < 1$  – almost certain correlation,
- $r_{xy} = 1$  – certain correlation.

## Research results

The analysed group of 46 farms characterized with high range of agricultural land areas (table 1), which was 141.42 ha and standard deviation of 29.84 ha. Average area of agricultural land is 33.68 ha when standard deviation was 30.85 ha. All farms had meadows and pastures and the biggest area of permanent grasslands in a farm was 47.55 ha. Not in all analysed farms, animal production was carried out.

Average stocking density was 80.26 LSU·ha<sup>-1</sup> AL. The replacement value of mechanization means characterized with high range which was 1686.70 thousand PLN·farm<sup>-1</sup> at the standard deviation equal to 427.02 thousand PLN·farm<sup>-1</sup>. Whereas, average replacement value of mechanization means expressed in thousand PLN·ha<sup>-1</sup> AL was 10.97.

Table 1  
*Description of the researched farms*

Specification	Minimal value	Maximum value	Average	Standard deviation
Area of agricultural land (ha·farm <sup>-1</sup> )	8.58	150	42.74	29.84
Arable land (ha·farm <sup>-1</sup> )	5.00	150	33.68	30.85
Permanent grasslands (ha·farm <sup>-1</sup> )	-	47.55	9.05	10.00
Animal livestock (LSU·ha <sup>-1</sup> AL)	-	295.91	80.26	67.30
Replacement value of mechanization means (PLN·ha <sup>-1</sup> AL)	2.90	58.06	27.03	10.97
Replacement value of mechanization means (thousand PLN·farm <sup>-1</sup> )	231.60	1918.30	975.26	427.02

In the crop structure (fig. 1) grains along with maize for grain constituted 56% of the area of all crops. Oil plants had 4%, root 5% and papilionaceous plants 2% participation in agricultural lands. Meadows and pastures had in total 21% of participation in the crops structure.

Farms were divided into four groups acc. to the level of intensity of production organization (table 2) where average area of farms was 42.74 ha AL (8.58-150 ha AL). Farms in these groups proved decrease of intensity of production organization with the increase of the farm area respectively from 771.23 points to 236.56. Acc. to the assumed criteria the most numerous group of 17 farms constituted farms, where intensity of production organization was within 400-550 points. Whereas, the biggest farms (95.83 ha AL) were in the first group of production organization (to 300 points).

Farms with the highest production organization, where index was over 771.23 points, farmed on the area of 33.54 ha AL that is almost on three times smaller than farm with the lowest organization of agricultural production, for comparison – average for the investigated group was 42.74 ha AL. The fact, that farms with intensity above 550 points obtained high index of livestock which was over 117.64 LSU·100 ha<sup>-1</sup> AL is significant. Assessment of work inputs proved relations between the level of employment and the increase of intensity of production organization.

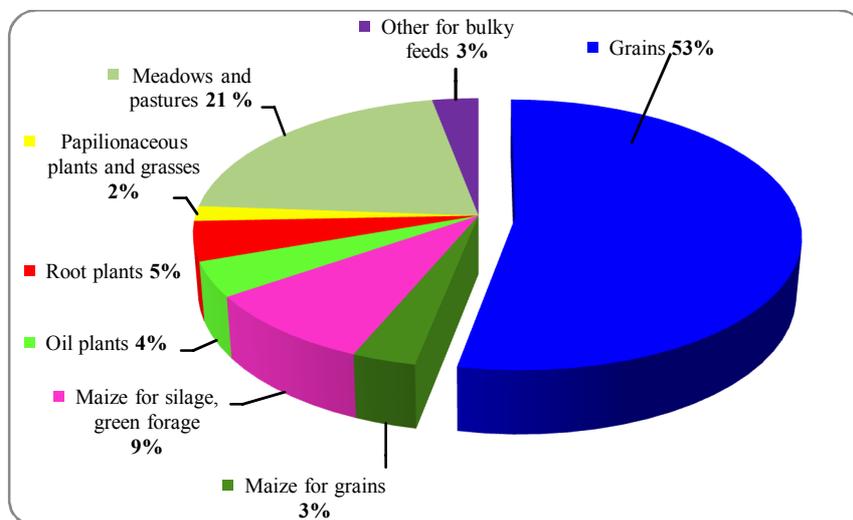


Figure 1. Structures of crops in the investigated farms

Table 2  
Labour resources in the researched farms

Specification	Unit	Categories of farms acc. to points of intensity of production acc. to Kopeć				At the average for 46 farms
		>300	300≤400	400≤550	≥550	
Number of farms	–	6	7	17	16	-
Area of farms	(ha AL)	95.83	42.56	38.88	33.54	42.74
Stocking density	LSU·100 ha <sup>-1</sup> UR	27.18	46.83	76.97	117.64	80.26
Intensity of production organization	(points, including in: plant production)	236.56	320.74	449.96	771.23	517.75
	animal production)	137.49	162.83	137.09	172.98	156.27
Employment in a farm	people·farm <sup>-1</sup>	99.06	157.91	312.87	598.25	361.47
- conversion employees	employee·100 ha <sup>-1</sup>	2.15	2.60	2.81	3.50	2.93
- foreign employees	UR	2.25	6.11	7.22	10.42	9.41
		0.20	0.60	0.97	0.81	0.76

Farms with intensity to 300 points employed 2.25 employees per 100 ha AL, where in farms with intensity above 550 points this number was 10.42. The highest number of foreign employees were employed by farms with intensity from 400 to 550 points (0.97 conversion employees per 100 ha AL). That is almost five times higher than farms with intensity to 300 points and over 1.5 times higher than farms with intensity from 300 - 400 points. Whereas, in comparison to the fourth group of intensity over 550 points, these farms employed the number of conversion employees per 100 ha of AL almost at the same level (0.81).

Taking into consideration the structure of labour inputs, manner of organization of agricultural production and degree of participation of technical means, the nature of the production system in a farm may be determined, e.g. capital intensive, labour-intensive (Michałek and Kowalski, 1993; Wójcicki, 2001). The investigated farms characterized with quite variable size of capital participation calculated into replacement value of mechanization means per a hectare of agricultural land. Along with the increase of production organization intensity, the index of value of all possessed groups of machines expressed in thousand PLN·ha<sup>-1</sup> AL (tab. 3) increased.

Taking into account the replacement value, it may be stated that farms with intensity to 300 points farming on big areas show almost 1.5 times higher participation of capital in technical mechanization means.

Particular groups of farms, when executing the production process, except for capital participation in mechanization means showed also variable human labour inputs. Employment of physical workers in the investigated systems was also variable and increased along with production intensity from 2.15 employees in farms with intensity to 300 points to 3.50 persons in farms with intensity above 550 points. Whereas, these indexes referred to the number of people employed per 100 ha AL allowed stating that farms with intensity to 300 points employ 2.25, from 300 to 400 points – 6.11 while from 400 to 550 points – 7.22 and above 550 points – 10.42 employees per 100 ha AL. It may be stated that farms with intensity above 550 points in comparison to farms with intensity to 300 points use the area of AL almost three times smaller.

The increasing intensity in production is related to higher loading with work of employees. In the system with intensity above 550 points this loading is lower by 1208.51 man-hour in comparison to employee in farms with intensity to 330 points. Farms with intensity over 550 points incur the highest inputs per 1 ha of AL in comparison to three remaining groups of intensity. One may state that farm with intensity to 300 points with low level of employment of conversion employees incur almost five times lower inputs of live work per 1 ha of AL compared to farms with intensity above 550 points of production organization.

When analysing descriptions of relations between human labour and objectified labour a technical infrastructure index was assumed expressed in PLN·man-hour<sup>-1</sup> and PLN per an employee (Zaremba, 1977). Farms with intensity to 300 points but with bigger area at comparable employment of natural persons proved the highest index of technical infrastructure, referred to three remaining, which was 1173.69 PLN·man-hour<sup>-1</sup> and 2354.83 thousand PLN per an employee but the highest level of work load (1930.61 man-hour per a farm per a year). The mentioned indexes express only possibilities of participation of technical means in the labour process (it is practically the replacement value of mechanization means per an employee or an hour of his work).

Table 3  
*Level of technical infrastructure of the work process in the investigated farms*

Specification	Unit	Categories of farms acc. to points of intensity of production acc. to Kopeć				At the average for 46 farms
		>300	300≤400	400≤550	≥550	
Number of farms	–	6	7	17	16	
Area of farms	(ha AL)	95.83	42.56	38.88	33.54	42.74
Intensity of production organization	(points, including in: plant production animal production)	236.56	320.74	449.96	771.23	517.75
		137.49	162.83	137.09	172.98	156.27
		99.06	157.91	312.87	598.25	361.47
Number of employees in a farm	(Persons)	2.15	2.60	2.81	3.50	2.93
Number of conversion employees	employee·100ha <sup>-1</sup> AL	2.25	6.11	7.22	10.42	9.41
Loading employees with work	man-hour·year <sup>-1</sup>	1930.61	904.00	818.78	722.10	1093.87
Inputs of human work	man-hour·ha <sup>-1</sup> AL	45.27	129.82	151.97	224.29	209.67
Inputs of objectified work	kWh·ha <sup>-1</sup> AL	877.98	1334.88	1501.65	1842.34	1538.88
Replacement value of mechanization means	thousand PLN·farm <sup>-1</sup>	1238.70	862.94	965.43	991.95	975.26
Replacement value of mechanization means	thousand PLN·ha <sup>-1</sup> AL	12.93	20.28	24.83	29.57	27.03
Technical infrastructure index of the work station	PLN·man-hour <sup>-1</sup>	1173.69	467.12	456.36	440.56	537.49
Technical infrastructure index of the work station	thousand PLN·employee <sup>-1</sup>	2354.83	472.80	443.00	441.10	1115.98

Statistical analysis of farms proved a positive average correlation between intensity of production organization and objectified labour inputs (fig. 2). Coefficient of correlation  $r = 0.52$  shows, acc. to the scale by Stanisiz (1998), average relation between these variables. The calculated coefficient of determination  $R^2$  informs on explaining by the variable intensity of production organization 26.71% of the objectified labour inputs.

The statistical analysis, which was carried out proved a positive weak correlation between the intensity of production organization and human labour inputs expressed in man-hour·ha<sup>-1</sup> AL. Coefficient of correlation was  $r = 0.33$ .

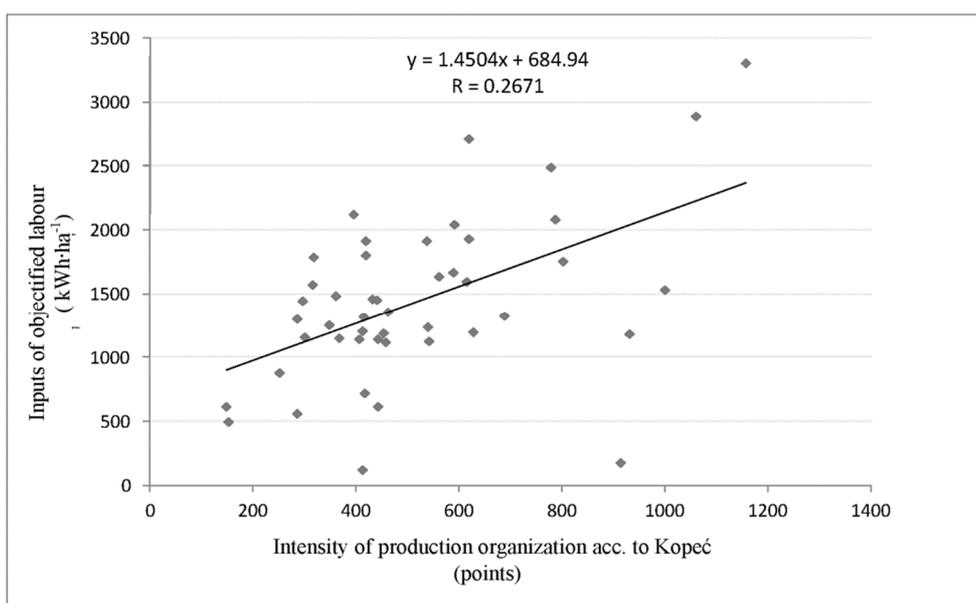


Figure 2. Impact of changes of intensity of production organization on the objectified labour inputs

## Conclusion

The analysis which was carried out proved that along with the increase of the intensity of production organization the number of physical workers increases in farms with simultaneous decrease of AL area.

The investigated farms featured quite variable size of participation of capital calculated into the replacement value of mechanization means per a hectare of agricultural land. Taking into account the replacement value, it may be stated that farms with intensity to 300 points farming on big areas show almost 1.5 times higher participation of capital in technical mechanization means.

Farms with intensity to 300 points but with bigger area at comparable employment of natural persons proved the highest index of technical infrastructure, referred to three

remaining, which was 1173.69 PLN-man-hour<sup>-1</sup> and 2354.83 thousand PLN per an employee but the highest level of work load (1930.61 man-hour per a farm per a year).

A positive average correlation between intensity of organization intensity and objectified work inputs and a weak correlation between intensity of production organization and human work inputs were determined.

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## INTENSYWNOŚĆ ORGANIZACJI PRODUKCJI A CZYNNIK PRACY W GOSPODARSTWACH RODZINNYCH

**Streszczenie.** W pracy przedstawiono poziom ponoszonych nakładów pracy i wyposażenia w środki produkcji występujące w 46 gospodarstwach rodzinnych zestawionych wg intensywności organizacji produkcji. Uzyskane wyniki przedstawiono metodą tabelaryczno-opisową. Przeprowadzona analiza wykazała, że wraz ze wzrostem intensywności organizacji produkcji wzrasta liczba pracowników fizycznych w gospodarstwach z jednoczesnym spadkiem powierzchni UR. Badane gospodarstwa charakteryzowała się dość zmienną wielkością zaangażowania kapitału w przeliczeniu na wartość odtworzeniową środków mechanizacji, przypadającą na hektar użytków rolnych. Stwierdzono dodatnią przeciętną korelację między intensywnością organizacji produkcji a nakładami pracy uprzedmiotowionej oraz słabą korelację między intensywnością organizacji produkcji a nakładami pracy ludzkiej.

**Słowa kluczowe:** intensywność organizacji produkcji, czynnik pracy, praca uprzedmiotowiona, gospodarstwa rodzinne