

REGIONAL STRUCTURE OF TRACTOR MARKET IN POLAND

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ABSTRACT

There are ca 1,492 thousand tractors currently used in Poland, with the average power of 45.3 kW. There are 9.8 ha of agricultural land per one tractor, their average age is ca 25 years and the degree of wear 77%. There are between 20 to 30 thousand tractors newly registered per year, however, these are both new and used tractors imported from abroad. These new registrations, which also reflect new purchases, are diverse depending on the region. Based on the 2018 records of the Central Register of Vehicles and Drivers (CEPiK), the paper establishes essential parameters of the registered tractors, such as price, power, age, depending on the region. There were 25,422 records under analysis, as some of the original records were dismissed as errors after verification. It was established that in the western part of Poland, with farms twice or three times bigger than in the rest of the country, the purchased tractors were characterized by higher power and lower age and, consequently, higher prices (81-95 kW, 14-18 years, PLN168-186 thousands). In contrast, the tractors in south-east Poland, where the dominant farms are of agricultural land below 10 ha, had worse parameters (76-86 kW, 14-18 years, PLN76-86 thousands).

Introduction

Tractors are fundamental technical equipment in almost all farms in Poland. The agricultural land distribution in Poland is quite problematic; out of a total 1,498 thousand number of farms with an average agricultural area of 9.83 ha, only some 352 thousand are bigger than 10 ha. It is estimated that approximately 700 thousand produces only for their own use (self-production). Only 300 to 400 thousand are commercial farms. Those farms use 1,492 thousand agricultural tractors, with the average power 45.3 kW which increased from 2005 by 6 kW. On average, there is 9.8 ha per one tractor (Rocznik ..., 2020). The means of production are diverse, depending on the region, the size of the farm and the agricultural conditions (Lorencowicz and Uziak, 2018). Wear of capital goods, including tractors, is at the level of 77%, indicating the high level of machines' deterioration. It is worth noting that between 2005 and 2016, the number of tractors increased by 54,500 units. Although, from 2004,

the year of Poland's accession into European Union, the purchases of new tractors vary between seven to several thousand a year, the yearly increase is lower, as several machines are eliminated due to their conditions. The current level of purchases does not allow for restitution of the park machinery, as the yearly level of replacement is below 1%. However, considering only the tractors of higher power working in commercial farms, the average rate of replacement remains at the level of 3-4%. The above means that the most of tractors are used for longer than 20 years (the average age of 25 years), and tractors of even 40 years are still in operation. Hence, the Polish tractors' market is still potentially high as assuming the rate of replacement of 3% and ca 1 million number of units, the purchases should be at the level of ca 30 thousand units per year.

The current attempts to define regional differences in the agricultural tractor market in Poland based on the fundamental farm's characteristics. The analysis is based on data from 2018.

Methods and Materials

The detailed data regarding agricultural tractors registration for 2018 were obtained from the Central Register of Vehicles and Drivers (CEPiK, 2019) and from the Polish Chamber of Commerce of Agricultural Machines and Facilities (PIGMiUR) (Sprzedaż... 2019).

The data contained information on tractors registered in Poland for the first time in 2018 and encompasses both new machines as well as used ones, imported from abroad. The data analysed covered the brand, year of production, power (in kW), number of units and the registration location (voivodeships). Data was analysed using Excel spreadsheet. Tractors manufactured in 2016, 2017 and 2018 were considered as new (0-2 years old), according to methodology used by (PIGMiUR) (Sprzedaż... 2019). There were 26,509 agricultural tractors registered in 2018. However, detailed verification revealed lack of the tractor power in the records or other errors. Therefore, those records were removed, and the analysis was done for 25,422 registered tractors, i.e. 95.9% of the total population.

Tractors were grouped according to power and age. However, they were also grouped depending on technological and design advancement into two groups (Renius, 2020). Tractors of level I, II and III, were called 'Eastern', whereas those of level IV and V, as 'Western'. Units of more than 50 years old, manufactured by historical and not existing producers, were classified as vintage or collectors' items. Such tractors were imported to Poland by hobbyists interested in history of technology.

The prices of the tractors were determined based on the average prices of different models and brands depending on their power, verified on companies' websites and portals and previous investigations (Dyguś, 2020; Kalińska, 2014; Lorencowicz, 2014, Lorencowicz, 2016; Lorencowicz and Figurski, 2009; Rycerz, 2015).

In 2018, out of 25,422 tractors registrations considered in the analysis, there were 9,523 new tractors (37.5%), with 7,034 Western brands and 2,489 Eastern brands (Table 1). There were much more used tractors registered with 15,899 units (62.5%), with 10,434 Western and 5,465 Eastern brands.

Regional structure...

Table 1.
Regional distribution of tractors registration in 2018 (units)

Voivodeship	Western New	Western Used	Eastern New	Eastern Used	Total	Share %
Dolnośląskie	345	371	57	183	956	3.8%
Kujawsko -Pomorskie	551	910	109	315	1,885	7.4%
Lubelskie	587	1,349	255	817	3,008	11.8%
Lubuskie	127	96	38	43	304	1.2%
Łódzkie	591	797	122	390	1,900	7.5%
Małopolskie	351	544	152	441	1,488	5.9%
Mazowieckie	1,360	1,604	437	929	4,330	17.0%
Opolskie	182	241	24	61	508	2.0%
Podkarpackie	171	408	111	372	1,062	4.2%
Podlaskie	608	1,142	555	519	2,824	11.1%
Pomorskie	305	423	77	280	1,085	4.3%
Śląskie	223	233	79	151	686	2.7%
Świętokrzyskie	284	400	77	240	1,001	3.9%
Warmińsko- Mazurskie	412	363	82	137	994	3.9%
Wielkopolskie	712	1,362	204	516	2,794	11.0%
Zachodniopo- morskie	225	191	110	71	597	2.3%
Total (units)	7,034	10,434	2,489	5,465	25,422	100.0%
Share %	27.7%	41.0%	9.8%	21.5%	100.0%	x

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

When considering the power of the tractors, which is one of their parameters indicating quality of the purchased units, the most number of tractors, 6,501, were of power 61-80 kW, with the next power bracket of 81-100 kW, having 4,082 units (Table 2).

The average power of tractors registered in 2018 was 81.0 kW but varied depending on the manufacturer (technical quality) and place of purchase. In case of, Western tractors, the average power was 92.3 kW, whereas for Eastern brands, it was much lower at 56.5 kW.

Table 2.
Power distribution of tractors registered in 2018 (units)

Power bracket (kW)	Western New	Western Used	Eastern New	Eastern Used	Total	Share %
Below 15	53	43	171	62	329	1.3%
16-25	70	80	58	350	558	2.2%
26-40	509	423	352	926	2,210	8.7%
41-60	1,249	1,685	858	1,867	5,659	22.3%
61-80	1,719	2,736	738	1,308	6,501	25.6%
81-100	1,038	2,215	254	575	4,082	16.1%
101-125	914	1,605	41	298	2,858	11.2%
126-150	640	737	0	61	1,438	5.7%
151-175	317	414	11	3	745	2.9%
176-200	278	203	2	4	487	1.9%

Power bracket (kW)	Western New	Western Used	Eastern New	Eastern Used	Total	Share %
201-225	58	114	0	0	172	0.7%
Above 225	189	179	4	11	383	1.5%
Total (units)	7,034	10,434	2,489	5,465	25,422	100.0%
Average power (kW)	92.3	90.8	56.5	58.7	81.0	x

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

The age of the tractor is one of the fundamental parameters indicating its wear. Failure rate as well as reduction in the operating parameters are related to the tractor age. To that extend, there were only 7,034 units (27.7%) of new Western tractors (in the range from 0 to 2-year old), with used ones at the 10,434 units (41.0%), additionally with 414 units, which can be considered as collectors' items (vintage tractors). Within Eastern tractors group, out of the total 7,954 items, only 2,489 were new (9.8%) and 5,465 – used (21.5%). In the used tractors group, the most tractors were of 21-25 years – 2,954 units, 16-20 years – 2,941, and above 30 years old – 2,885 (Table 3).

Table 3.

Age distribution of tractors registered in 2018 (units)

Age (years)	Western	Eastern	Total	Share
New (0-2 years)	7,034	2,489	9,523	37.5%
Used	10,434	5,465	15,899	62.5%
including:				
3-5 years	1,312	114	1,426	5.6%
6-10 years	1,521	108	1,629	6.4%
11-15 years	1,161	317	1,478	5.8%
16-20 years	2,158	783	2,941	11.6%
21-25 years	2,154	800	2,954	11.6%
26-30 years	1,610	976	2,586	10.2%
above 30 years	518	2,367	2,885	11.3%
Total	17,468	7,954	25,422	100%
Share %	68.7%	31.3%	100%	x
Average age	10.7	18.7	13.2	x

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

In general, there were much more Western than Eastern used tractors registered, and in the average age of the Western group (18.3 years) was much lower than that of the Eastern group (25.3 years). However, the age, as well as the number of registered tractors, varied regionally.

Regional variation of power and age of the tractors

The average power of an agricultural tractor registered in Poland in 2018 was 81.0 kW. However, there was a clear regional variation, depending on the voivodeship (Fig. 1). Tractors with the lower power were registered in the southern and central parts of the country. The lowest average power was recorded in Śląskie voivodeship – 36.8 kW. The most popular tractors in the eastern and central part of Poland, had the power from 41 kW to 60 kW.

Regional structure...

Whereas in the western and northern parts, the power increased, and those above 80 kW were registered in Dolnośląskie, Lubuskie and Opolskie.

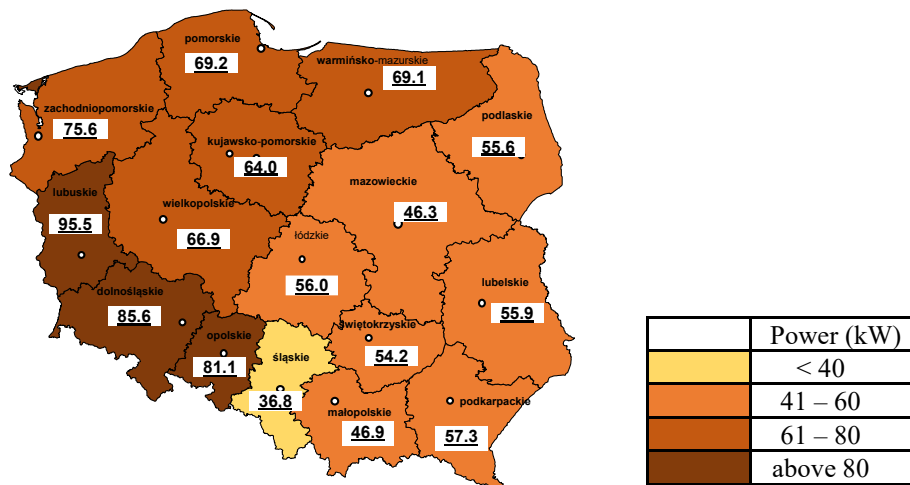


Figure 1. Regional distribution of registered tractors depending on power

Source: Self-analysis based on Fedoruk, 2020

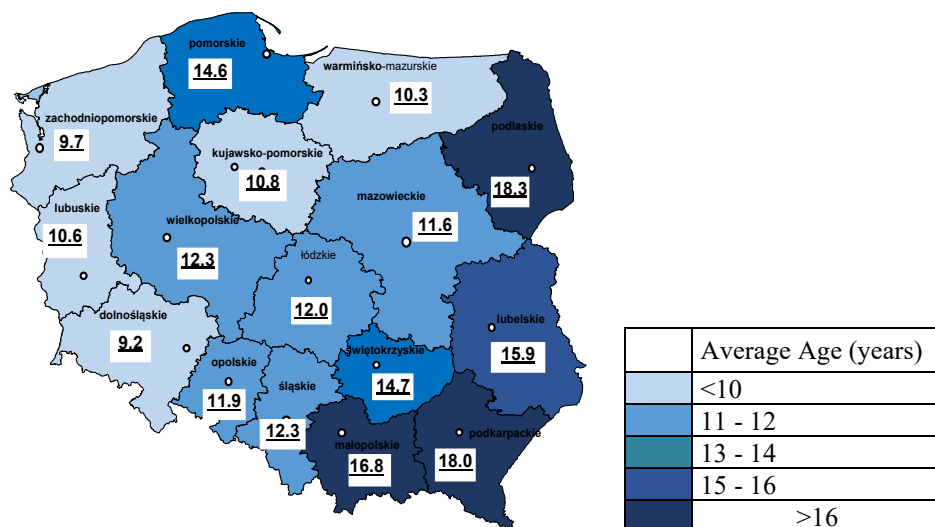


Figure 2. Regional distribution of registered tractors depending on age

Source: Self-analysis based on Fedoruk, 2020

Similarly, the age of tractors registered in 2018 varied depending on the region (Fig. 2). The average age for the whole country was 13.2 years, with the newest recorded in Dolnośląskie (9.2 years) and Zachodniopomorskie (9.7 years) voivodeships. Tractors registered in Central Poland were on average 10 to 12 years old. The oldest units were recorded in Podkarpackie and Podlaskie voivodeships, average ages of 18.0 and 18.3 years, respectively.

Regional variation of tractors value

The total market value of tractors registered in Poland in 2018 was PLN 3,035,318 thousand, with new and used tractors, respectively 2,015,351 (66.4%) and 1,019,968 (33.6%) – in PLN thousands (Table 4). The Western group dictated the market value of the tractors, having a higher value than the Eastern group for both new and used units. Tractors classified as the Western group had the total value of PLN 2,646,128 thousand (87.2% of all total value), whereas the Eastern group PLN 389,190 thousand (only 12.8%). By value, the majority of the Western group tractors were new ones; PLN 1,746,114 thousand (57.5%). In the Eastern group, the new tractors had a value of PLN 269,237 thousand, which constitutes only 8.9% of the total purchases of that group.

Within the new tractors, the majority were Western ones with the value of PLN 1,746,114 thousand (86.6% of all new tractors), with Eastern tractors value of PLN 269,237 thousand (only 13.4% of all new tractors).

The Western tractors had the highest value of PLN 318,986 thousand for the power bracket 101-125 kW, and the lowest value of PLN 1,961 thousand for tractors below 15 kW of power. For Eastern tractors, the highest value (PLN 96,069 thousand) was achieved for tractors of 41-60 kW, and the lowest (PLN 2,436 thousand) for 16-25 kW group.

The total value of the used tractors registered in 2018 was PLN 1,019,968 thousand, with a great advantage of Western tractors (PLN 900,014 thousand – 88.2%) over Eastern tractors (PLN 119,953 thousand – 11.8%). Similar to new tractors, the highest value for the Western group achieved tractors of power 101-125 kW, and the lowest for power below 15 kW. Within Eastern tractors, the highest value of PLN 35,635 thousand was achieved for power 61-80.

Regarding regional distribution, the highest values of Western tractors were recorded in Mazowieckie and Wielkopolskie voivodeships, whereas Eastern tractors dominated in Podlaskie.

Table 4.

Market value of tractors registered in 2018 by Voivodeship (in PLN thousands)

Voivodeship	Western New	Western Used	Eastern New	Eastern Used	Total	Share %
Dolnośląskie	112,526	44,354	5,624	3,720	166,224	5.50%
Kujawsko-Pomorskie	154,997	87,315	12,484	6,710	261,506	8.60%
Lubelskie	123,413	90,131	28,014	16,299	257,857	8.50%
Lubuskie	37,587	11,714	3,532	897	53,730	1.80%
Łódzkie	124,303	60,008	13,359	9,889	207,559	6.80%
Małopolskie	64,675	26,952	14,744	7,452	113,823	3.70%
Mazowieckie	284,769	124,440	37,389	23,173	469,771	15.50%

Regional structure...

Voivodeship	Western New	Western Used	Eastern New	Eastern Used	Total	Share %
Opolskie	54,489	26,604	3,034	1,152	85,279	2.80%
Podkarpackie	40,143	27,005	10,953	6,055	84,156	2.80%
Podlaskie	154,237	104,751	70,058	13,268	342,314	11.30%
Pomorskie	84,060	41,345	8,016	5,556	138,977	4.60%
Śląskie	56,544	22,312	7,987	3,944	90,787	3.00%
Świętokrzyskie	56,013	21,870	7,927	4,687	90,497	3.00%
Warmińsko-Mazurskie	121,918	39,913	9,505	3,116	174,452	5.70%
Wielkopolskie	200,037	145,382	22,991	12,757	381,167	12.60%
Zachodniopomorskie	76,403	25,919	13,620	1,277	117,219	3.90%
Total	1,746,114	900,015	269,237	119,952	3,035,318	100.00%
Share %	57.50%	29.70%	8.90%	4.00%	100.00%	x

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

By age, out of the used tractors, the Western group was much younger, with the highest value of PLN 295,666 thousand for the age range of 6-10 years, whereas Eastern tractors were much older, with the highest value of PLN 31,173 thousand for the age group 16-20 years. In general, Eastern brands had a higher value than the Western ones for older.

There is a big difference between the average value of the Western group tractors and Eastern group (Table 5). Within new units, the average value (price) of the Western group was PLN 248.2 thousand, whereas those of the Eastern group amounted to PLN 108 thousand. Typically, the average value of Western units is double in comparison to those of the Eastern group. The lowest values were associated with tractors over 30 years old, with that value for Western group at the level of PLN 12 thousand and for the Eastern group – PLN 9 thousand.

The average value of new tractors varied depending on the location (Table 5). The highest value of the average value of the new tractors occurred in Dolnośląskie voivodeship – PLN 294 thousand, which was followed by Opolskie – 279, Zachodniopomorskie – 269 and Warmińsko-Mazurskie – 266 – all in thousand PLN). In general, the highest average prices of the new tractors are in western Poland and in Warmińsko-Mazurskie district, whereas the lowest prices are in the belt from Malopolska to Mazowsze.

Table 5.

Average value of tractors registered in 2018 by Voivodeship (in PLN thousands)

Voivodeship	Western New	Western Used	Eastern New	Eastern Used	Total
Dolnośląskie	326.2	119.6	98.7	86.8	173.9
Kujawsko-Pomorskie	281.3	96	114.5	76.8	138.7
Lubelskie	210.2	66.8	109.9	49.1	85.7
Lubuskie	296	122	92.9	90.7	176.7
Łódzkie	210.3	75.3	109.5	58.9	109.2

Voivodeship	Western New	Western Used	Eastern New	Eastern Used	Total
Małopolskie	184.3	49.5	97	34.9	76.5
Mazowieckie	209.4	77.6	85.6	58.3	108.5
Opolskie	299.4	110.4	126.4	91.9	167.9
Podkarpackie	234.8	66.2	98.7	42.4	79.2
Podlaskie	253.7	91.7	126.2	71.1	121.2
Pomorskie	275.6	97.7	104.1	66.7	128.1
Śląskie	253.6	95.8	101.1	68.4	132.3
Świętokrzyskie	197.2	54.7	102.9	41.5	90.4
Warmińsko-Mazurskie	295.9	110	115.9	86.1	175.5
Wielkopolskie	281	106.7	112.7	84.2	136.4
Zachodniopomorskie	339.6	135.7	123.8	103.8	196.3
Average	248.2	86.3	108.2	64.2	119.4

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

The variation of the average value of tractors registered in 2018, depending on the region, is shown in Fig. 3. In general, the average price for the Western tractors is higher than those of Eastern, sometimes it is even a double.

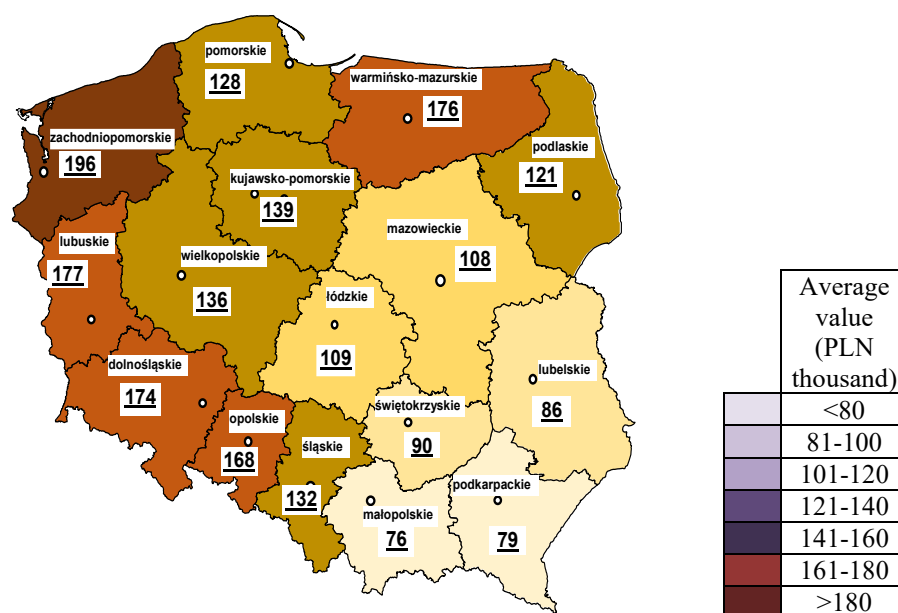


Figure 3. Average value of tractors by voivodeship

Source: Self-analysis based on Bolewska, 2020

In the south-western part of Poland, in Lubuskie, Dolnośląskie and Opolskie voivodships the average price is from PLN 160 to 180 thousand. The highest average price of the tractors (PLN 196 thousand) was observed in Zachodniopomorskie.

Tractors power, value, and age vs farms sizes in different regions

The analysis indicated a relationship between the average size of the farm in voivodships and tractors parameters such as average power, age, and price. There is a positive correlation between the average farm size and the purchased tractors' power, meaning increasing power with the increase in the farm size (Fig. 4).

A similar trend is observed in case of prices of tractors (Fig. 5). The prices in the range of PLN 170 thousand were noted in Warmińsko-Mazurskie, Lubuskie, Opolskie, and Dolnośląskie voivodships. The lowest average values, between PLN 76 and 79 thousand were reported in Podkarpackie and Małopolskie. In case of used tractors, the highest price of PLN 103.8 thousand was discovered in Zachodniopomorskie. Regions such as Małoposka and Podkarpacie, with smallest farms, purchased tractors of the lowest values, PLN 34.9 – 42.3 thousand.

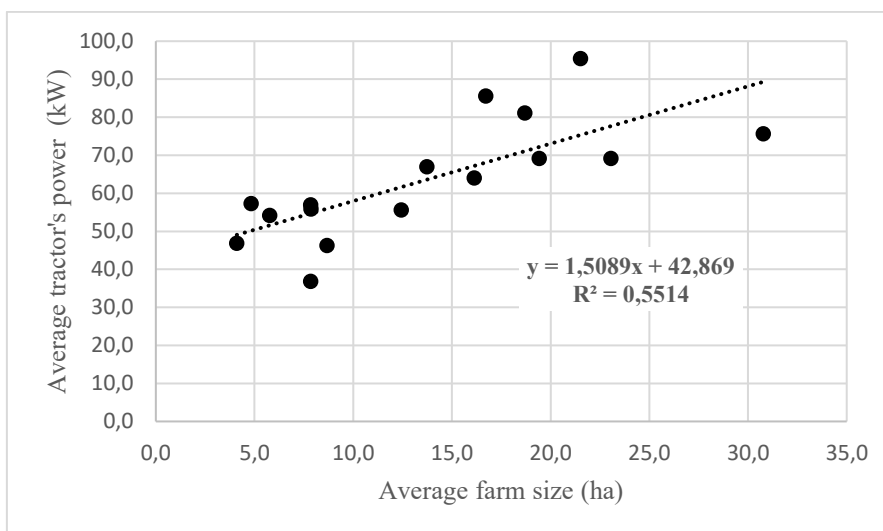


Figure 4. Relationship between average power of registered tractors and average farm size

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

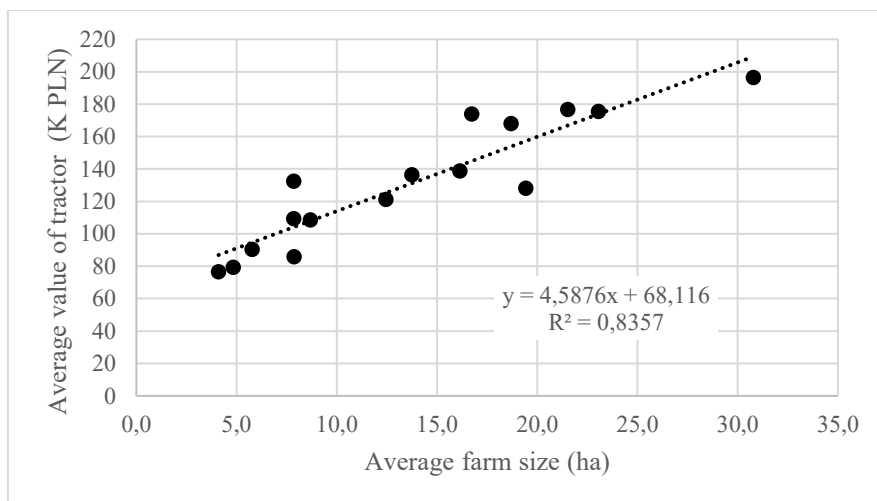


Figure 5. Relationship between average value of registered tractors and average farm size

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

There is no clear relationship between the age of tractors and the average farm size, as indicated in Fig. 6.

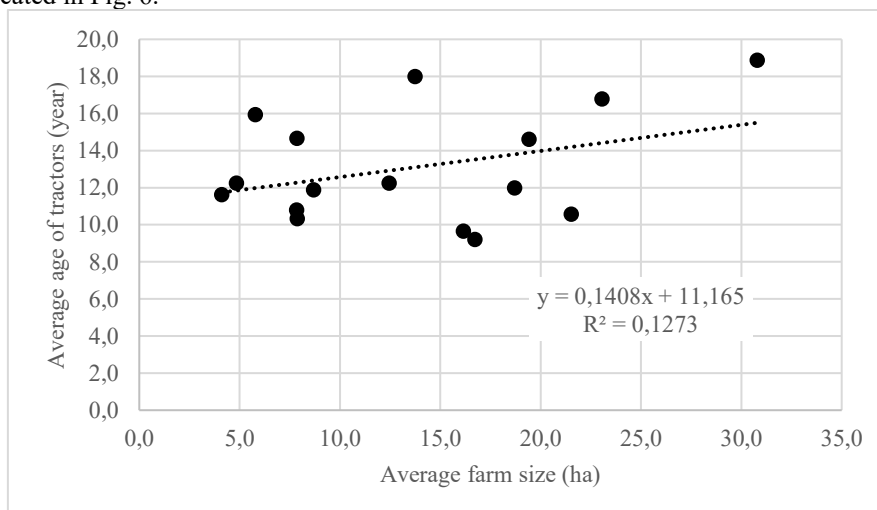


Figure 6. Relationship between average age of registered tractors and average farm size

Source: Self-analysis based on Sprzedaż..., 2019; Bolewska, 2020; Fedoruk, 2020

Conclusions

Purchase decision of farmers regarding tractors has many factors. Farmers consider not only the price of the unit but also its technical parameters as well as the tractor brand (Grisso et al., 2014; Georgantzis and Sabater-Grande, 2002; Walley et al., 2007). The analysis performed in this research proved a big variety of the tractors' market in Poland, however, it confirmed previously reported trends and tendencies (Lorencowicz and Pawelec, 2012; Pawelec, 2011). Regional variation of the tractors market is similar to that of general equipping of Polish agriculture in tractors (Zalewski, 2017; Rudnicki et al., 2016; Lorencowicz, 2013). Since the western and northern voivodships are characterized by larger farms, they consequently require tractors of a higher power, and therefore higher prices. Moreover, farms in those regions have bigger income but also bigger opportunity of acquiring EU funding. Both of those factors allow farmers from those areas to purchase tractors of better technical parameters, mainly higher power. Farmers from southern and eastern Poland, where the farms are smaller, have very limited investment outlays. Therefore, they are more likely to purchase used tractors and units of lower power.

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REGIONALNA STRUKTURA RYNKU CIĄGNIKÓW W POLSCE

Streszczenie. Obecnie w Polsce używanych jest około 1 492 000 ciągników ze średnią mocą 45,3 kW. Na jeden ciągnik przypada 9,8 ha użytków rolnych, ich średni wiek wynosi 25 lat a stopień zużycia 77%. W ciągu roku rejestrowanych jest pomiędzy 20 a 30 tysięcy traktorów, jednakże są to zarówno nowe i używane traktory przywiezione z zagranicy. Te nowe rejestracje, które odzwierciedlają także nowo zakupione ciągniki są zróżnicowane w zależności od regionu. Na podstawie rejestrów wpisanych do Centralnej Ewidencji Pojazdów i Kierowców (CEPiK), niniejszy artykuł określa istotne parametry zarejestrowanych ciągników, takich jak cena, moc, wiek w zależności od regionu. Analizie poddano 25 422 rejestry, ponieważ po weryfikacji część z oryginalnych wpisów zostało odrzuconych jako błędne. Ustalono, że w zachodniej części Polski, gdzie gospodarstwa są dwa lub trzy razy większe niż w pozostałej części kraju, zakupione traktory charakteryzowały się dużą mocą i młodszym wiekiem a w konsekwencji wyższymi cenami (81-95 kW, 14-18 lat, 168-186 tysięcy zł). Przeciwnie, ciągniki w południowo-wschodniej Polsce, gdzie przodujące gospodarstwa posiadały użytki rolne poniżej 10 ha, miały gorsze parametry (76-86 kW, 14-18 lat, 76-86 tysięcy).

Słowa kluczowe: rynek ciągników, wyposażenie techniczne w rolnictwie, różnice regionalne