

AN ANALYSIS OF THE NEW TRACTORS DISTRIBUTION LOGISTICS IN THE ASPECT OF THE EUROPEAN UNION PROGRAMMES FOR SUPPORTING AGRICULTURE MODERNIZATION

ANALIZA LOGISTYKI DYSTRYBUCJI NOWYCH CIĄGNIKÓW W ASPEKCIE PROGRAMÓW UNII EUROPEJSKIEJ WSPIERAJĄCYCH MODERNIZACJĘ ROLNICTWA

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ABSTRACT

The present article contains an analysis of issues concerning logistics of agricultural tractors distribution. Programmes and the level of utilization of means from Structural Funds of the European Union for modernization of equipment of agricultural farms in Poland have been presented. Structure of agricultural tractors market in Poland and the issues on domestic selective distribution of leading producers of agricultural tractors have been characterized. The achieved results of research on the sales level of agricultural tractors have been presented. The research has been carried out at the Trade Department of the authorized distributor of tractors and agricultural machines. The research cycle covered the years 2003-2010. The research results have been statistically prepared using the R programme for Windows (version 2.14.1) and defining trend, random fluctuations and seasonal fluctuations. The time schedules of sales were analysed in the aspect of subsidizing purchases from the Structural Funds of the European Union and the agritechnical procedures calendar.

Key-words: agricultural tractors distribution, distribution logistics, modernization of equipment of agricultural farms, Structural Funds of the European Union

STRESZCZENIE

W artykule zaprezentowano analizę zagadnień dotyczących logistyki dystrybucji ciągników rolniczych. Przedstawiono programy i poziom wykorzystania środków z Funduszy Strukturalnych Unii Europejskiej na modernizację wyposażenia gospodarstw rolniczych w Polsce. Scharakteryzowano strukturę rynku ciągników rolniczych w Polsce oraz zagadnienia krajowej dystrybucji selektywnej wiodących producentów ciągników rolniczych. Zaprezentowano uzyskane wyniki badań

poziomu ilościowego sprzedaży ciągników rolniczych. Badania zrealizowano w Dziale Handlowym autoryzowanego dystrybutora ciągników i maszyn rolniczych. Cykl badań obejmował lata 2003-2010. Wyniki badań opracowano statystycznie przy wykorzystaniu programu R wersja 2.14.1 dla Windows, wyznaczając trend, wahania przypadkowe i wahania sezonowe. Rozkłady czasowe sprzedaży poddano analizie w aspekcie dofinansowania zakupów z Funduszy Strukturalnych Unii Europejskiej i kalendarza zabiegów agrotechnicznych.

Słowa kluczowe: dystrybucja ciągników rolniczych, logistyka dystrybucji, modernizacją wyposażenia gospodarstw rolniczych, Fundusze Strukturalne Unii Europejskiej

STRESZCZENIE SZCZEGÓŁOWE

Na przestrzeni ostatniej dekady logistyka dystrybucji nowych ciągników rolniczych w Polsce, dostosowana została do zmieniających się potrzeb restrukturyzowanych obszarów wiejskich. Przeprowadzono analizę struktury rynku ciągników rolniczych w Polsce oraz analizę programów Unii Europejskiej finansujących modernizację gospodarstw rolniczych w latach 2003-2010. Zbadano i poddano analizie strukturę krajowych systemów dystrybucji selektywnej ciągników wiodących producentów. Na ostatnim etapie przygotowań do członkostwa w Unii Europejskiej, powszechny spis rolny przeprowadzony w Polsce w 2002 r. potwierdził, że rolnicy użytkują 1338,7 tys. ciągników, a statystyczny reprezentant tej grupy pojazdów miał 22 lata. Powszechny spis rolny przeprowadzony w 2010 r., wykazał użytkowanie na terenie Polski 1466,3 tys. ciągników rolniczych (Tabela 1). W 2007 r. jedynie co trzeci sprzedawany ciągnik był nowy, natomiast w 2010 r. pojazdy fabrycznie nowe stanowiły już połowę kupowanych w Polsce. Specjalny Przedakcesyjny Program Rozwoju Obszarów Wiejskich (SAPARD) utworzony w celu pomocy krajom starającym się o członkostwo w UE otrzymał budżet w wysokości 1084 mln euro (4795 mln zł). Dopłaty dla beneficjentów zrealizowano w latach 2005 i 2006, a elementem dominującym w umowach był zakup nowych ciągników rolniczych. Wstąpienie Polski do Unii Europejskiej oznaczało konieczność wzrostu stawki podatku VAT z 0% do 22% na pojazdy i maszyny rolnicze. W latach 2004-2006 instrumenty polityki rolnej były realizowane w Polsce w ramach Narodowego Planu Rozwoju. Jednym z działań był Sektorowy Program Operacyjny (SPO). Ogółem na potrzeby rolników przeznaczono 1784 mln euro ze środków UE i budżetu krajowego. Kolejnym działaniem jest Program Rozwoju Obszarów Wiejskich (PROW) na lata 2007-2013. Środki finansowe na realizację całego programu przekraczają 17 mld euro (70 mld zł). W okresie od 2007 r. do listopada 2011 r. w ramach tej grupy środków rolnicy zakupili 19394 ciągniki rolnicze. W warunkach polskich struktura firm dealerskich odzwierciedla zróżnicowanie ilości gospodarstw i ich wielkość w poszczególnych województwach (Tabela 2 i 3). Generalną zasadą jest to, że marki producentów krajowych: PRONAR, POL-MOT/URSUS, FARMTRAC i FARMER oraz ciągniki w niższej klasie cenowej: ZETOR i BELARUS mają sieć sprzedaży z większą ilością autoryzowanych firm dealerskich. Zagęszczenie punktów sprzedaży waha się od kilku do nawet kilkunastu firm na terenie jednego województwa. Koncerny amerykańskie JOHN DEERE i CLAAS oraz europejskie Same, Deutz Fahr, Lamborghini, FENDT i Massey Ferguson zastosowały koncepcję sieci sprzedaży, która standardowo na terenie województwa posiada jednego lub dwóch przedstawicieli. Potencjalny nabywca ma obecnie do dyspozycji zróżnicowaną

cenowo ofertę rynkową ponad 450 modeli o mocy 18-400 kW wytwarzanych przez producentów krajowych i zagranicznych (Tabela 4). Badania w latach 2003-2010 objęły strukturę sprzedaży ogółem 1012 szt. fabrycznie nowych ciągników rolniczych (Rys. 1). Wybrane do przedsiębiorstwo prowadzi od 25 lat działalność dystrybucyjną i serwisową na obszarze Polski środkowo-wschodniej. Analizę statystyczną szeregu czasowego, którym jest ilość sprzedanych ciągników, przeprowadzono w celu określenie charakteru badanego zjawiska. Sprzedaż w sektorze pojazdów rolniczych w badanym okresie obejmowała marki: JOHN DEERE, ZETOR, Same Deutz Fahr Group (SDFG) oraz PRONAR. Struktura sprzedaży nowych ciągników rolniczych w Polsce charakteryzowała się zmiennością popytu (Rys. 2). Występowały duże różnice w ilości sprzedanych pojazdów na przestrzeni poszczególnych miesięcy w kolejnych latach. Zmienny był również popyt przy porównaniu kolejnych rocznych wyników sprzedaży dla okresu objętego badaniem. Na przełomie lat 2003 i 2004 wystąpił trend rosnący, wymuszony zbliżającą się akcesją (Rys. 3). Wzrost stawki podatku VAT zakończył okres bardzo wysokiego popytu. Przez cały 2005 r. i okresowo w 2006 r. był trend rosnący dla sprzedaży ciągników rolniczych z powodu wypłat z programu SAPARD. Trend malejący w 2007 r. był zbieżny w czasie z brakiem wypłat z funduszy unijnych. Kolejne transze wypłat w ramach Programu Rozwoju Obszarów Wiejskich (PROW) powodowały trend okresowo rosnący w latach 2008-2010. Sprzedaż nowych ciągników uzyskała dzięki dopłatom unijnym poziom najwyższy od momentu akcesji Polski do Unii Europejskiej. Niejednorodność struktury popytu na przestrzeni kolejnych miesięcy w latach 2003-2010 pokazują wahania przypadkowe. Wysokim wzrostem sprzedaży w poszczególnych miesiącach roku towarzyszyły spadki popytu do poziomu minimalnego w kolejnych okresach, co było zjawiskiem niekorzystnym dla funkcjonowania logistyki dystrybucji (Rys. 4). Badania rynku potwierdziły, że uruchamianie kolejnych transzy dopłat przez Agencję Restrukturyzacji i Modernizacji Rolnictwa powodowało skokowy wzrost sprzedaży. Zmienna wartość indeksów sezonowych na przestrzeni roku kalendarzowego, obrazuje wpływ prac i zabiegów agrotechnicznych na cykliczność zmian popytu na ciągniki rolnicze. Początek roku, gdy nie są wykonywane polowe zabiegi agrotechniczne, posiadał sprzedaż niższą od poziomu odniesienia o 52,9%. Sezon wiosennych prac polowych znajduje odbicie w radykalnym wzroście popytu na ciągniki, który w kwietniu był wyższy od poziomu przeciętnego o 92,9%. Po zakończeniu prac w miesiącu maju następowało obniżenie poziomu sprzedaży. Wyższy popyt występował przed rozpoczęciem sezonu żniwnego, a obniżony w czasie zbioru plonów. Sezonowy wzrost poziomu sprzedaży występował także pod koniec roku, ale był on nadal niższy od poziomu odniesienia. Modernizacja gospodarstw, prowadzona przy powszechnym wykorzystaniu funduszy z Unii Europejskiej, wpłynęła po kilku latach na zmianę potrzeb i oczekiwań części rolników. Dofinansowanie zakupu na poziomie 50% spowodowało wzrost zainteresowania modelami ciągników o wyższej mocy i bogatym wyposażeniu.

INTRODUCTION

Over a span of the recent decade the distribution of new agricultural tractors in Poland has been adapted to constantly changing needs of restructured rural areas. The purchase of new tractors was a priority when investing in modernization of technical equipment of rural farms. Agricultural tractors are a main source of driving

power and traction energy of machine and device towed weight during both plant and animal production (Dreszer, et al., 2008; Dulcet, et al., 2005; Karczmarczyk, 2005).

The increase in the pace of integration processes at the end of the 20th century, both in European and global aspects, has included Poland in the field of interest of barons of agricultural machines industry. The logistic of distribution of tractors, which are almost 50% of the world's production of agricultural machines, is a primary task for each and every producer (Lorencowicz, 2011).

The qualitative, quantitative and age structure of the market of exploited vehicles in Poland was a challenge for logistic distribution systems of producers of individual brands of tractors. This problem should be considered particularly in the aspect of meeting the demand stimulated by means from the Structural Funds of the European Union. As a new ready market, Poland requested forming proper structures in distribution chains of enterprise. The chain of authorized dealer shops was created and expanded by producers so that the agricultural tractors could be offered via selective distribution (Lorencowicz and Kita, 2010).

The model of actions executed in accordance with the rules of selective distribution allows to make contact with selected group of receivers and present wide offer optimally adjusted to needs, requirements and expectations of future purchasers (Ciesielski and Długosz, 2010; Christopher and Peck, 2005; Coyle, et al., 2003; Kuboń, 2007a).

The sales organization should encompass an analysis of the type and structure of goods delivery to future purchasers via a company or authorized dealer chain. The key issue for logistics is the creation of distribution channels having desired spatial structure and flow capacity (Hodczak-Sekulska and Redmer, 2010a, 2010b). The proper organization of these processes allows acquiring property rights to goods and provides instant reception and exploitation of purchased agricultural vehicles. The management of logistics of selective distribution is oriented to permanent reduction of total sales costs in order to increase the price competitiveness of agricultural tractors in respective power segments (Cyplik, et al., 2008; Juściński and Piekarski, 2008a, 2008c; Kuboń, 2007b; Tabor, 2001; Tabor and Kuboń, 2004).

Another standard within the frames of the distribution logistics is the technical service in the field of inspections and repairs of agricultural tractors and simultaneous protection of deliveries of spare parts and exploitative fluids. The effectiveness of these processes is increased through the use of the outsourcing method in the logistics management (Juściński, 2011; Juściński and Piekarski, 2010a, 2010b; Skudlarski, 2005; Tomczyk, 2009a, 2009b).

MATERIAL AND METHODS

The selective distribution preferred by producers of agricultural vehicles and machines requires dividing ready markets into fields, which size would ensure the desired level of demand for offered products (Grant, et al., 2006; Rutkowski, 2005). Because of the construction solutions used in agricultural tractors, the technological level and equipment are the market segment imposing high financial demands on potential users (Kuboń, 2008; Wajszczuk, 2006; Wajszczuk, et al., 2010; Wąsowicz, 2001)

Over a span of the recent decade, the directions and dynamics of changes on domestic sales market of agricultural tractors have depended on various factors.

Stimulating the demand with constantly changing conditions of financing of the machines and vehicles purchases was particularly important issue which should be encompassed in the process of management of distribution logistics. Means gained from consecutive programmes created within the frames of Structural Funds of the European Union enabled, among others, the modernization of technical equipment of farms, area-based and product surcharges and help for young farmers. Because of their size and time structure, the executed payouts of the subsidies on the purchase of machines were a factor that could affect the heterogeneity of the demand. Other forms of extortions were generated by the dependency of the level of works in farms on the calendar of agritechnical procedures (Dulcet, et al., 2005; Karczmarczyk, 2005).

An analysis of the structure of the agricultural tractors market in Poland and an analyses of the European Union programmes financing modernization of agricultural farms in the years 2003-2010 were carried out. The structure of the domestic tractor distribution systems for leading producers was examined and analysed.

The purpose of the work was also to carry out research on sales of new tractors. The subject of performed analyses was an authorized distributor of the leading brands of agricultural tractors on the Polish market. The selected trade and service enterprise has been running a service and distribution activity in Central and Eastern Poland for the last 25 years. During the research carried out in the years 2003-2010 the quantitative arrangement of sales of brand-new agricultural tractors was carried out. The statistical analysis of the demand was conducted in the aspect of the European Union restructuring programmes and cyclical seasonal changes.

STATISTICAL ANALYSES

The analysis of the Y_t time series, which stands for the number of sold tractors, was carried out in order to determine the character of the analysed phenomenon through time sequence of observations of random variables, i.e. determining the trend, random fluctuations and seasonal fluctuations. The technique based on centred moveable averages was used to level the time series. Because of the character of the analysed phenomena, i.e. agritechnical seasons over the span of the calendar year, the length of the moveable periods was set: $d = 1, 2 \dots 12$. The analysis of the phenomenon was carried out on the basis of a multiplicative model of the elements of the time series. Such a model can be presented as the following equation (1) (Aczel and Sounderpandian, 2008; Pułaska-Turyna, 2008):

$$Y_t = T_t \times S_t \times C_t \times I_t \quad (1)$$

where: Y_t – series value,
 T_t – series trend,
 S_t – seasonal fluctuations,
 C_t – cyclical fluctuations,
 I_t – random fluctuations.

Centred moveable averages for the consecutive Y_t levels have a form determined by the following formula (2):

$$\bar{y}_t^{(d)} = \frac{1}{d} \left(\frac{1}{2} y_{t-\frac{d}{2}} + \sum_{t-t_0}^{t+t_0} y_t + \frac{1}{2} y_{t+\frac{d}{2}} \right), \quad t_0 = \frac{d}{2} - 1 \quad (2)$$

The value of the seasonal indexes was isolated on the basis of the following interrelation (3):

$$O_i = \frac{1}{c} \left[\sum_{t=1}^c \frac{y_{t_i}}{\bar{y}_i^{(d)}} \right] \times 100WK^{(M)} \quad (3)$$

where: c – the number of the intermittence cycles

$WK^{(M)}$ - average multiplicative adjusting index for obtaining $\sum_{i=1}^{12} O_i = 1200$

The value of an average multiplicative adjusting index is described by the following interrelation (4):

$$WK^{(M)} = \frac{100 \times d}{\frac{1}{c} \sum_{t=1}^c \frac{y_{t_i}}{\bar{y}_i^{(d)}} \times 100} \quad (4)$$

Random fluctuations for a multiplicative series are shown by the following interrelation (5):

$$y_{t(skor)}^{(M)} = \frac{y_t}{O_i} \times 100 \quad (5)$$

The series trend was isolated using a five-period weighted average (6):

$$\hat{y}_t^{(M)} = \bar{y}_t^{(5)(M)} = \frac{1}{g} \sum_{t-2}^{t+2} y_{t(skor)}^{(M)} \times w_t \quad \text{for } [w_t] = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 2 \\ 1 \end{bmatrix} \quad (6)$$

The level of reference (average level) for seasonal indexes in respective months amounted to 100% and was a reference number when performing graphic analysis of the impact of seasonal fluctuations on the arrangement of the variables set. A statistical analysis of the research results was carried out using R programme for Windows (version 2.14.1) (Crawley, 2008; Walesiak and Gatnar, 2009).

RESULTS

AN ANALYSIS OF THE SIZE AND STRUCTURE OF AGRICULTURAL TRACTORS MARKET IN POLAND

During the final stage of preparations for membership in the European Union, the common agricultural register carried out in Poland in 2002 proved that farmers used 1,338,700 tractors. A statistical representative of this group of vehicles was 22 years old. According to the data of the Institute of Economics of Agriculture and Food Management, the domestic market of agricultural tractors at that time reached the sales level of 6,000 pieces a year. The size of the demand generated by domestic food producers drastically differed from the absorptive powers of the then European Union market. In the analogous period it was only 20-25% of the sales level in the segment of agricultural tractors in France, Italy or Germany. The common agricultural

register carried out in 2010 showed that there were 1,446,300 agricultural tractors used in Poland (Table 1).

Table 1. The structure of the number of tractors on farms according to the area groups of the arable lands in Poland in 2010

Tabela 1. Struktura ilości ciągników w gospodarstwach według grup obszarowych użytków rolnych w Polsce w 2010 roku

No.	Arable lands area ha	Number of tractors pcs	Tractors participation %
1	under 1	54,118	3.69
2	1-5	391,441	26.70
3	5-10	355,669	24.26
4	10-15	219,158	14.94
5	15-20	129,613	8.84
6	20-50	223,033	15.21
7	50-100	47,24	3.22
8	above 100	46,061	3.14
In general:		1,466,333	100.00

Source: Chief Central Statistical Office 2011

Over a span of the analysed period the number of tractors increased by 127,600. This group contains both brand-new vehicles made in Poland, new tractors imported from other countries by authorized dealer chains and tractors imported individually from Western and Eastern Europe. In the analogous period, there were 48,200 tractors produced in Poland, 117,100 tractors were imported and 25,300 were exported, which set the total domestic supply at the level of 140,000 vehicles annually. Comparing the possession with the size of the market offer means withdrawal and scrapping of 12,400 agricultural tractors (Central Statistical Office, 2011; Pawlak, 2011).

The analysis of the market structure during the common agricultural register in 2010 indicated that since Poland entered the European Union, farmers had bought 184,000 tractors. Comparing the supply with the number of tractors purchased by farmers indicates that there is a large internal market of used vehicles amounting to over 40,000 pieces. Transactions between private users in the pre-accession period were dominant on the domestic market. After launching consecutive tranches of the European Union subsidies, the age structure of the purchased tractors also changed. In 2007 only every third tractor was brand-new. In 2010 however, every second vehicle purchased in Poland was brand-new (Lorenkowicz 2011a).

AN ANALYSIS OF THE EUROPEAN UNION PROGRAMMES ON SUPPORT OF DEVELOPMENT AND MODERNIZATION OF AGRICULTURE

The Special Accession Programme for Agriculture and Rural Development (SAPARD) was established in order to aid countries willing to become members of the European Union (EU). The purpose of this programme in Poland was to support processes of structural rural transformations and prepare both institutions and individual beneficiaries for using the Instruments of the Common Agricultural Policy.

The SAPARD operational programme had a budget of 1,084 million EUR (4,795 million PLN) and encompassed actions in six areas. Action No. 2 is a field that encompasses 15% of the allocated means oriented to investments in agricultural farms. The implementation of the programme began in July 2002. The reception of applications ended in August 2004. The Agency for Agriculture Restructuring and Modernization signed 13,742 contracts in total worth 145 million EUR (637.4 million PLN) for Action No. 2. The programme encompassed the total number of 24,431 contracts with farmers. The EU means covered approximately 50% of the costs of the enterprise. The remaining costs and VAT was paid by farmers from their own funds. Surcharges on beneficiaries executed in the years 2005-2006. The purchase of new agricultural tractors was a dominant element in the contracts approved for execution (www.arimr.pl).

The accession of Poland to the European Union on 1 May 2004 also forced the necessity of adapting the domestic distribution market for the new requirements from which the most important one was the increase of the VAT rate from 0% to 22% on agricultural machines and vehicles. In the years 2004-2006, instruments of agriculture policies in Poland were executed within the frames of the National Development Plan. One of the activities was the Sector Operational Programme on Restructuring and Modernization of the food sector and rural development. Within the frames of the execution of 42,582 applications, the programme supported investments in agricultural farms with funds amounting to 644 million EUR (2,419 million PLN). In general, 1,784 million EUR was spent on the needs of farmers from the EU means and the state budget.

Another activity is the Programme For Rural Development (PRD) for the years 2007-2013 which encompasses four areas of restructuring activities. Financial means for the execution of the whole programme exceed 17 billion EUR (70 billion PLN). The thematic area of Agricultural Farms Modernization, encompassing 15% of the subsidies became very popular among farmers, which resulted in signing over 41,000 contracts. Consecutive editions of applications submissions by farmers at the Agency for Agriculture Restructuring and Modernization were conducted in 2007, 2009 and 2011. During the period between 2007 and November 2011, farmers purchased 19,394 agricultural tractors within the frames of this group of means. The maximum value of aid a single beneficiary could get per one farm within the frames of the execution of the whole Programme for Rural Development could not exceed 300,000 PLN. Depending on specific conditions the level of aid was set from 40% to 75% of qualified costs (www.wrirw.pl)

AN ANALYSIS OF STRUCTURE OF THE DOMESTIC SYSTEM OF AGRICULTURAL TRACTORS DISTRIBUTION

The logistics of tractor distribution in respective power classes, and therefore having different value, required preparing a concept of spatial arrangement of companies running authorized sales and technical service (Juściński and Piekarski, 2009c). Territorial location of enterprises running an authorized distribution of agricultural tractors for leading brands in sales in 2010 on the Polish market is presented in Table 2 and 3. In Polish conditions, the structure of dealer companies reflects the variety in the number of farms and their size in individual provinces. The general rule is that domestic producers brands such as: Pronar, Pol-Mot/Ursus, Farmtrac and Farmer as well as tractors in the lower price range: Zetor and Belarus have sales chains with greater number of authorized dealer firms (Table 2).

Table 2. Territorial location of authorized agricultural tractors dealers in Poland
Tabela 2. Rozkład terytorialny autoryzowanych dealerów ciągników rolniczych w Polsce

Producers of agricultural tractors								
No.	Province	New Holland	Case IH	John Deere	Zetor	Pronar Belarus	Farmer	Farmtrac
		pcs	pcs	pcs	pcs	pcs	pcs	pcs
1	Dolnośląskie	4	1	2	2	7	1	6
2	Kujawsko - Pomorskie	3	2	1	6	6	6	3
3	Lubelskie	3	2	1	7	8	5	4
4	Lubuskie	2	1	1	2	2	1	3
5	Łódzkie	5	1	1	5	11	4	4
6	Małopolskie	1	2	-	4	4	2	4
7	Mazowieckie	8	2	2	8	14	6	11
8	Opolskie	1	1	1	3	4	3	2
9	Podkarpackie	1	1	1	3	3	3	2
10	Podlaskie	4	2	1	5	12	5	3
11	Pomorskie	3	1	1	4	4	2	2
12	Śląskie	2	-	1	4	4	1	2
13	Świętokrzyskie	2	1	-	3	3	2	3
14	Warmińsko - Mazurskie	1	1	2	2	6	2	2
15	Wielkopolskie	4	3	2	4	12	5	8
16	Zachodniopomorskie	4	2	1	4	5	2	2
In general:		48	23	18	66	105	50	61

Source: Author's own analysis

Table 3. Territorial location of authorized agricultural tractors dealers in Poland
Tabela 3. Rozkład terytorialny autoryzowanych dealerów ciągników rolniczych w Polsce

Producers of agricultural tractors								
No.	Province	Same	Deutz Fahr	Lamborghini	Fendt, Massey Ferguson	Valtra	Claas	Pol-Mot Ursus
		pcs	pcs	pcs	pcs	pcs	pcs	pcs
1	Dolnośląskie	2	2	1	-	2	3	4
2	Kujawsko - Pomorskie	1	3	2	1	1	2	6
3	Lubelskie	-	3	3	1	2	2	10
4	Lubuskie	2	1	-	-	-	-	5
5	Łódzkie	1	3	2	1	2	2	9
6	Małopolskie	2	3	2	1	1	1	8
7	Mazowieckie	3	6	4	1	-	-	15
8	Opolskie	1	2	1	-	1	1	4
9	Podkarpackie	-	1	-	2	1	-	4
10	Podlaskie	1	1	1	3	3	1	10
11	Pomorskie	1	1	-	-	2	1	6
12	Śląskie	1	2	1	1	-	1	3
13	Świętokrzyskie	1	2	2	1	1	1	4
14	Warmińsko - Mazurskie	1	1	1	2	2	2	7
15	Wielkopolskie	1	3	4	3	4	3	14
16	Zachodniopomorskie	1	1	1	1	1	2	7
In general:		19	35	25	18	23	22	116

Source: Author's own analysis

The density of sales points runs from a couple to a dozen or so companies in one province. American concerns John Deere and Claas and European Same, Deutz Fahr, Lamborghini, Fendt and Massey Ferguson implemented a concept of sales chain which, in a standard way, has one or two representatives per province (Table 3).

Areas having the greatest number or size of farms, i.e. Mazowieckie, Lubelskie, Podlaskie and Wielkopolskie provinces are serviced by greater number of authorized dealer companies. In the period of Poland's accession to the EU New Holland concern, which is a leader in sales market of new tractors, has expanded its own distribution chain by almost 100% (Juściński and Piekarski, 2008a).

The price range of the offered models is a result of used construction solutions, their technological level and various and rich offer of additional equipment installed in a selected tractor at the consumer request (Table 4).

Table 4. Arrangement of market prices of new agricultural tractors in Poland in 2010
Tabela 4. Rozkład cen rynkowych nowych ciągników rolniczych w Polsce w 2010 roku

No.	Tractor power kW	Minimal price PLN	Maximal price PLN
1	under 25	23,000	69,000
2	25-40	44,000	102,000
3	40-60	50,000	179,000
4	60-100	64,000	242,000
5	100-150	74,000	369,000
6	above 150	151,000	790,000

Source: Author's own analysis

A potential buyer can now select from 450 models with 18-400 kW of power manufactured by domestic and foreign producers (Juściński and Piekarski, 2009d; Skrobicki and Ekielski, 2006).

AN ANALYSIS OF THE LEVEL OF AGRICULTURAL TRACTORS DISTRIBUTION IN A SELECTED DEALER COMPANY IN THE YEARS 2003-2010

Over a span of eight years of research, services executed by an enterprise being an authorized dealer of agricultural machines and tractors were a subject of analysis. The conducted research encompassed sales structure of 1012 agricultural tractors in total. The sales in the sector of agricultural vehicles in the analysed period encompassed the following brands: John Deere, Zetor, Same Deutz Fahr Group (SDFG) and Pronar. The sale of John Deere tractors, which is the leading brand in an analysed company, was carried out in Central and Eastern Poland. The distribution in case of the remaining producers, however, had a local character. The arrangement of the number of agricultural tractors sold in respective months in the years 2003-2010 is presented in the following histogram (Fig. 1).

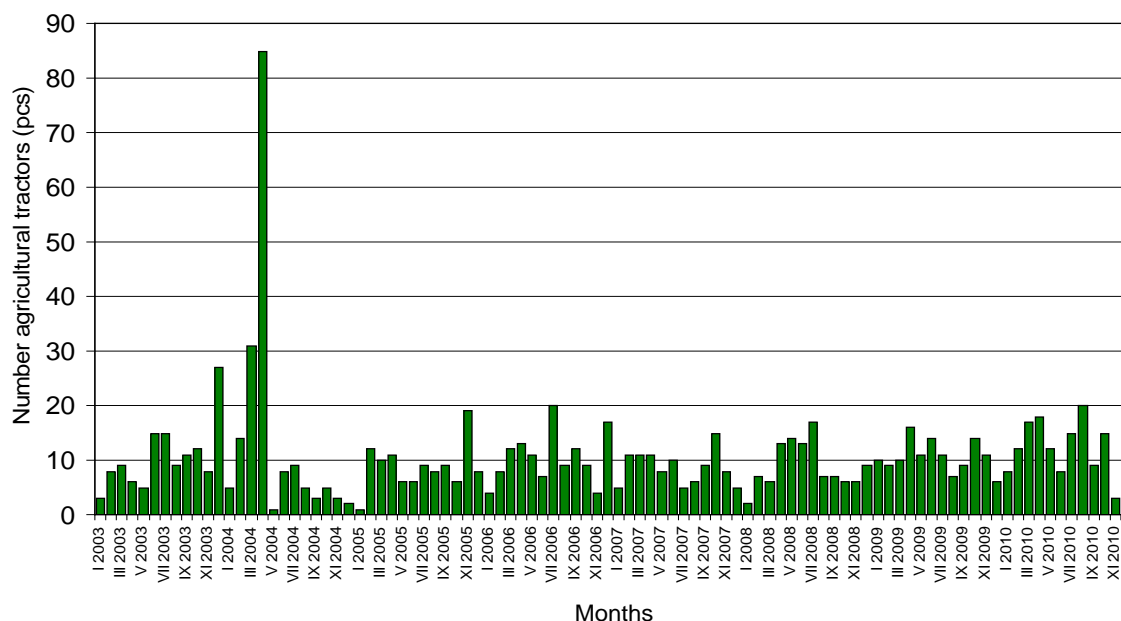


Fig.1. The arrangement of the number of agricultural tractors sold in the years 2003-2010 in a monthly pattern [Author's own analysis]

Rys. 1. Rozkład ilości sprzedanych ciągników rolniczych w latach 2003-2010 w układzie miesięcznym [Opracowanie własne]

Table 5. The structure of sold agricultural tractors

Tabela 5. Struktura ilości sprzedanych ciągników rolniczych

No.	Sales execution time	2003	2004	2005	2006	2007	2008	2009	2010
		%	%	%	%	%	%	%	%
1	I quarter	15.6	29.2	21.9	19.1	26.0	14.0	22.7	25.9
2	II quarter	20.3	55.0	21.9	24.6	27.9	37.4	32.0	26.5
3	III quarter	27.4	9.9	24.8	32.5	19.2	29.0	21.1	30.8
4	IV quarter	36.7	5.9	31.4	23.8	26.9	19.6	24.2	16.8
In general:		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's own analysis

In 2003, 128 tractors were sold. The research proved that the sales level in quarterly view was characterized by a rising trend over a span of the whole year (Table 5). The common regularity characterizing these three quarters was the fact that the highest level of sales was reached in the last month of the analysed period. The lowest demand level occurred in January and May. The local demand maximum, which was 400% higher than the one in January, occurred in June and July. The highest demand occurred in December and amounted to 21% of the annual sales level.

In 2004, 171 tractors were sold. In comparison to the previous year, there was a 13.4% growth in sales. In the period between February and April the sales increased very dynamically and the demand maximum occurred in April. Over a span of one month 50% of the total number of tractors was sold and 79% of an annual sale was done during the first four months. The structure and dynamics of sales were

drastically reduced in the remaining months. From May to December sales hovered at a few pieces per month.

In 2005, 105 tractors were sold. In comparison to the previous year, sales level dropped by 38.6%. The analysis proved that the first and the second quarter had equal level of sales and the increase in demand occurred in the second half of the year. The increase in demand was noted in July, March and April and the maximal level of 18.1% was reached in November.

In 2006, 126 tractors were sold. The lowest sales rate in a quarterly view occurred at the beginning of the year and the highest in the third quarter (Table 5). In comparison to the previous year, sales rate increased by 20.0%. The minimal demand rate occurred in January and November. The maximal number of vehicles amounting exceeding the minimal rate by 400% was sold in July. Another high increase in sales occurred in December.

In 2007, 104 tractors were sold. The demand was even, despite a slight local decline in the third quarter (Table 5). Sales dropped by 17.5% in comparison to the previous year. The lowest demand occurred in January, July and December, and the highest sales rate occurred in October. The monthly maximum was higher by 200% comparing to the sales level from the beginning and from the end of the year.

In 2008, 107 tractors were sold. The first quarter was the time of the lowest demand. The maximal sales rate was recorded in the second quarter (Table 5). In comparison to the previous year there was a slight increase in sales by 2.9%. The lowest sales occurred in January, March, October and November and the maximal demand occurred in July.

In 2009, 128 tractors were sold. The sales level increased by 50% in the second quarter in comparison to the beginning of the year (Table 5) and increased by 19.6% in comparison to the previous year. The lowest demand was recorded in December and the maximal number of tractors was sold in April, June and October. The highest sales level exceeded the minimal demand by 150%.

In 2010, 143 tractors were sold. The highest sales level was recorded in the third quarter. In the last quarter, the demand decreased by almost 50%. In relation to the last year this year's sales increased by 11.7%. The lowest sales were recorded in November and December, amounting to only 15% of the August's sales rate. The highest number of tractors was sold in August, April and March.

DISCUSSION

STATISTICAL STUDY: TREND, RANDOM FLUCTUATIONS AND SEASONAL FLUCTUATIONS

The brand-new agricultural tractors sales structure in Poland is characterized by the variability of demand (Fig. 2). There are big differences in the number of sold vehicles over a span of respective months in consecutive years. The demand is also variable when compared to consecutive annual sales results for the analysed period. It has to be emphasized that there were numerous unprecedented events in the years 2003-2010 on the distribution market of the brand-new agricultural tractors in Poland. They encompass the preparation processes to accession, entering the EU and gradual adjustment of the Polish agriculture to the EU standards. The financial condition and area structure of agricultural farms and their level of technical

equipment have set the directions of the development and priorities of restructuring and modernization.

The trend diagram (Fig. 3) illustrates the character of long-term changes on the brand-new agricultural tractors sales market on the basis of research conducted at the selected dealer. At the turn of the years 2003 and 2004, there was an upward trend forced by the upcoming accession. The increase of the VAT on agricultural machines and vehicles ended the period of a very high demand and started the trend of dynamically decreasing sales rate over a span of the remaining months in 2004. During the whole 2005 there was an upward trend for sales of agricultural tractors despite the reduced demand in comparison to the previous year. The reason for the increase in the sales rate in this period was the execution of the majority of payouts for beneficiaries of contracts signed within the frames of the SAPARD.

The tendency of the periodically rising trend, yet without the dynamics from the previous period, occurred in 2006 when the execution of the SAPARD payouts was concluded. The falling trend in 2007 was concurrent with the lack of payouts from the EU funds. Over a span of the aforementioned period the first edition of receiving applications within the frames of the Programme for Rural Development was executed. As their execution was postponed due to procedural requirements connected with applications approval and verification, the period of majority of payouts for investments was rescheduled for 2008. The rising trend with periodical declines also occurred in the years 2009-2010.

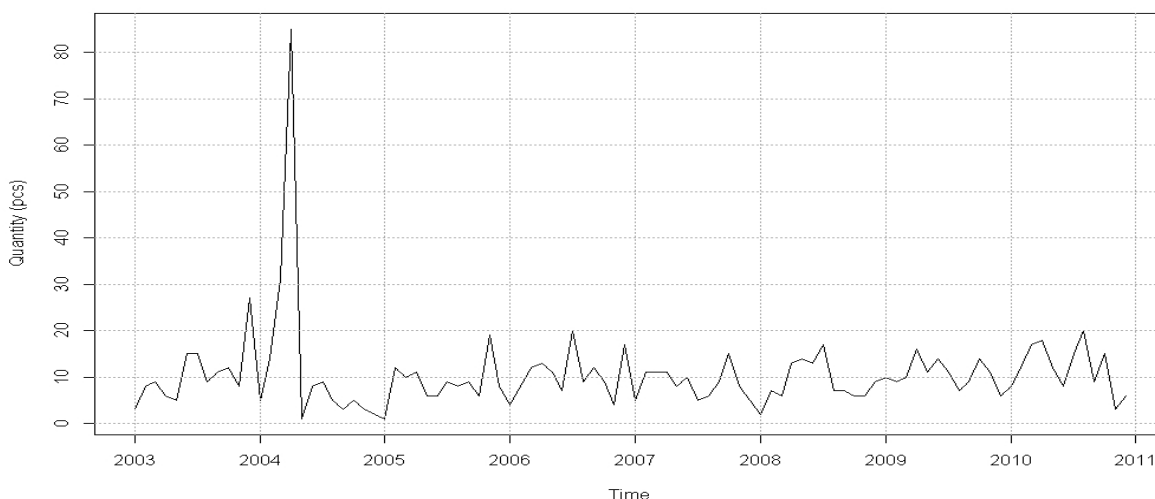


Fig.2. The structure of the number of sold agricultural tractors in the years 2003-2010 [Author's own analysis]

Rys. 2 Struktura poziomów sprzedaży ciągników rolniczych w poszczególnych miesiącach lat 2003-2010 [Opracowanie własne]

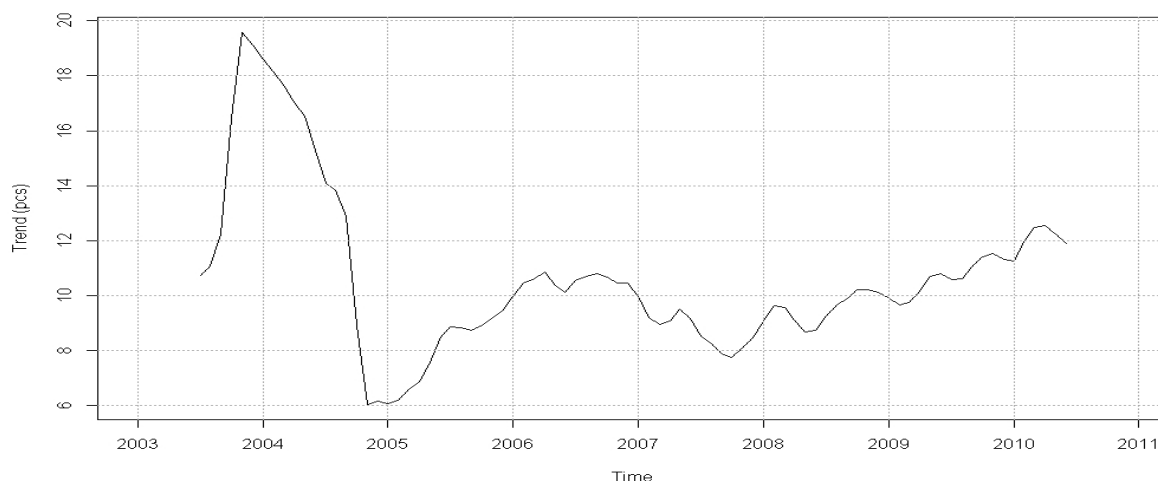


Fig.3. The trend of the structure of agricultural tractors sales in the years 2003-2010 [Author's own analysis]

Rys. 3 Trend struktury sprzedaży ciągników rolniczych w latach 2003-2010 [Opracowanie własne]

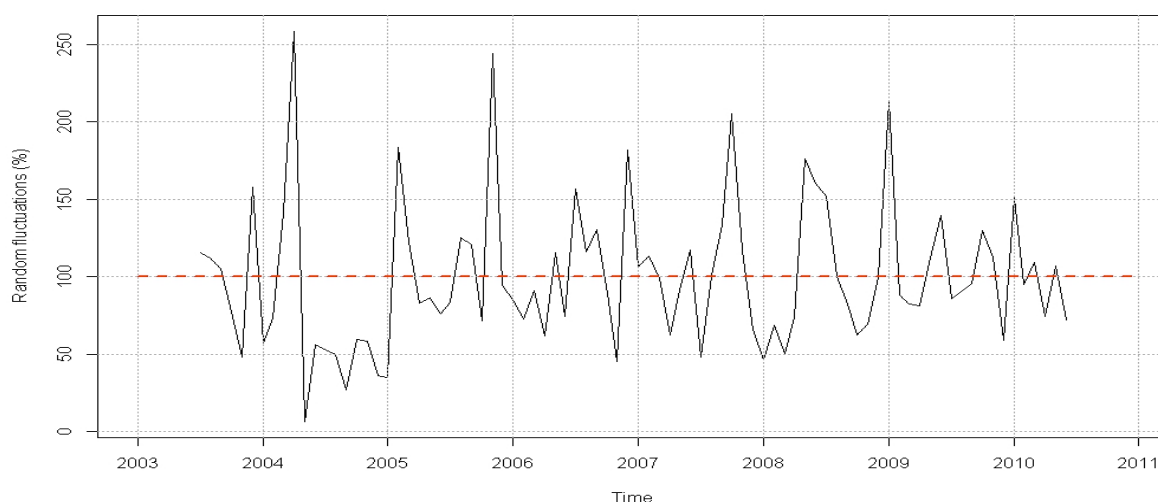


Fig.4. Random fluctuations for the sales levels of agricultural tractors in the years 2003-2010 [Author's own analysis]

Rys. 4 Wahania przypadkowe dla poziomów sprzedaży ciągników rolniczych w latach 2003-2010 [Opracowanie własne]

Because of the significant improvement in a system of receiving and approving farmers' applications for execution, the second edition of the Programme for Rural Development launched in 2009, did not hamper the rising trend as it did in 2007. The rising trend over a span of the two recent years of conducted research resulted in the fact that brand-new tractors sales reached the highest level since Poland's accession to the EU.

The character of changes on new agricultural tractors distribution market is illustrated in the diagram (Fig. 4). Heterogeneity of the demand structure over a span of consecutive months in the years 2003-2010 is illustrated by random fluctuations

isolated from the time series. The high increase in sales in respective months of the year was accompanied by demand declines to the minimal level in subsequent periods. The highest value of random fluctuations occurred in December 2003, April 2004, January and November 2005, July and December 2006, October 2007, May and July 2008 and January 2009. Despite the long-term rising trend, such an irregular arrangement of maximal demand values was a serious challenge for logistic systems of tractors dealers and producers. High value of demand random fluctuations forced significant corrections in distribution plans and even products manufacturing.

Market observations confirmed that launching consecutive payout tranches by the Agency for Agriculture Restructuring and Modernization caused instant sales increase. The lack of information on the date of further subsidies payouts was a significant problem for distribution logistics. Competition and strong pressure on distribution cost reduction in the whole sales chain hindered preserving high vehicle supply. Warehouse stock is an element that significantly impacts the financial condition of dealer companies. The lack of reliable sales forecasts coming from dealers was a factor that hindered making production plans by manufacturers. The random demand rise introduced an element hampering the process of distribution chain management and simultaneously increased the danger of emergence of additional costs when making changes in production plans caused by execution of individual orders. Enterprises also had to assess the risk of loss of potential profits with the inability to safeguard vehicle supplies immediately after the demand rise (Frankowska and Jedliński, 2011; Juściński and Piekarski, 2009c; Wojciechowski, 2007).

The comparison of quantitative structure of tractors sales was carried out in the aspect of seasonal fluctuations isolated from the time series by an elimination of trend, and cyclical and random fluctuations. The statistical analysis of the sales structure in an analysed dealer company over a span of eight consecutive years allowed to define the value of seasonal indexes over a span of a calendar year.

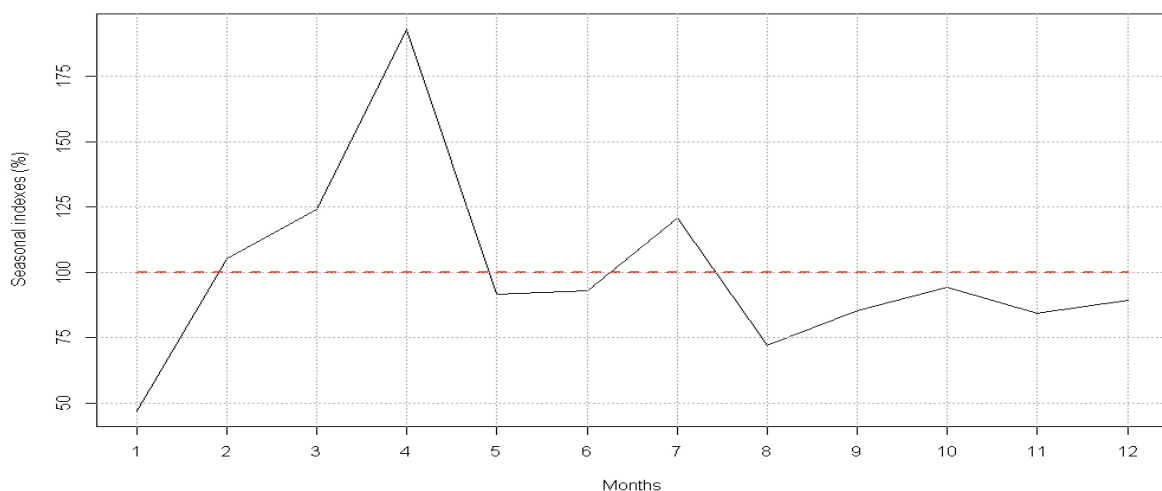


Fig.5. Seasonal indexes for the number of agricultural tractors sold in the years 2003-2010 [Author's own analysis]

Rys. 5 Indeksy sezonowe dla ilości sprzedanych ciągników rolniczych w latach 2003-2010 [Opracowanie własne]

The beginning of the year, a period when there are no field agritechnical procedures carried out, had sales level by 52.9% lower than the reference level. The lack of the need of using vehicles results in the fact that farmers postpone purchasing vehicles and, therefore, lower the costs of farm functioning by postponing payments to subsequent months. As a result of seasonal fluctuations in three consecutive months sales exceeded average level: by 5.2% in February, 24.1% in March and 92.9% in April. The season of spring field works is reflected in radical rise in demand for tractors which are necessary equipment in case of such activities (Dulcet, et al., 2005; Karczmarczyk, 2005). The drop in sales level after the works are concluded is very characteristic. In May and June, seasonal indexes were lower than reference level by accordingly 8.5% and 7.2%. Before the crops began, there had been a seasonal rise in sales in July, higher by 20.8% than the average level. Another seasonal fluctuation connected with the beginning of harvest resulted in the 27.8% drop in demand in August comparing to the average value. As a result of seasonal fluctuations in the period between September and December, the demand was accordingly 14.8%, 5.9%, 15.6% and 10.8% below the reference level (Juściński and Piekarski, 2008b).

CONCLUSIONS

The statistical analysis of the research results showed a trend changes course, which allows to put forward a hypothesis on a significant impact of funds from the EU on the structure and level of purchase of new agricultural tractors. Due to announced changes in regulations, the period before Poland's accession to the EU was generated by upward trend in tractors sales. Through 50% subsidies, consecutive programmes supporting agriculture modernization increased the demand for agricultural tractors and generated a long-term upward trend.

The statistical analysis proved that there are random fluctuations that affect elements of time series defining the number of sold tractors, which was unfavourable phenomenon for functioning of the distribution logistics. Because of the wide usage of the EU subsidies on financing the purchase of new tractors, it is possible to put forward a hypothesis on the impact of time of granting subsidies on the size of demand fluctuations. It was reflected particularly well in the tractors sales level in cases when financial means from SAPARD and PRD were granted irregularly and there was delay in transferring them to farmers.

The value of seasonal indexes calculated for time series of tractor sales allows to put forward a hypothesis on significant impact on seasonal character of conducted works and agritechnical procedures on cyclical character of changes in demand for agricultural tractors. As a result of seasonal fluctuations there is a low sales rate at the beginning of the year. The season of spring field works generated radical rise in demand. After the works were concluded in May there was a decline in sales level. The higher demand occurred before the harvesting and was getting lower during cropping. The seasonal rise in sales level also occurred at the end of the year but was still lower than the reference level.

The development of distribution logistics after Poland's accession to the EU led to the direct market confrontation of vehicles from various brands. Agricultural tractors in the same power class, but with different construction and use solutions, were offered in a wide price range. The process of trying to reach the same potential customer forced changes on distribution market. Producers' renegotiated trade contracts with

dealers so that they could gain exclusive rights to sale their products. The aforementioned issue occurred during the conducted research and concerned tractors manufactured by Zetor company and SDFG concern. After two years of simultaneous sales, the products of SDFG concern were withdrawn from the commercial offer of the analysed enterprise.

The conducted analysis proved that authorized sales of agricultural vehicles of multiple producers by one dealer can be carried out on a domestic market providing there is no direct trade interest conflict. The simultaneous distribution of multiple tractor brands was temporarily functioning in the analysed enterprise. The dealer executed simultaneous distribution of John Deere and Zetor agricultural vehicles over a span of four years.

The distribution company can run simultaneous sales of products from various producers who cooperate within the frames of one concern. Such model of functioning was confirmed by conditions of Same Deutz Fahr Group concern. The research carried out over a span of two years indicated that the commercial offer was expanded by Same, Deutz Fahr and Lamborghini vehicles.

After a couple of years, the modernization of farms carried out with a common use of funds from the EU made impact on the change of needs and expectations of some farmers. The analysed company withdrew Zetor tractors, which were products from the lower price range, and began exclusive sales of American tractors from Deere & Company. Such actions were an answer to the rising interest of farmers in higher class vehicles with 50% subsidies on their purchase. Moreover, products from the Czech plant had four times more sales spots, which significantly hindered reaching the desired sales level in selective distribution.

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