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MATERIALS AND COMMODITY FLOWS IN FARMS FROM THE ASPECT OF PRODUCTION SIMPLIFICATION*

Maciej Kuboń, Dawid Kurzawski
Institute of Agricultural Engineering and Informatics
University of Agriculture in Kraków

Summary. The paper presents the size and structure of raw materials and commodities flow in agricultural farms from the aspect of production simplification. The assumed aim was carried out based on the research conducted in 80 farms of Southern Poland. Facilities for research were divided according to a simplification degree. The highest I° degree of simplification includes only one group of plants. Subsequent degrees of simplification respond to an increasing number of plants, since the number of cultivated groups of technological plants decides on the simplification degree. As a result of the research which was carried out, the size and structure of raw materials and goods flows was assessed within 3 main areas of logistics – supply, production and distribution. The final effect of the research was development of raw materials and commodities flow in the researched groups of farms.

Key words: logistics**,** management, flow, simplification, production, model

Introduction

Modern logistics is considered as theory and practice of physical flows management of tangible and intangible goods within a logistic chain [Wojciechowski 2010].

Thanks to logistics, planning, controlling and performance of time and space products transformation and through harmonisation of these activities, physical and informative flows are initialised. Therefore, logistics, which coordinates and integrates phases and processes which take place both in a single enterprise as well as in the whole supply chain in order to provide a recipient with a proper product in a proper place and time, should be considered as a tool with potential for sustainable development [Skowrońska 2006].

Improvement of the material management process both at the strategic as well as operational level is a significant part of enterprise efficiency management. Extensiveness of

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material flow processes creates such risks as dispersion of analysis concentrated on many various factors, influencing effective purchase management processes, transport, storing, level of stock, working capital and financial means flow [Śliwczyński, Koliński 2012].

Agricultural products as well as food and raw materials for production are significant components of the transported mass, however mainly in an internal view. For instance, agricultural enterprises are considered as "involuntary" transport units. Since, the amount of transported fodder, fertilizers (especially organic), seed potatoes, animals etc. is very high. These amounts are lower in the outside transport [Logistyka... 2008]. Research results carried out by Wajszczuk [2006] proved that costs of logistics in high – area agricultural enterprises were from 1126.5 PLN·ha^{-1} AL to 1637.4 PLN·ha^{-1} AL including 71-86% of physical costs of material flow - which gives the ratio level in the amount of 900.8 PLN·ha^{-1} AL to 1391.5 PLN·ha^{-1} AL.

Not many research concerning costs of logistics in agricultural businesses, especially in farms have been carried out so far [Klepacki 2008, Kuboń 2007] but at the beginning of 21st century logistics determined both functioning as well as development of farms. Therefore, its meaning is crucial. Agricultural businesses are quite varied concerning seasonal nature, a type of the required transport mean, used storages, period of storing. Strong relations of entrepreneurs with raw material suppliers and recipients occur in many branches [Kuboń 2006; Klepacki et al. 2011].

The objective and the scope of the study

The study was carried out within a research project No. N N 313141238 *"Scientific and technical progress in the modernisation process of the Polish agriculture and rural areas"* carried out in the Institute of Agricultural Engineering and Informatics of the University of Agriculture in Kraków.

The objective of the paper was to determine the size and structure of raw materials and commodities flows in farms of varied degree of production simplification.

The scope of the research covered 80 farms located in the region of Małopolska. Facilities for research were selected randomly. In addition, the farm size adequate to the farms structure in Małpolska and diversity of production, were the basic criteria of selection.

3 detailed streams, i.e. (1) a supply stream, (2) a production stream and (3) a distribution stream were subjected to detailed analysis.

Research methodology

Research for the paper was carried out by means of a questionnaire in the form of a guided survey and its purpose was to collect information concerning general characteristics of farms. The questionnaire included questions on the bases of which, the following were determined: the structure of land use and the sowing structure, livestock, the size and structure of plant and animal production, its distribution, a transport type, a transport form, purchase, multiples of purchase, date of purchase) and the size of commodity production (amount, average distance from the market, a type of transport, a form of transport, multiple of sale, time of storing).

In order to carry out the assumed purpose of the paper, the researched farms were divided according to the degree of production simplification. The highest I° degree of simplification includes only one group of plants. Subsequent degrees of simplification respond to an increasing number of plants, since the number of cultivated groups of technological plants decides on the simplification degree [Malaga-Toboła 2009]. Division was as follows:
– group I° – 11 farms,
– group II° – 15 farms,
– group III° – 19 farms,
– group IV° – 19 farms,
– group V° – 16 farms,

Calculation methodology

In order to carry out the assumed purpose of the study, the following calculations must have been carried out:
– the size of plant and animal production was determined as a sum of plant and animal products produced in farms $t \cdot ha^{-1}$.
– the size and structure of transported loads in internal and outer transport was determined $t \cdot ha^{-1}$.
– distribution of plant and animal production was determined $t \cdot ha^{-1}$. A part of a product, which was moved to another branch (within internal turnover) was isolated as material input for production.
– the size and structure of the purchased production means was determined – a sum of the purchased agricultural and non-agricultural materials $t \cdot ha^{-1}$ AL. Multiple of purchase, time of storing, use of the storing space were calculated on the basis of information included in questionnaires.
– the size and structure of the sold produce was determined – a sum of the plant and animal commodity production $t \cdot ha^{-1}$ AL.

Results of the research

Plant and animal production are the basic departments of agricultural production. Soil and living organisms, which are capable of photosynthesis are characteristic production factors at plant production. While, animal production is a department of a farm which produces mainly animal products. It also includes production of farm animals and maintaining sport animals [Grontkowska 1997].

Table 1 presents the structure of using land in the researched farms. The values presented in the table indicate that the highest average area of agricultural land (AL) was 16.2 ha in farms of I° of simplification while the lowest was in farms of V° simplification and was 7.1 ha. Agricultural land (AL) constituted the highest share in the structure of land use in all researched farms. Their highest share was reported in farms of I° i II° of simplification where it was 100%. In farms of V° of simplification the highest share of permanent grassland was reported. Their area was 38% of total area of arable land. One must emphasise that neither orchards nor perennial plantations occurred in any of the researched farms.

Table 2 presents the structure of using land in the researched farms. When analysing the structure of sowing one may notice that grains were cultivated in the biggest amount in

these farms. The highest share of them was reported in facilities of IV° of simplification (73.3%) while the lowest in farms of I° – 39.3%.

Table 1. The structure of the land use in the researched farms
Tabela 1. Struktura użytkowania ziemi w badanych gospodarstwach

Specification	Area in [ha]		
	Arable land	Permanent grassland	Agricultural land
I° of simplification			
Average	16.2	-	16.2
Standard deviation	18.2	-	18.2
II° of simplification			
Average	15.3	-	15.3
Standard deviation	23.0	-	23.0
III° of simplification			
Average	10.0	1.5	11.5
Standard deviation	8.1	1.8	9.1
IV° of simplification			
Average	10.0	3.3	13.3
Standard deviation	16.7	2.3	16.1
V° of simplification			
Average	4.4	2.7	7.1
Standard deviation	11.5	2.2	12.0

Source: author's own study

Table 2. Sowing area in the researched farms
Tabela 2. Powierzchnia zasiewów w badanych gospodarstwach

Specification	Area in [ha]			
	Grain	Root crops	Fodder crops	Vegetables
I° of simplification				
Average	6.4	-	-	9.8
Standard deviation	21.1	-	-	4.7
II° of simplification				
Average	9.3	0.9	-	5.1
Standard deviation	23.4	1.7	-	4.7
III° of simplification				
Average	7.1	0.6	0.3	1.9
Standard deviation	8.5	0.9	0.7	3.3
IV^0 of simplification				
Average	7.3	1.6	0.1	-
Standard deviation	12.2	3.4	0.2	-
IV° of simplification				
Average	2.9	1.3	0.1	-
Standard deviation	8.2	3.4	0.3	-

Source: author's own study

Cultivation of vegetables was also the highest in these farms – 9.8 ha which constituted 60.7%. The area of fodder plants sowing was within 0.6 to 1.3 ha except for facilities of I° of simplification, where they were not cultivated at all, similarly to industrial and fodder crops. The next table (tab. 3) presents livestock in the researched farms.

Table 3. Livestock density in the researched farms
Tabela 3. Obsada zwierząt w badanych gospodarstwach

Specification	Animal group	
	Cattle	Pigs
	LSU per 1 ha of AL	
I° of simplification		
Average	-	-
Standard deviation	-	-
II° of simplification		
Average	-	0.1
Standard deviation	-	0.2
III° of simplification		
Average	0.2	1.1
Standard deviation	0.6	1.7
IV° of simplification		
Average	0.4	0.3
Standard deviation	0.4	0.7
V° of simplification		
Average	0.5	0.1
Standard deviation	0.4	0.1

Source: author's own study

Table 3 proves that the highest number of livestock occurred in farms of III° of simplification - 1.3 LSU·ha^{-1} (including livestock of pigs 1.1 LSU·ha^{-1}, which constituted 85% of total structure) while the lowest in farms of II° of simplification, (while cattle did not occur in these farms).

Figure 1 presents the structure of material and commodities flow in farms of I degree of simplification. These facilities purchased at supply markets at the average of 3.6 t·ha^{-1} AL of various types of production means, out of which 19.5% was used directly for production and 80.5% was stored for further use. The average size of production in the researched facilities was 33.2 t·ha^{-1} AL out of which 99.8% was allotted for sale – which proves high orientation of farms towards commodities, 0.1% for consumption and 0.1% for use in this or another branch of production. Commodities production was 33.1 t·ha^{-1} AL, out of which 72.7% of commodities was sold after harvesting and 27.3% within 3 to 6 months after harvesting.

Figure 2 indicates that the researched farms purchased at the average 5.7 t·ha^{-1} AL out of which 31.3% was used directly for production and 68.7% was stored for later use. Average size of production in the researched farms was 25.8 t·ha^{-1}AL out of which 93.3% was allotted for production, 0.3 % for consumption and the remaining 6.4% was transferred to turnover inside farms. Commodities production was 93.3% of global production, i.e. 24.0 t·ha^{-1}AL out of which 68.2% was sold soon after harvesting and 31.4% in later time.

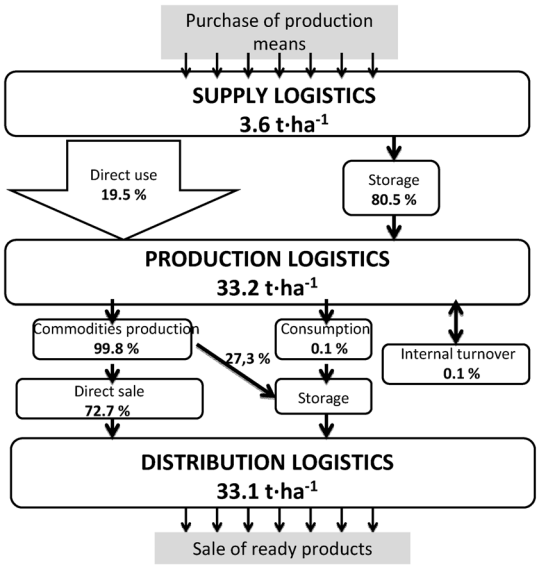

Fig. 1. Structure of raw materials and commodities flow in farms of I degree of simplification
Rys. 1. Struktura przepływów surowcowo-towarowych w gospodarstwach o I stopniu uproszczenia

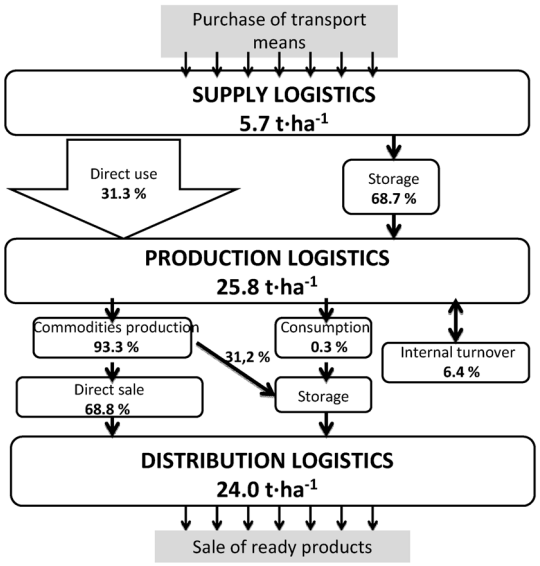

Fig. 2. Structure of raw materials and commodities flow in farms of II degree of simplification
Rys. 2. Struktura przepływów surowcowo-towarowych w gospodarstwach o II stopniu uproszczenia

Next figure (fig. 3) presents the structure of raw materials and commodities flow in facilities of III degree of simplification. The researched farms purchased at the outside markets at the average 4.0 t·ha^{-1}AL out of which 36.3% was directly introduced for production and the remaining part was placed in storages for later use. The average size of production in this group was 20.7 t·ha^{1}AL out of which 66.5% was sold, 1.4% was allotted for consumption and the remaining 32.1% was used within internal turnover in a farm. Commodities production in the researched farms was at the level 13.8 t·ha^{-1} AL out of which direct sale constituted 73.1% and indirect sale was 26.9%.

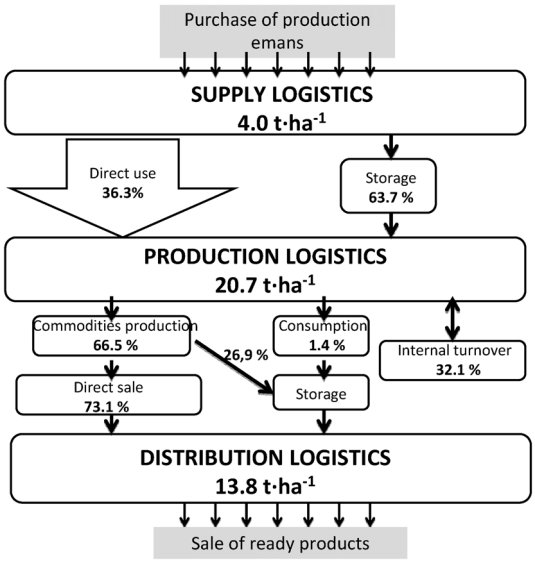

Fig. 3. The structure of raw materials and commodities flow in farms of III degree of simplification
Rys. 3. Struktura przepływów surowcowo-towarowych w gospodarstwach o III stopniu uproszczenia

Next figure (fig.4) presents structure of raw materials and commodities flow in farms of IV degree of simplification. Fig. The presented scheme indicates that the researched farms purchased at the average 2.0 t·ha^{-1} AL out of which 19.7% was used directly for production and 80.3% was stored for later use. The average size of production was at the level 16.7 t·ha^{-1} AL where commodities production was 53.9%, 2.4 % was the consumption and the remaining 43.7% were commodities used within internal turnover. Commodities production was at the level of 9.0 t·ha^{-1}AL out of which 79.3% was sold soon after harvesting and 20.7% later.

Figure 5 presents the structure of raw materials and commodities flow in farms of V degree of simplification. The researched farms within supply of farms in production means, purchased at the average 2.3 t·ha^{-1} AL out of which 25% was used soon after purchase for production and 75.0% was stored for later use. Global production in this group was at the level of 19.9 t·ha^{-1} AL out of which a half was allotted for sale, 2.3% for consumption and 44.7% for internal turnover. Commodities production was 10.5 t·ha^{-1} AL, out of which 80.2% of commodities was sold after harvesting and 19.6% up to 8 months after harvesting.

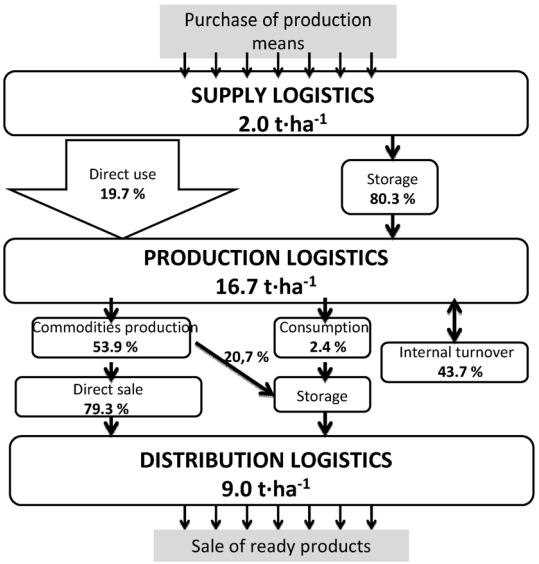

Fig. 4. The structure of raw materials and commodities flow in farms of IV degree of simplification
Rys. 4. Struktura przepływów surowcowo-towarowych w gospodarstwach o IV stopniu uproszczenia

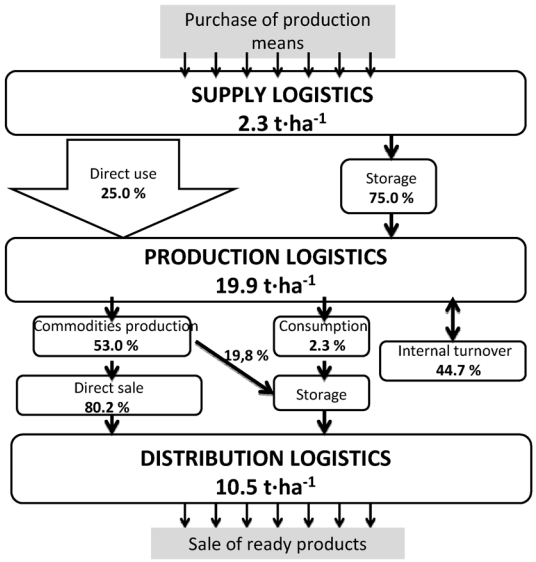

Fig. 5. The structure of raw materials and commodities flow in farms of V degree of simplification
Rys. 5. Struktura przepływów surowcowo-towarowych w gospodarstwach o V stopniu uproszczenia

Conclusions

1. The size and structure of raw materials and commodities flow in the researched facilities depends on the degree of production simplification. The biggest number of production means was purchased of II° of simplification - at the average 5.7 t·ha^{-1}AL while the lowest number out of a farm of IV° of simplification - at the average 2.0 t·ha^{-1} AL.
2. From the perspective of phase logistics, the highest mass of commodities in all the researched groups was transferred in the production phase, including the lowest in farms of IV^{o} of simplification (16.7 t·ha^{-1} AL) and the highest in farms of I° of simplification (33.2 t·ha^{-1} AL) While the highest number of commodities in the distribution phase was moved in facilities of I° of simplification (33.1 t·ha^{-1} AL) and the lowest of IV° of simplification (9.0 t·ha^{-1} AL).
3. When comparing the mass of sold commodities to the mass of production means it was found that in all the researched groups, this index was a multiple of a denominator. The highest ratio occurred in farms of I° of simplification – 9.2. while the lowest in farms of III° of simplification – 3.4.

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PRZEPŁYWY SUROWCOWO-TOWAROWE W GOSPODARSTWACH ROLNYCH W ASPEKCIE UPROSZCZENIA PRODUKCJI

Streszczenie. W pracy przedstawiono wielkość i strukturę przepływów surowcowo-towarowych w gospodarstwach rolnych w aspekcie uproszczenia produkcji. Założony cel został zrealizowany na podstawie badań przeprowadzonych w 80 gospodarstwach Polski Południowej. Obiekty do badań zostały podzielone według stopnia uproszczenia. Najwyższy I° stopień uproszczenia obejmuje tylko jedną grupę roślin. Kolejne stopnie uproszczenia odpowiadają zwiększającej się liczbie roślin, bowiem to liczba uprawianych grup roślin technologicznych decyduje o stopniu uproszczenia. W wyniku przeprowadzonych badań dokonano oceny wielkości i struktury przepływów surowcowo-towarowych w 3 głównych obszarach logistyki – zaopatrzenia, produkcji, dystrybucji. Końcowym efektem przeprowadzonych badań było stworzenie modeli przepływów surowcowo-towarowych w badanych grupach gospodarstwach.

Słowa kluczowe: logistyka**,** zarządzanie, przepływ, uproszczenie, produkcja, model

Contact details:
Maciej Kuboń; e-mail: Maciej.Kubon@ur.krakow.pl
Instytut Inżynierii Rolniczej i Informatyki
Uniwersytet Rolniczy w Krakowie
ul. Balicka 116B
30-149 Kraków