Investments in logistic solutions in Polish agri-food companies

Introduction

The Polish food processing industry is one of the most important branches of the Polish economy. Without exaggeration it can be described as one of the most important economic driving forces. Since 1989, the food industry has undergone significant transformation of ownership first, followed by technological and organizational transformation. Undoubtedly, these changes contributed to its unprecedented growth, especially dynamic after Polish accession to the European Union. For example, in the largest bakery industry comprising 44.3% of all companies in the sector, the volume of bread production has increased in the years 2003–2011 over two-fold. In turn, the value of Polish exports of food products in the years 2001–2011 increased more than 4.5-fold (Poczta et al., 2012).

On the other hand, Polish sector of food production is one of the most fragmented. According to the data in the REGON database, 98.9% of the companies of food processing belongs to the sector of small and medium-sized enterprises (SMEs), which employ no more than 250 people. Micro-enterprises, employing no more than 10 people, account for 69.9% of the companies. A similar structure of the companies occurs in all sectors, except for tobacco products. Usually larger enterprises have better financial possibilities and organizational are better prepared to functioning on market characterized by a high level of competitiveness. Also in terms of industry sector, the food processing industry is very diverse. The two largest sectors: bakery and meat cover, respectively, 44.3% and 20.5% of companies. In turn, the two smallest sectors tobacco and oil-fat cover, respectively, 0.1% and 0.8% of companies. To remaining seven sectors from 2% to 9% of companies belong.

Obtaining a good market position, competitive advantage, and finally commercial successful being is conditioned by many external factors mainly macroeconomic. Their importance is growing in the face of increasing globalization of the market, and changes in trade, such as the growing importance of supermarkets, distribution network, and systematic transfer of trade activity to the digital area via the Internet (Cechelski, 2006) (Porter, 2006) (Wiatrak, 2008). An important external factor that increases the competitiveness on the Polish market of food production is also integration with the European Union, which in addition to opening up the market for external stakeholders, forced a number of technological and organizational changes (Kucharski and Majewski, 2006) (Szczepaniak, 2008). Finally, just in the food processing industry in many sectors providing of fresh food or food for short term storage or with shelf life is particular important. This of course requires the use of appropriate technologies and organization of the logistics chain (Blackburn and Scudder, 2009) (Rong et al., 2011) (Cai et al., 2013).

Investments in logistic solutions, optimization of logistic chains and logistic systems development is seen as one of the most important factors determining the growth of the competitiveness of enterprises (Klepaccy, 2008). Among the most direct effects of logistic investments the various aspects of internal integration in the enterprise: infrastructure, commercial activities, work organization, information management, legal, planning, financial and security are most frequently mentioned (Ratliff and Ramhuddin, 2012) (Rodrigue, 2012).

Nowadays, in the era of globalization and the digital economy, the key importance of investments in logistics become investments in technology and information systems. Their aim is not only to support and optimize various aspects of the enterprise functioning, facilitating cooperative partnership, or improving the flows within the logistics chains. With modern information systems using a wide range of network environment, primarily traceability is possible, that is tracking products over the entire length of the logistic chain (Folias et al., 2006) (Regatteri et al., 2007) (Wicki and Jalowiecki, 2010).

The aim of the research, the results of which are presented in this paper was to determine the scale of investment and investment plans in different categories of companies appointed by employment size and industry, but primarily by levels of logistics complexity, used logistic solutions advancement, and used information technologies and systems. Presented research in the field of investment level in the various sectors and company size groups of agri-food sector in Poland were carried out for the first time according to the knowledge of authors.

1 P. Jalowiecki, Warsaw University of Life Sciences – SGGW, Faculty of Applied Informatics and Mathematics, e-mail: piotr_jalowiecki@sggw.pl.
2 E. jawske, Warsaw University of Life Sciences – SGGW, Faculty of Applied Informatics and Mathematics, e-mail: ewa_jalowiecka@sggw.pl.
3 Reviewed paper.
Methods

The study was based on a survey conducted in 2010–2011 among Polish enterprises of food processing. The division of surveyed companies according to five criteria was taken into account. The first criterion was the size of employment. Four categories of enterprises were distinguished: micro (up to 9 employees), small (10 to 49 employees), medium (50 to 249 employees) and large (250 or more employees). The second criterion of division of surveyed enterprises was functioning sector. Because in some industries response to the survey has granted only a few companies in further studies took into account only the 6 sectors: production, processing and preserving of meat (in this paper indicated by MS abbreviation); processing of fruit and vegetables; manufacturing of dairy products; manufacturing of grain mill products and starch; production of bakery and farinaceous products and the production of other food products. The other three division criteria were three coefficients determined in accordance with the previously developed methodology: complexity of logistics index (WZI), advancement level of logistics solutions index (WZL) and advancement level of IT solutions (WZI).

All three indicators are synthetic indices. To build WSL index 27 variables were used. In the case of WZL index, 25 variables with five areas of logistics activity: organization and logistics management, inventory control, warehouse management, transportation management, packaging and reverse logistics were used. WZI index was built on the basis of the aggregation of 6 variables representing the area of logistics information management. Permissible range for these indices was from 0 to 5. Determining methods of all three indices with description of their components are presented in (Jałowiecki and Jałowiecka, 2013) (Jałowiecki and Jałowiecka, 2014) (Jałowiecki et al., 2014). In studies, which results are presented in this paper, alues of all three indices were categorized using evenly distribution in the range of values into five categories: very low, low, average, high, very high.

Taking into account the criteria adopted for the division of surveyed companies the number and percentages of companies planning different types of investments were determined in each group. Planned investments are divided into 10 categories: implementation of modern IT solutions; implementation of logistics cost accounting; investments in storage areas; investments in transport; outsourcing storage; outsourcing of transport services; investments in packaging equipment; centralization of logistical tasks; participate in specialized courses, training courses, studies in the field of logistics and investment in resources and production facilities.

Also the existence and strength of the relationship between the variables representing the five criteria for categorizing companies and the current scale of investment processes were examined. In this case four categories of companies were distinguished that declared: lack of investment in fixed assets, investments below the consumption of fixed assets and investments at a level allowing restoration of fixed assets and investments in excess of the value of consumption of fixed capital. Due to categorization of all examined variables to determine the relationship between them, Spearman rank correlation coefficient was used. Its significance was examined by using test based on t-Student statistic. To examine the strength of the relationship between the sector of the enterprise, and the scale of investment processes were examined. In this case four categories of enterprises were distinguished: micro (up to 9 employees), small (10 to 49 employees), medium (50 to 249 employees) and large (250 or more employees).

Findings

In almost all groups of investments, tendency according to which percentage of companies planning to it increased along with the increase of employment size of company was found. This relationship has been confirmed by Spearman's rank correlation coefficient for employment size and declared level of investments in company (ρ = 0.30, t = 6.69; t = 1.97, p-value < 0.001, α = 0.05). It was not strong correlation but clearly visible and statistically significant. Percentages for large and medium enterprises were higher than the average percentages for all companies, but for small and micro companies there were lower than average. Only investments in transport, logistic tasks centralization, and investments in resources and production facilities were exceptions (see Figure 1).

More than half of all companies planning to invest in the purchase or improvement of transportation (52.6%). About a quarter of companies planned while investments in storage areas (26.2%) and packaging equipment (25.8%). On the other hand every fifth, examined company declared the implementation of modern IT solutions (20.5%). Least frequently declared types of investments include: investments in resources and production facilities (1.2%), outsourcing of storage (2.5%) and the centralization of logistics activities (2.7%).

The average number of categories of planned investments developed in all enterprises was at the level of 1.54. In individual terms of employment size it definitely increased with employment size of company. For microcompanies it was 1.11, for small companies 1.41, for middle companies 1.95 and for large enterprises 2.55. Regardless of the size category of employment, surveyed companies declared most frequently investments in transportation. In this case, in all categories of enterprise size, the percentage was always over 50%. Only in large enterprises at a similar level 48.3% developed as part of investment declaration for the implementation of modern IT solutions and warehouse space.
Among the surveyed sectors, by far the highest average category of investment activities number was declared by dairy firms at the level of 2.63. The next were fruits and vegetables, and other grocery sectors (accordingly 2.06 and 1.98). Significant smaller average number of planned groups of investments were found in meat, and cereal and starch sectors.
(accordingly 1.63 and 1.45), and by far the least it was in bakeries (1.27). In all industries, investments in transport were also the most frequently declared. In the case of the dairy industry, this kind of investment ¾ of companies declared.

Due to the lack of a logical sequence it was not possible to calculate the correlation between the sector, and declared level of investment in surveyed companies. Nevertheless, on the basis of the $\chi^2$ test of independence and V-Cramer coefficient value, it was found that belonging to sector significantly differentiates the declared level of investments in company ($V_{XY} = 0.16$; $\chi^2 = 37.13$; $\chi^2_{\text{adj}} = 40.11$; p-value = 0.09, $\alpha = 0.05$). Only among enterprises processing fruits and vegetables, the percentage declaration of investment in transportation was lower than 50% and amounted to 42.4%. In this industry as many companies indicated as planned, investments in IT solutions, and in warehousing areas (54.5%) (see Figure 2).

Declarations regarding planned investments in groups of companies designated by the values of WSL, WZL and WZI indices were in a very similar way. In the most cases, the percentage of companies declaring intentions in different groups of investments increased with the increase of studied index value. Only exceptions were investments in resources and production facilities for all three indices, investments in packaging equipment for WZL index, and investments in transport for WZI index (see Figures 3, 4 and 5).

![Fig. 3. Percentage of companies planning different types of investments with the division by the level of logistics structure complexity (WSL index value)](source: own preparation.)

Average numbers of planned investments groups were: 0.29 for companies with very low value of WSL index, 1.04 for low value, 1.30 for average value, 2.07 for high value, and 3.03 for very high value. Average numbers of declared different investments group plans were: 0.48 for companies with very low WZL index value, 1.07 for low value, 1.45 for average value, 2.41 for high value, and 2.93 for very high value. Average numbers of different groups of investments plans were: 0.57 for companies with very low value of WZI index, 1.29 for low value, 1.86 for average value, 2.42 for high value, and 2.53 for very high value.

Clearly visible relationships between higher values of WSL, WZL and WZI indices, and larger scales of declared investments plans were confirmed by values of Spearman correlation coefficients between indices values and current scale of investment processes in company. For WSL index it was $\rho = 0.28$ ($t = 6.37$; $t_\alpha = 1.97$, p-value <0.001, $\alpha = 0.05$), for WZL index it was $\rho = 0.27$ ($t = 6.05$; $t_\alpha = 1.97$, p-value <0.001, $\alpha = 0.05$), and for WZI index it was $\rho = 0.26$ ($t = 5.84$; $t_\alpha = 1.97$, p-value <0.001, $\alpha = 0.05$).
Fig. 4. Percentage of companies planning different types of investments with the division by the level of logistic solutions advancement (WZL index value)

*Source: own preparation.*

Fig. 5. Percentage of companies planning different types of investments with the division by the level of IT solutions advancement (WZI index value)

*Source: own preparation.*
Conclusions and implications

The results clearly indicates that the scale of planned investments is far greater in larger companies. Certainly an important cause in this case are better financial larger enterprises. Probably, in particular for micro and small companies, significantly reduced are also needs for using of advanced solutions in various areas of logistics. This is a result of both definitely smaller average number of both agricultural raw materials suppliers and consumers of food products in the two smallest categories of companies (tobacco and oil-fat). Especially clear is a difference in the case of the largest groups of farmers as suppliers and retailers as customers (bakeries and meat) (Jałowiecki and Jałowiecka, 2013).

Identified dependencies clearly indicate that not only increase in size, but also more complex structure of logistics, a higher level of used logistic solutions advancement as well as a higher level of IT solutions and systems advancement influences the larger-scale investments at present and the investment plans in the future. Admittedly there are not strong dependencies, but are clearly noticeable.

The most common declarations of plans for investment in the purchase and modernization of transport, is probably also the result of a large diversity and dispersion primarily consumers of food products. This mainly concerns the dairy industry in which the average number of retail stores as customers are more than 13 times higher than the average for all industries (Jałowiecki and Jałowiecka, 2013).

Studies, which results are presented in this paper have been conducted for agri-food production sector the first time in Poland. These studies were an element of wider research concerned on the state of logistics and IT solutions in agri-food industry.

Abstract

In this paper, results of studies on the logistic investments level in Polish agri-food sector are presented. Researched investments were divided into 10 groups, and researched companies were divided according to five criteria. There were: employment size, sector, in which company operates, and values of three indices: WSL – logistics structure complexity index, WZL – logistic solutions advancement level index, and WZI – IT solutions advancement level index. Studies also were provided for all researched companies together. Studies were performed on the base of the results of survey developed within 511 Polish agri-food companies in years 2009-2010. Relationships between higher employment size, higher values of all three indices, and investments scale in company were found. The most often declared investments group in all researched groups of companies were investments in transport (more than half of researched companies). About 25% of companies studied declared investments plans connected with warehousing and packaging equipment, and about 20% with new IT solutions.

Inwestycje w zakresie rozwiązań logistycznych w polskich przedsiębiorstwach rolno-spożywczych

Streszczenie

W artykule zaprezentowano wyniki badań dotyczących poziomu inwestycji w zakresie logistyki w polskim sektorze przetwórstwa rolno-spożywczego. Badane inwestycje logistyczne podzielono na 10 grup, natomiast badane przedsiębiorstwa pogrupowano według 5 kryteriów: wielkości zatrudnienia, branży funkcjonowania, wartości współczynników kompleksowości struktury logistyki (WSL), stopnia zaawansowania rozwiązań logistycznych (WZL) oraz stopnia zaawansowania rozwiązań informatycznych (WZI). Badania przeprowadzono także w ujęciu całościowym dla wszystkich badanych przedsiębiorstw razem. Źródłem danych były wyniki ankiety przeprowadzonej w latach 2009-2010 wśród 511 polskich przedsiębiorstw produkujących wyroby spożywcze. Stwierdzono zależności pomiędzy wyższym poziomem zatrudnienia, wyższymi wartościami współczynników WSL, WZL i WZI, a poziomem inwestycji logistycznych. Najczęściej deklarowaną grupą inwestycji we wszystkich grupach przedsiębiorstw były te, które dotyczyły środków transportu (ponad połowa badanych podmiotów). Około 25% badanych przedsiębiorstw posiadło plany inwestycyjne związane z gospodarką magazynową oraz infrastrukturą opakowań, ok. 20% przedsiębiorstw deklarowało inwestycje w zakresie technologii informacyjnych.

REFERENCES


