CLUSTER ANALYSIS OF BULGARIAN MEAT PROCESSING INDUSTRY

Maria Vodenicharova*

* Business Logistics, University of National and World Economy, Sofia, 1700, Bulgaria,
Email: mvodenicharova@unwe.acad.bg

Abstract The goal of research is to perform a cluster analisys of the Bulgarian meat industry from the point of view of the logistics development.
In order to study the state and development of the meat industry logistics in Bulgarian meat processing organizations, a wide range of statistical and analytical methods are used (comparison, group average, graphical method, cluster analysis and others). The date processing in done by a computer program for statistical date processing – SPSS (*Statistical Package for Social Sciences*).
The object of the industry is the meat processing companies in Bulgariq. According to the MFA Agro statictics for November 2010, the meat processing industry includes 65 factories for cutting red meat, 30 white meat slaughterhouses, 283 meat processing factories and the minced meat factories – meat preparations and mechanically separated meat, making a total of 378 companies in the industry.
The result of the study show that logistics plays a vital role for the meat processing organizations, because of the growing demand for quality, price and speed of delivery of products. Successful management of logistics allows time saving through faster movement of information, details and products from one process to another.

Paper type: Research Paper

Published online: 14 October 2011
Vol. 1, No. 3, pp. 163-173

ISSN 2083-4942 (Print)
ISSN 2083-4950 (Online)

Keywords: *logistics management, meat processing organizations, quality, JIT, MRP, HACCP*

1. INTRODUCTION

In the current stage of development, efficient logistics is a key element in the development of the organizations and also could help achieving a competitive advantage by integrating the processes that add value and also strive to optimize the links between them.

The meat processing industry has a key place in the food sector of the country and the challenges which the manufacturers are facing each day are getting bigger. It is now impossible to finance the large stocks, the number of products is steadily increasing and the delivery term is shortened.

From production to consumption, the frozen and chilled meat products must be stored and transported at a certain temperature. This requires the logistics of the meat processing enterprises to apply the principles of the so-called *cold chain* which affects all parties involved in the supply chain.

The goal of this report is to reveal the degree of development of logistics in the meat processing organizations in Bulgaria, by using cluster analysis.

The object of the study is the meat processing companies in Bulgaria. According to the MAF (*Ministry of Agricultural and Food*) Agro statistics for November 2010, the meat processing industry includes 65 factories for cutting red meat, 30 white meat slaughterhouses, 283 meat processing factories and the minced meat factories - meat preparations and mechanically separated meat, making a total of 378 companies in the industry.

The study is based on data from the meat processing organizations in Bulgaria, collected using a questionnaire. Respondents are 58 organizations, 51 of them are privately owned Bulgarian companies, which makes 87.9% and 12%, or 7 organizations are joint ventures with foreign participation as “Karol-Fernandez Meat – KFM Company” Ltd., which has more than 50% foreign participation.

In assessing the state of logistics organizations in meat is used than for research on the status and trends in logistics in Bulgaria (Dimitrov, 2003) and explore the management of the supply chain in manufacturing and marketing of perfumery and cosmetics industry and sugar industry (Rakovska, 2004). Studies were conducted in 2000-2006 and show the development of logistics management and supply chain organizations in Bulgarian.

1.1. State of logistics in the meat processing organizations in Bulgaria

The main players in the meat processing industry supply chain in the country are farms and importers of meat, meat production plants for red and white meat (slaughterhouses), meat processing factories (meat processing plants and production of minced meat and meat preparations) and their own stores, meat product retailers and wholesalers, catering establishments and individual consumers (households). There are various opportunities for export from both farms and meat producing companies for red and white meats, and also meat processing organizations which can export meat products, sausages and ready meals of canned meat.

The meat processing organizations sample of respondents includes a total of 31% slaughterhouses and 69% meat processing factories. According to the number of staff, 27.6% are micro enterprises, 51.7%, are small enterprises, 17.2% are medium and 3.4% are large companies employing over 250 people. The number of settlements which have manufacturing operations shows that 81% of the surveyed organizations operate locally while the rest operate nationwide.

The most used equipment by the meat processing organizations is the streaming production equipment (39.7%), followed by the highly specialized equipment (31%), while cells equipment and the universal equipment are used less. This is typical for the meat processing industry due to the heavily used outing logistics.

The product structure of the meat processing industry in Bulgaria does not differ from that in other European countries and generally do not suffer significant changes over the years. The growth is mainly in the direction of higher level of cooked and cut, continuous improvement of sanitary and veterinary requirements, methods and means for increasing the durability of products, reducing the number of sets produced by an enterprise and closer manufacturing expertise to produce only certain types of meat products.

In general, the organizations in the meat processing industry can be divided into: organizations with national coverage and organizations with regional (local) coverage. According to the analysis of the geographical distribution of sales in the country, in 2004 average 71% of the analyzed meat industry organizations market their production to the local market and only 29% of businesses sell goods on the domestic market. In the years to 2007, the share of sales on the local market reduces while the share of sales on the national market increases.

Local intermediaries for supply are used less – 27.6%, compared with the direct supply from the manufacturer, and in future these values will be even lower. The sources of supply imported directly from the manufacturer are 14.2% and in the next three years, this percentage increases to 44.8%. Since in our country the herds of farm animals are insufficient to satisfy the needs of the regional market, the meat processing industry increasingly uses imported products.

In connection with bringing the sector into compliance with health, hygiene and quality standards of the EU invested large investments. Yet investments made in meat production and processing sector are almost entirely by Bulgarian companies. Very few in number and size are foreign investments in the sector, the share of foreign investments in meat processing occupies only 0.1% of total foreign investments in the food industry for the country in the period 1992-2004 After 2005, however, there is a growing interest by foreign companies in the meat processing industry organizations seeking Bulgarian partners and explore opportunities for joint production. However, joint ventures with foreign participation in the meat industry remain few.

According to the information gathered from the surveyed organizations, the areas which need urgent improvement showed a slight increase in the importance of logistics compared to the results of the study from 2000, when marketing stood first, followed by distribution, manufacturing and supply. In this study, production comes first, followed by distribution and then marketing.

1.2. Investments in logistics activities

Data show that increased awareness of the logistics concept to previous studies. In all terms increased awareness and logistics increasingly gaining popularity in the surveyed organizations.

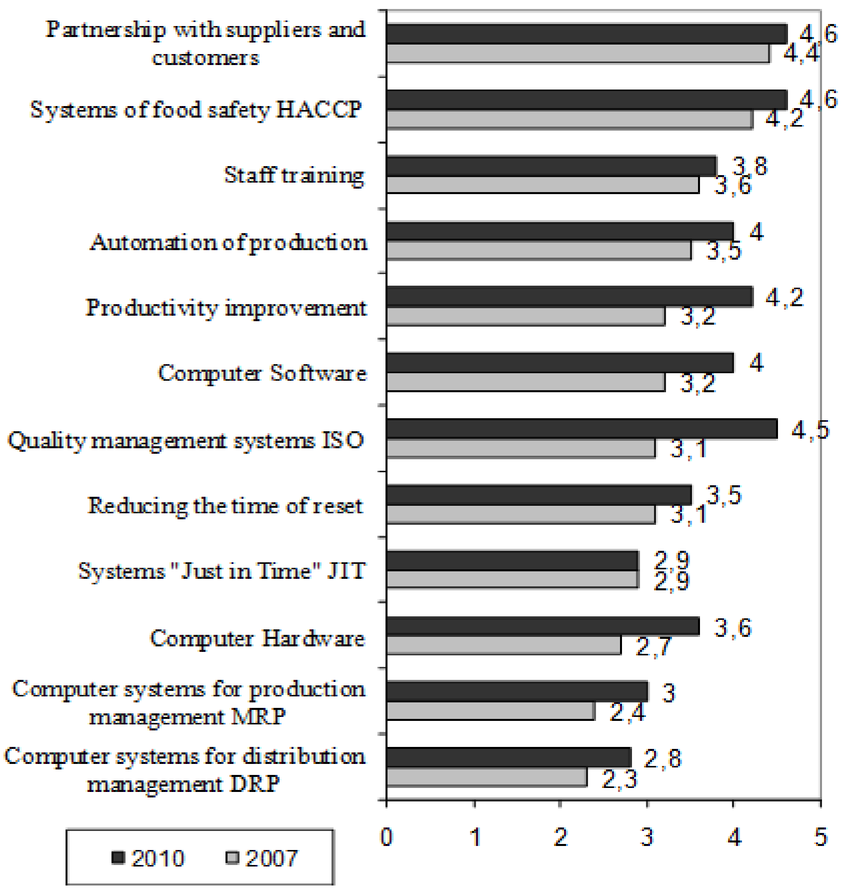

Fig. 1 Areas of investment (estimated by five-point scales)

It is noteworthy that the term knowledge of JIT (*Just in Time*) has increased significantly from an average mark of 2.8 of the survey in 2000, the average score to 4.2 in 2007, next it may be noted that the terms are TQM and EDI gained significant popularity among meat processing organizations.

The role of logistics in corporate management can be estimated by the focus of efforts of the meat processing organizations to the present moment and the three years coming. To the biggest extent (3.9) organizations have targeted their efforts to increase production efficiency. This is the area that needs urgent improvement. Next is meeting the requirements of the European Union.

One of the important indicators for assessing the role of logistics in corporate management by the meat processing organizations, is the extent to which they have invested (and / or plan to invest) in areas related to logistics (Fig. 1).

The organizations in the meat processing industry have invested resources mostly in building partnerships with suppliers and customers. Next is the investment in building HACCP systems /Hazard Analysis and Critical Control Points/.

In 2010, the resources are reduced, but a new requirement for food tracking appears, where the most of the investments are targeted. This confirms the conclusions drawn from studies conducted in the period 2000 – 2004 (Dimitrov, 2000), that firms first seek external integration before they have achieved a high degree of internal integration. This feature is characteristic for logistics processes in Bulgaria, and also occurs in the meat processing industry. The organizations in the meat processing industry increased their investments in recourses in 2010; the highest rate is given to investments for development of partnerships with suppliers and customers, i.e. for developing the external integration of the company. Only after that they intend to invest in systems that are directly related to the integrated management of logistics processes in the organizations such as JIT, DRP, and MRP. This feature occurs in other sectors of the economy of our country as well.

1.3. Logistics activities and organizations structure

One of the most important indicators for the development of logistics is its impact on the organizational structure of the enterprises. Nearly one third of the surveyed organizations (29%) have a separate logistics department which integrates some of the logistics activities. Some of the functions of the logistics department are order processing, packaging, transportation management (to some extent), and inventory management, operational management of procurement and warehouse management. The integration of logistics activities in the logistics department is relatively low. The average logistics department performs five of 15 listed logistics. There is no logistics department in a meat processing organization that has achieved full integration of logistics management activities.

In most meat processing organizations (71%) the logistics activities are performed by different units of the enterprise. Data analysis shows that logistics activities are performed mainly by the Production department and Marketing / Sales departments and to a lower extent by Purchase Department. The data also shows that in some meat processing organizations with traditional organizational structure there is a relatively high degree of integration of the logistics management in the Production department or the Marketing / Sales departments. These are meat processing organizations which refer to Stage I of the functional logistics management. Despite the lack of logistics department in these organizations, the logistics activities are integrated in the other departments.

It can be concluded that in 59% of the meat processing organizations, the management of logistics activities is fragmented, 12% had initial stage of integration of the management of logistics activities, which is a Stage I of the functional stage of development. 26% of meat processing organizations are in Stage II , and only 3% are in Stage III (Fig. 2).

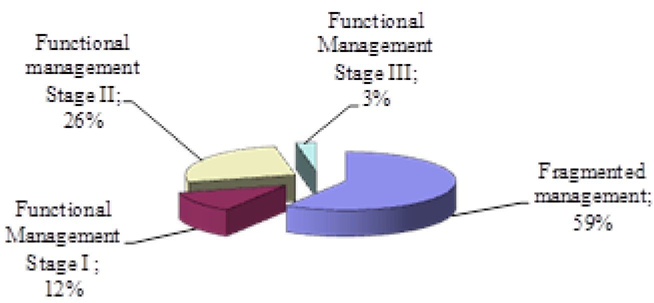

Fig. 2 Distribution of organizations according to logistics activities management

It can be concluded that the meat processing industry is characterized with low intra-firm integration of logistics activities and the organizational development of logistics is not as good as in other industries (cosmetics, fragrances, sugar industry).

1.4. Logistics activities management in the meat processing organizations in Bulgaria

The management of most logistics operations is based on expert methods and practical experience. This conclusion is confirmed by data on using computers software for the management of logistics activities (Fig. 3).

The quoted data shows that so far, software products for integrated management of logistic activities are hardly used, RFID systems, creating barcodes and barcode technologies, demand forecasting and transport management. The situation with the warehouse management, the supply management, and quality management systems and food safety HACCP is slightly better.

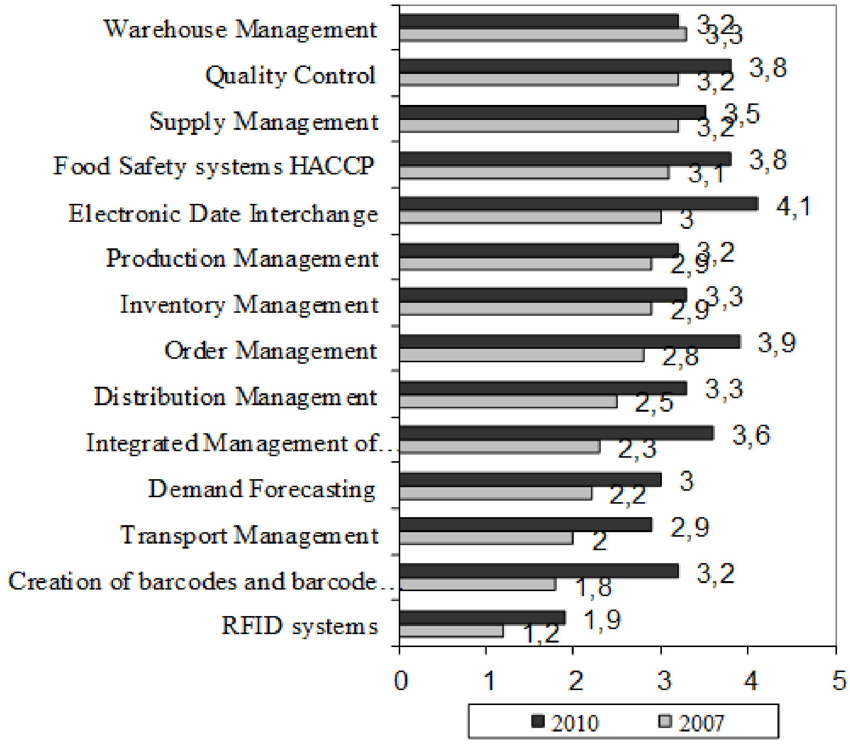

Fig. 3 Use of software for managing logistics activities (assessments on five-point scale)

In 2010 the meat processing enterprises increased the use of software for managing a large part of the logistics activities.

Compared to the cited study from 2000 it can be noted that the meat processing organizations have expanded their partnerships with similar companies and also other trade and distribution organizations. However, there are fewer partnerships with suppliers. This is caused by the ambition of the organizations to produce their own basic products used for production. This feature is characteristic only for the meat processing industry in Bulgaria, while in other countries, organizations tend to concentrate in only one production phase, i.e. meat processing without meat production and slaughterhouses. This is the so-called specialization of production which was developed by 1980 and affects mainly the small production units - workshops and slaughterhouses, resulting in the consolidation of the logistics base in the meat processing industry. Today, due to the lack of quality raw materials, Bulgarian enterprises prefer closed production cycle. Besides the different forms of partnership, the respondents have revealed the different areas of cooperation which occur. The organizations cooperate mostly in traditional areas, such as the exchange of information on prices, and also the exchange of information on demand forecasting. The organizations in the meat processing industry seek external integration of logistics activities, because they intend to deepen the cooperation in all tested areas.

2. CLUSTER ANALYSYS IN THE MEAT PROCESSING ORGANIZATIONS IN BULGARIA

To obtain a complete evaluation of the degree of development of logistics in the meat processing organizations in Bulgaria, at this stage of the study, cluster analysis was applied. The formation of clusters is done by grouping the units according to the chosen indicators to assess the state of logistics in the meat processing industry.

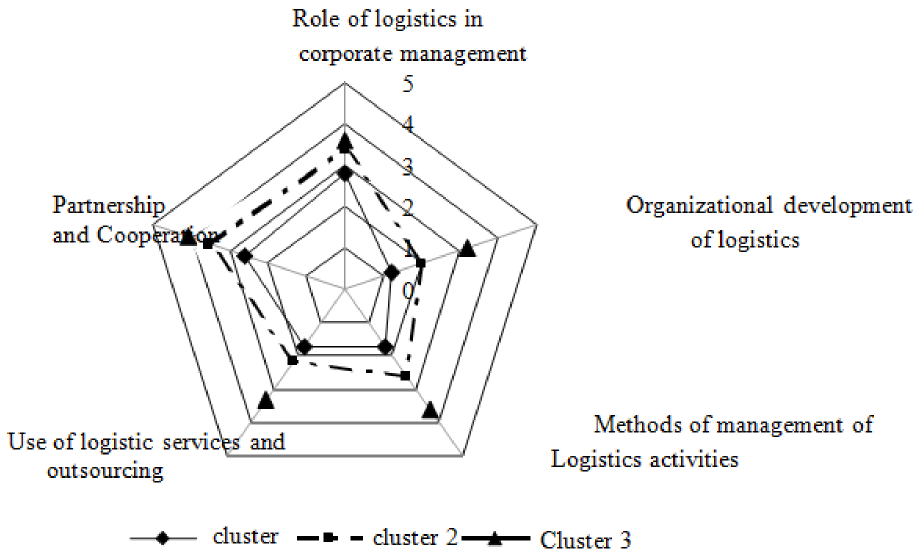

Fig. 4 Indicators for the development of logistics in clusters of meat processing organizations

The evaluation is based on five summary indicators for assessing the degree of development of logistics organizations in the meat processing industry: the role of logistics in corporate management, organizational development of the logistics management; methods in logistics activities, use of logistics outsourcing and partnerships cooperation with other companies in the field of logistics. Summary indicators are calculated as average of one or more secondary indicators.

Secondary indicators are obtained by specific questionnaire and are also calculated as an average for each question. The method chosen for cluster analysis (method of K-medium) requires the number of clusters to be determined beforehand.

Cluster analysis is conducted in several steps with different number of clusters, starting with five. The results of the analysis show that surveyed organizations can be grouped into three clusters. 45% of surveyed organizations fall within the first cluster, 44% fall within the second cluster and 12% fall within the third cluster.

Figure 4 shows the performance of logistics in the meat processing organizations.

Meat processing enterprises with overall low assessment of the role of logistics in the company management fall within the first cluster. They are in the fragmented stage of development of organizational structures. Simple methods for logistics management are applied in these organizations (in most cases practical experience) and use of logistics services of external organizations, partnerships with suppliers and customers do not go beyond the traditional trade relations.

The second cluster includes meat processing organizations which recognize the role of logistics in corporate management and are at the stage of functional management of logistics organizational development (Stage I and II). They implement better methods of logistics management, partial use of logistics services from external companies and also elements of partnership with their suppliers and customers.

The third cluster includes meat processing organizations, with high assessment of the role of logistics in corporate management. They are in Stage II and III of organizational development and apply more sophisticated methods of managing logistics activities, greater use of logistics outsourcing and various forms of partnerships with suppliers, customers and other organizations.

The analysis of the meanings of indicators and sub-indicators shows that the three separate clusters correspond to the first three phases and stages of development of logistics, adopted in the present study.

The organizations which are in Phase I – fragmented management of logistic activities are in cluster 1. Cluster 2 consists of organizations which are in the first stage of intra-firm integration – initial integration. Cluster 3 includes organizations which are in the second stage of intra-firm integration – advanced integration.

None of the meat processing organizations in the country are in the third stage (full integration) of intra-firm integration and the third phase (phase of intra-and inter-firm integration) of logistics development.

3. CONCLUSION

The results of the study show that logistics plays a vital role for the meat processing organizations because of the growing demands for quality, price and speed of delivery of products. Successful management of logistics allows time saving through faster movement of information, details and products from one process to another.

Logistics organizations in meat has features that arise from the specifics of the product and consist mainly outbound logistics, as companies receive deliveries from a small number of suppliers, product a wide range of goods with high requirements for service and send goods to multiple customers a different location. Characteristics of logistics organizations in meat were stored and transported under certain conditions and for a short period of time, observing the principles of the EAS, which is a prerequisite for reaching the fresh produce to the consumer, the mandatory application of the system for food safety and HACCP systems traceability in the supply chain.

According to one of the most important indicators for the development of logistics - the impact on organizational structures, the meat processing industry is characterized by low intra-firm integration of logistics activities and the organizational development of logistics is not as good as in other industries such as cosmetics, fragrances, sugar industry and others.

The applied methods for the management of logistics activities showed low use of information systems and technologies, demand forecasting methods and methods of measuring the volume of orders. The use of outsourcing and logistics services in the meat processing industry in Bulgaria remains extremely poorly developed. Establishing partnerships in the supply chain is also characterized by striving for external integration of logistics processes. The analysis of the logistics in the meat processing industry in Bulgaria shows that meat processors implement logistics processes, but need to improve the inter-and intra-firm integration.

In terms of level of development of logistics, the surveyed organizations are separated into three clusters: cluster 1 - organizations which do not apply logistics concept, the second cluster includes organizations which have a growing interest in logistics concept, and the third cluster which includes meat processing organizations, where the role of logistics is important and apply the logistic concept to a large extent.

Cluster 1 falls into the first phase of development of logistics, which is characterized with low use of the logistic concept. Cluster 2 and cluster 3 are located in the second phase of development of logistics, which shows that organizations have realized the role of logistics, but do not apply it sufficiently in order to increase the competitiveness of the enterprise.

None of the meat processing organizations in our survey are in the third phase of development of logistics, which reveals opportunities for improvement of logistics in these organizations. The organizations which are in Phase II of development of logistics, have realized the role of logistics, but it is necessary to improve the methods of managing logistics activities and the greater use of outsourcing and logistics services. After achieving a high degree of internal integration, the meat processing organizations can focus on inter-firm integration and development of partnerships in the supply chain. Of course they should observe the principles of EAS (*cold supply chain*), which are characteristic for the meat processing industry.

REFERENCES

Dimitrov P., (2008), Logistical aspects of the competitive growth of the Bulgarian industrial enterprises. UNWE.

Dimitrov, P. (2000), Status and trends of logistics development in Bulgaria, (in Bulgaria), UNWE.

Dimitrov, P., Dimitrov, P., (2003), "Logistics development in industrial companies in Bulgaria". [in:] Dimitrov P. (ed.) Logistics in Bulgaria – theoty snd practice, Ibis, Sofia.

Dimitrov, P., E.Velichkova, M.Rakovska, (2008), Development of logistics sector in Bulgaria, Sofia.

Lambert D. and J. Stock. (1993) Strategic Logistics Management, 3rd ed. Burr Ridge. IL: Richard D. Irwin.

Rakovska, M., (2004), "Integration of activities inter-supply chain in the Bulgarian Business practices", [in:] Dimitrov, P. (ed.) Logistics in the National economy and the firm, Ibis, Sofia.

BIOGRAPHICAL NOTES

Maria Vodenicharova is an Assistant Professor at the University of National and World Economy in Sofia, Bulgaria. She was a PhD in Business Logistics from UNWE in 2010. Her research interests are broad aspects of business logistics and food safety. Since 2006, she was an Assistant in the Department of Business Logistics and leads seminars on eligible university discipline *Business Logistics*, and faculty discipline *Logistics Systems* at UNWE in Sofia, Bulgaria. She has qualifications in the field of systems for quality management, HACCP, GHP and integrated management systems. She also works as a consultant and provides HACCP systems for various industry and organizations in Bulgaria.