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A CASE STUDY ON LOGISTIC PROBLEMS IN THE COLLECTION OF REFUND BOTTLES[1]

1. Introduction

Environmental impact and waste management are becoming an increasingly important part of logistics. Management of waste streams can be seen as management of physical flows, and such flows are directly related to logistics. Thus these flows have been called reverse or waste logistics (but also ecologistics), 'Entsorgungslogistik' to use the German term. 'Ekologistyka' is the Polish term [see Korzeń, 2001, 16; Pfohl, 1998, 227; Ummenhofer, 1997, 61]. It is becoming more and more relevant at both company and state level, through the residues left from industrial and commercial activities, and many companies and countries worldwide are setting up systems to cope with this.[2] Section 2 of this paper defines the term reverse logistics, together with some of its most significant factors. In Section 3 the role of legal regulations is described, and changes in Polish law connected with packaging are mentioned. Section 4 presents our research about refund bottle issues, which was done in almost 100 shops in the city of Opole in Poland.

2. Main characteristics of reverse logistics

According to Pfohl [1998, 227], reverse logistics can be defined as the use of logistic methods to deal with residue matter to create an economi-

[1] Parts of this article were published earlier – see Kałasznik et al., 2002.

[2] Ummenhofer [1997, 61–5] discusses the efficiency of such systems.

cally and ecologically efficient flow of these residues, causing their transformation in space and time, together with changes in quantity and quality. Korzeniowski and Skrzypek [1999, 48] describe the goal of reverse logistics as a search for optimal organisational solutions to eliminate and utilise waste using modern waste management methods.

Reverse logistics is using logistic methods and solutions, so it is described as a part of a logistics system [see Pfohl, 1998] or as a part of a logistic chain (supply chain) [Blaik, 2001, 50], which is shown in Figure 1.

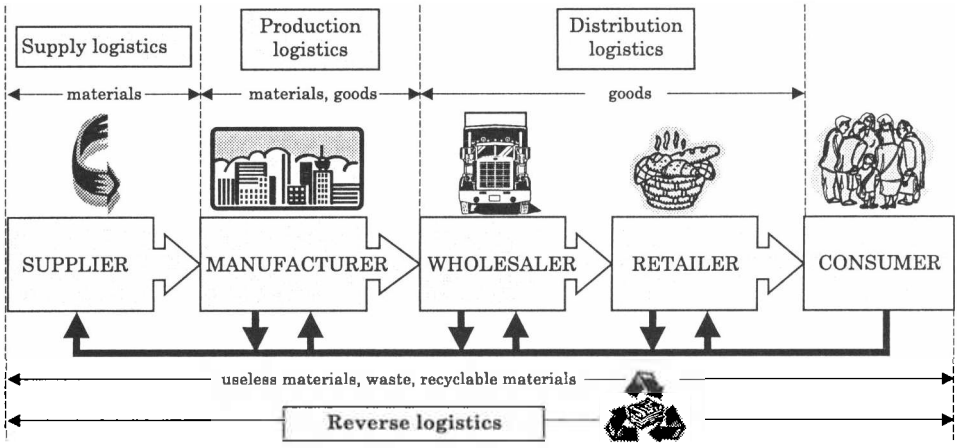

Fig. 1. Reverse logistics in the supply chain

Source: Based on Blaik, 2001, 50; Korzeń, 2001, 17 and Pfohl, 1998, 18.

Pfohl names two criteria that distinguish reverse logistics from other logistic subsystems (like transportation, warehousing, distribution):

1. Objects of flow – in most logistics subsystems and processes the main objects are goods, while in reverse logistics the main objects are residues. Depending on the possibility of reusing residues, they can be divided into recyclable materials and waste.

2. Direction of flow – redistribution channels of residues are part of distribution channels of goods. However, the source of residue streams is at the same time the final point of goods streams, which means that the flow of residues goes in the opposite direction to the flow of goods.

3. The role of legal regulations

According to Korzeniowski and Skrzypek [2000, 397], one of the most significant objects within the reverse logistics subsystem is packaging

waste. This is due to a rapid increase in the amount of packaging waste, which is causing more and more serious danger to the natural environment. As a result, from the beginning of 1990s a tendency of integrating packaging waste issues into the legal framework has been apparent in many countries. The aim of these legal regulations is to build up a 'barrier', which would block the flow of a wide stream of packaging waste into ever expanding rubbish dumps (see Figure 2).

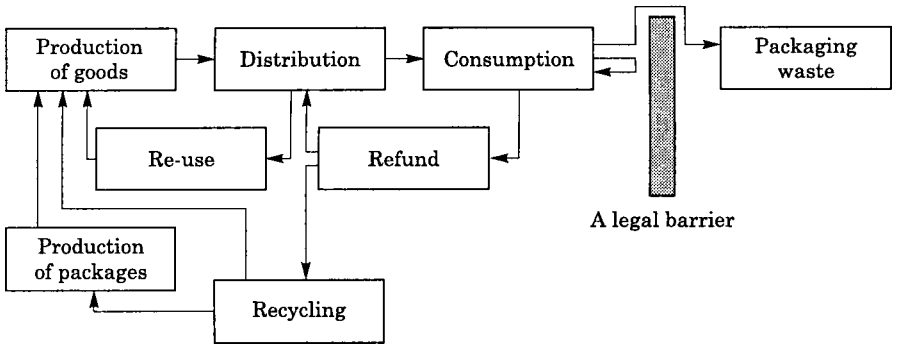

Fig. 2. The main aim of legal regulations connected with packaging waste – lowering the flow to rubbish dumps

Source: Korzeniowski and Skrzypek, 2000, 398.

At the present time Polish law regulations have also been enriched by so called "anti dump barriers". At the beginning of 2002 two main acts were introduced into the Polish legal system – an act about the duties of producers in the field of waste management and an act about product and deposit duties [Dziennik Ustaw, No. 63, Item 639, 2001], and "packaging and packaging wastes" act [Dziennik Ustaw, No. 63, Item 638, 2001].

The second act will be briefly presented here, as it is connected with the area of research presented in the next section. The introduction of the act will cause great changes into the "bottles logistic chain".

Clause 12 imposes a duty on a seller to place information in a shop about packaging and waste packaging. Next Clause 13 obliges shops which have a selling area bigger than 25 square meters to offer beverages in both sorts of packaging, disposable and multiple use. The following Clause (no. 14) obliges shops to return a deposit when bottles are returned which are in stock. Another Clause, no. 15, contains information directed to shops which have a selling area over 2000 square meters. These kind of shops are obliged to selectively collect the waste packaging of products which are in their stock. This collection has to be conducted according to set external regulation and at one's own expense.

The act presented will surely change the present situation in the collection of refund bottles. However, as some data from the research indicate, there are significant problems with introducing these regulations into practice.

4. Results of the research

The research was conducted between 26th February and 8th March in more than 120 shops in the city of Opole, Poland. However, some shops refused answering the questionnaire, so the total number of shops, which took part in the research, is 97. The non-response rate (about 20%) is so low thanks to the method of the research. The data were collected by interviewing the owner of a shop, manager or shop-assistant, or by leaving a questionnaire in a shop which was collected later. The main aim of the research was to check the popularity of products packaged in glass refund bottles and to investigate possible problems connected with the collection of these bottles.

At first some general data about the popularity of products packaged in refund bottles will be presented. About 88% of shops researched sell products in refund bottles. However, this percentage may be influenced by the fact that shops with no alcohol in stock, as well as small shops with less than 25 m^2 of selling area, were mostly not taken into consideration in this research.

It is interesting to look at the structure of products packaged in refund bottles, which are sold in the shops researched. As is shown in Figure 3, there are only 6 different products, which are sold in refund bottles. Moreover, in most of the shops there are just beer refund bottles, while all other products are offered in less than half of the researched shops.

However, when analysing the sales data for beer products, beers packaged in refund bottles have about a 51% share in the total beer sale in the shops researched. The other 49% are canned beers. When it comes to water refund bottles, just 23% of the total sale of water are these kind of products. That may explain, why less and less shops are interested in selling water in glass refund bottles. Other products in refund bottles were not considered in the research.

Answering this question, the interviewed were asked to give just an estimation of sales proportions. The data in Figure 3 are average numbers from all of the collected answers.

Table 1 shows the deposit on each refund bottle, which is added to the price of a product. Three kinds of deposit were distinguished: the lowest (minimum) and highest (maximum), which were found in the research, and an average deposit from all the shops. The differences between the

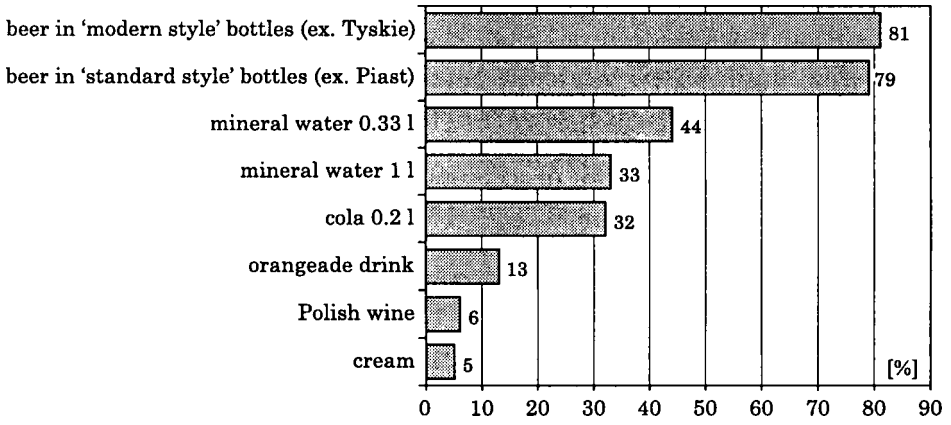

Fig. 3. Which of the following products packaged in refund bottles are on sale? (percentage of all shops)

minimum and maximum deposit are in most cases very significant, especially in the first four groups of products (more than a 100% difference).

Table 1. Minimum, maximum and average deposit on refund bottles (in Polish złoty[3])

Products in refund bottles	Deposit on a bottle		
	min	average	max
Beer in 'modern style' bottles (ex. Tyskie)	0.20	0.38	0.60
Beer in 'standard style' bottles (ex. Piast)	0.20	0.42	0.60
Mineral water 0.33 l	0.10	0.23	0.40
Mineral water 1 l	0.40	0.58	1.00
Cola 0.2 l	0.20	0.23	0.40
Orangeade drink	0.35	0.38	0.40
Polish wine	0.50	0.64	0.70
Cream	0.50	0.70	0.80

There was also a question in the research about refund prices for each bottle. Almost all researched shops had set up refund prices at the same level as the deposit prices, although there is no regulation connected with this matter in the act about packaging, which was described in Section 3.

Before analysing some specific issues of refund bottles flow, which have arisen as a result of the research, some information about the sub-

[3]The exchange rate in January 2003 was about 1 euro for 4 Polish złoty.

jects of the research, shops, will be presented. Out of 97 shops researched, 68% were small local shops and another 32% were different kinds of medium shops (discount shops, supermarkets etc.). No large shops, like hypermarkets, were included in the research. When considering the location of shops researched, 35% were situated in the city centre, while another 65% were on the outskirts of Opole. Finally, the largest group of interviewed people in shops were shop-assistants (46%), followed by managers (30%) and shop owners (24%).

The next figures present various aspects of the refund bottles issue. The questions shown in these figures were used to help to investigate possible problem areas in the reverse logistic chain of refund bottles. In the first of these questions, reasons for selling products packaged in refund bottles were checked. As can be seen in Figure 4, demand for these products is the main reason. But when looking back to Figure 3 it is clear that beer is the product, which is mentioned here. The first five answers, which were the most popular to this question, were given in the questionnaire as optional answers. It was possible to choose more than one answer or to give some additional reasons.

The question in Figure 5 refers to the 14th Clause of the Packaging Act. As shown, only 52% of the shops researched fulfil this legal regulation and accept with no conditions the return of all refund bottles that are in the shop's stock. Other shops have some conditions connected with accepting refund bottles. There were three optional answers to this question (the ones which got a response rate of more than 50%) and it

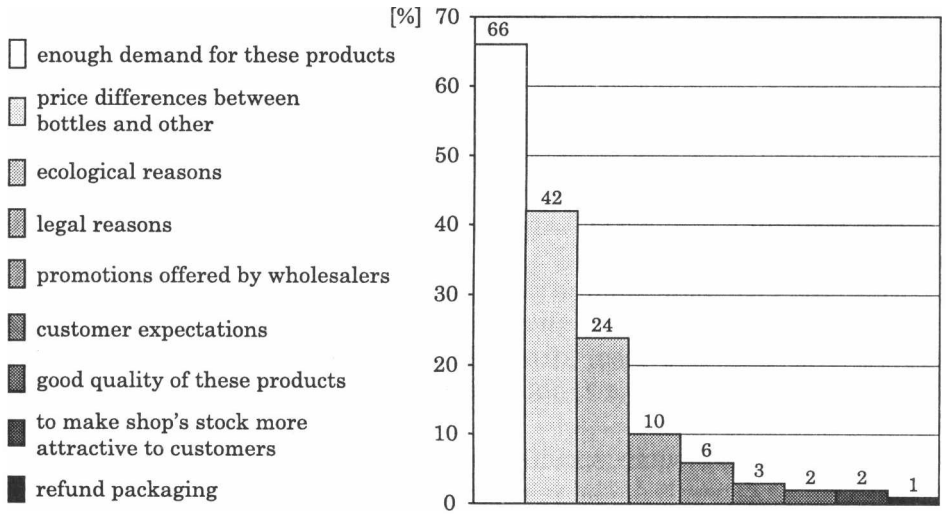

Fig. 4. Why do you sell products is refund bottles? (more answers possible)

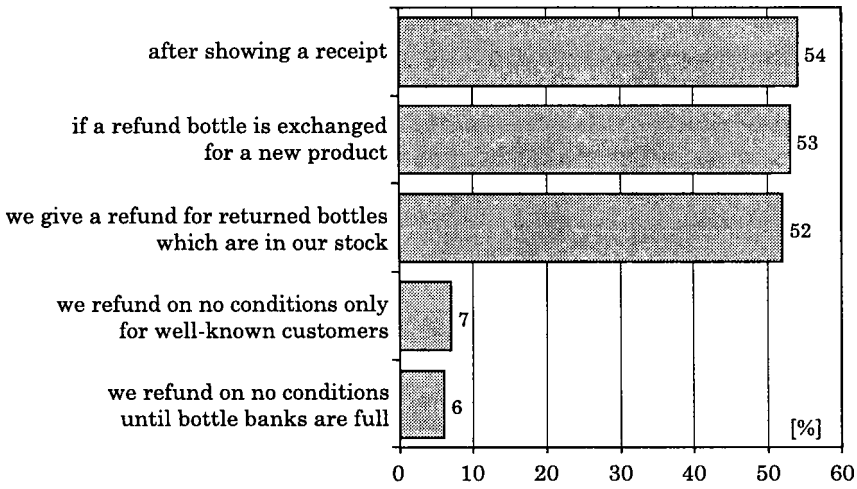

Fig. 5. On what conditions do you give a refund? (more answers possible)

was also possible to give some other answers. It was also possible in this question to give more than one answer.

Concerning the reverse logistic chain structure behind retailers, 89% of the shops researched retailers deliver refund bottles to wholesalers. The other 11% return those bottles to such organizations as logistic centres of discount nets, which deal with refund bottles flow to producers instead of each shop in the net.

Now the question aimed at finding some common obstacles in refund bottle flow will be presented (see Figure 6). The first three answers were suggested in the questionnaire as optional answers, and again it was possible to choose more than one answer. The main obstacle – a lack of warehousing area, mentioned by 52% of the shops – is strongly connected with the large number of small, local shops that were researched. Another significant obstacle are wholesalers, who deal with most of the shops regarding refund bottles and who only agree to take the amount of returned bottles equal to the amount of new products delivered by them in 38% of the shops. What is more, they also take only bottles of the same brand as the delivered products, and they refuse to take other bottles of the same product, but of a different brand. The third obstacle (not big enough demand) is probably connected with the low participation of water packaged in refund bottles in the total sale of mineral water products.

The people interviewed were asked at the end to give some proposals on how to solve the problems they face and improve the situation in the

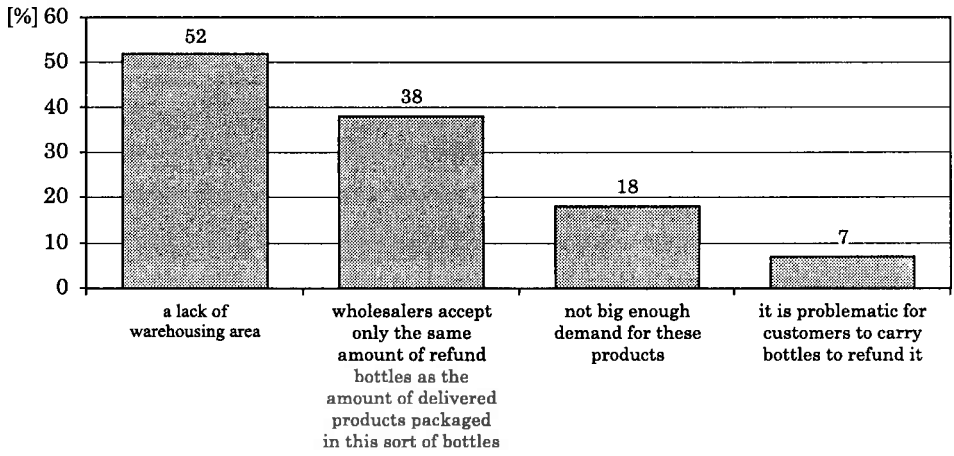

Fig. 6. What are the obstacles in selling products packaged in refund bottles? (more answers possible)

field of refund bottles (see Table 2). There were no answers suggested in this question. There was though one common idea – to organize separate places where a refund for used bottles would be given, and which would be prepared for this kind of activity. In other words, there is a common opinion, that shops should not be involved in the reverse logistic process regarding refund bottles. This opinion might be a result of various factors. Among others, the difficulties caused by wholesalers must be mentioned here. The next three proposals are connected with this issue. Apart from the limited amount and type of refund bottles that can be returned to the wholesaler (as mentioned above), retailers also face problems connected with the range of differences in bottle shapes (depending on the brand of a beer) and problems connected with different bottle banks from each producer (this problem applies also to breweries).

Table 2. What are your ideas for improvement of the situation in the field of refund bottles?

Improvement	% of sample
An obligation to refund bottles should be taken outside shops and given to separate organisations.	18
Wholesaler should accept all kinds and amounts of refund bottles.	8
Standardisation of all refund bottles of one type of product.	5
Standardisation of bottle banks.	3
Stop production of plastic packaging.	1
Establish wise legal regulations.	1

5. Conclusions

To sum up the research, two main conclusions can be distinguished:

1. A lack of legal regulations in the area of reverse logistics in relations between retailers and wholesalers can be observed.

There were two acts introduced at the beginning of 2002 in Poland, which were discussed in Section 3. The first of them focuses on producers (manufacturers), who place products together with their packaging on the market. The second act focuses on retailers, who sell products packaged in recyclable materials. A lack of clear regulation connected with wholesalers has caused a real "bottleneck" in the reverse logistics process of collecting refund bottles.

2. The popularity of products packaged in refund bottles refers only to beer products, as other products packaged in refund bottles have a marginal role in the market. This suggests that there is a need for building a wide framework of both economical and legal incentives for producers to provide other products packaged in refund packaging. Even the best legal solutions connected with reverse logistics of refund bottles will not be efficient, if there are just a few such products on the market.

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