



ORIGINAL PAPER

Reversible Vending: Features and World Practice

Michal Stojanov*

Abstract

The present article gives an overview of some important and specific features of reverse vending. We give examples of world practice in the management of packaging waste in different countries. In detail is discussed the concept of automatic processing of packaging waste, depositing of those packaging customers receive certain economic incentives. Thus the system which takes back products packaging allows sales agents actively to participate in the process of recovery, which functions as a mechanism for economic motivation of end users. The key role of reverse vending is in terms of the beneficial impact on the environment and targeted waste management of flows generated and recycled packaging waste. The purpose of this work is to examine the nature of the reverse vending technology and its application as a concept for sustainable management of waste from product packaging in the world, the role of the representative agent of exchange in this process and opportunities for future development and implementation in Bulgaria.

Keywords: vending, reversible vending, packaging waste.

* Associate Professor, Ph.d., University of Economics, Varna, Phone: 0035952660233, Email: michl_bg@yahoo.com.

Introduction

In the second decade of the 21st century traders are facing not only the traditional challenges of a competitive environment, but also even more sharply pronounced market insecurity. After more than two decades of market transformations and multiplied number of active market players, the concentration in consumer market under the conditions of stagnation in consumer demand shows that the successful expansion of a certain market player is mostly possible with the development of innovative trade concepts, considering also the development of its corporate social involvement.

Consumers' confidence was seriously undermined by the economic crisis which caused systemic insecurity for employees and decreased motivation of consumers to look out for better terms of exchange. In this process the search for profit is a continuous task which manifests itself in the search for information and the planning of purchases, at the point of sale and in the after-sale phase, in the use of the product and the utilization of unused, partly or incompletely used products. In this context the responsible consumer thinks every decision through concerning the allocation of resources by means of complex judgement of all possible benefits and downsides of acquiring it. The latter is in view of the commitment, sometimes also regulated legally, in respect of the consumer product after its complete use and the arising contingent obligation for it to be separated correctly from the total household waste and for its management as waste. Furthermore, "consumers play a key role in processing packaging and packaging waste and should therefore be adequately informed in order to adapt their behavior and attitude" (European Parliament and Council Directive 94/62/EC, 1994: 240). Reverse vending is a concept by which a technological solution is created which offers the possibility to restore resources in the context of sustainable development.

The aim of this paper is to examine the nature of the technology of reverse vending and its application as a concept for sustainable management of waste from product packaging around the world, the role of the representative agent of exchange in this process and the possibilities for further improvement and implementation in Bulgaria.

The reversible vending concept

The resource limitations presuppose the growing significance of utilization and recycling technologies. And not only in respect of treating waste products, but mainly in the so-called multiple resource recovery. The most efficient way of recovering and reusing is found in respect of the management and utilization and reverse flows of product packaging. In this process a key role is played by the representative agent of exchange who contributes to the relationships and the connection between production and consumption to the greatest extent. Traders fulfill a key function in the realization of most consumer products and as part of their activity they also perform a number of functions in favour of producers. One of the tasks which traders fulfill is related to the redemption of reusable packaging. This process may be extremely labour-intensive, and at that with a little or almost no economic benefit for the exchange agent or the specialized utilization agent. The latter has been defined in Bulgarian legislation as "an organization which is a legal entity registered under the Commercial Act or in accordance with their respective national legislation, which does not distribute profit and which manages and/or independently performs the activities of separate collection, recycling and utilization of mass waste" (Waste Management Law, 2014). As a result, in homogeneous and subject to standardization working processes the use of automated technologies is gaining ground. The use of vending machines today is widely accepted and implemented in respect of a

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very wide range of products and services. Automation stands out with a multitude of advantages, but the major ones are related to the economy of resources, mostly in respect of labour expenditure.

A key point in the implementation of reverse vending technology is the process automation which reduces the need for human involvement. Furthermore, it allows for a greater portion of operations from optical recognition or barcode scanning of the returned product to its preparation for further recycling to be performed at the very redemption centre – sorting, reducing the volume of certain types of packaging (paper, plastic and metal), mode of controlled safety of operators and hygiene at the place of exchange. Therefore modern vending machines are a suitable technological solution, because it allows for the automatic servicing and utilization of product packaging to be united in a single highly efficient technological solution. One descriptive definition of reverse vending machine is “a device designed properly to identify and process empty beverage containers and provide a means for a deposit refund on returnable containers” (Reverse vending machine antifraud act, 2008: 2). The concept is patented by Tomra Systems ASA under the brief description of machine constructed to “receives, handles, sorts, and stores returnable items or objects” (Saether, 2010: 1). The invention of reverse vending machine is dedicated to the search of cost efficient, simple and space saving technology which effectively performs environmental and economical tasks. So in developed countries the concept of reverse vending is spreading widely, since consumers themselves perform the operations related to the service of returning the used product packaging. By means of their deposition for reuse, consumers to a great extent contribute to the closing of the lifecycle of the respective product and at that with a clearly defined economic benefit for themselves. It is an expression of the refunded deposit which the consumer gets with the return of the product packaging. Since the system has been developed on the principle of “the right of the redeemer,” which means that regardless of who bought the product, its packaging may deliver economic benefit for the same person or another. This indicates that the technology of reverse vending stimulates responsible behavior of our consumer society in respect of the environment.

The economic benefit, of course, is not only for the end consumer, but it can also be created for the rest of the players and mostly for the producer who has invested their own resource in the creation of durable product packaging. Compared to disposable packaging, reusable packaging has a higher value, but also durability, which allows for the initial higher investment distributed in the repeated cycle of their use to be divided equally and even if at some point or after a certain cycle of reuse to become more profitable economically. The monetary compensation doesn't have to be materialized in the form of money or commodity credit, it may also be presented as a voucher for goods, voucher for using popular services, tickets, coupons, etc. In this manner the prize for recycling is wide-ranging personal motivation. The printed vouchers from reverse vending machine introduce original incentive and promotional schemes part of retailer marketing program. They can be exchanged for other products and allow retention of resources within a turnover of retailer. Thereby the agent of exchange can derive an economic benefit both from deposited packaging and from the additional sales of products purchased with vouchers provided to customers. In Scotland the *Recycle and Reward* Initiative focuses not only on the possibility to receive a stimulus for the returned product packaging, but also on the useful effect of this action in respect of recycling and its ecological effects. The programme was piloted in the beginning of 2013 by means of eight different compensation schemes and is aimed not only at changing attitude to waste

product packaging, but also at discovering the most appropriate mechanism for stimuli such as vouchers, charity donations, deposit recovery, etc. (Cash for trash could tackle litter, 2013).

In business practice there are two the most common models for reverse vending machine operation: The first is conventional sale model, where the reverse automated machine is purchased by the retailer and as owner of it he collects the disposed recycled products compensates the depositors and later he gets monetary compensation or reimbursement of deposit from the fillers, bottlers, importers or recyclers. The second is lease model which is very flexible, allowing central recycling organization to maintain ownership on reverse vending machines. That provides many opportunities for placement and installation the machines in convenient public places. This approach increases the capacity to collect product packaging for its future recycling or reusing in many locations. This means that the convenience of operation “round-the-clock and seven days a week could lead to automatic vending machines being used not only as a standby when traditional locations are closed, but also during normal working time” (Molinari, 1964: 8).

Along with the enumerated advantages of automated reverse vending technology, there are also advantages in respect of the mode of operation which can be around-the-clock (0-24 hours) on all days of the week and in this manner it can comply fully and be in line with the consumer and their time management. In case of reaching a certain degree of fullness, the remote monitoring of the reverse vending machines can execute a command and submit early information or real-time information about the need for replacing, no available capacity, repairs or the need for the respective technical maintenance, etc. So the reverse vending technology can be implemented in practice for “collecting for reuse”, but also for “collecting for recycling.” The first type of operations is related to the automation of the process responsible for collecting certain types of product packaging which have been “conceived and designed to accomplish within its life cycle a minimum number of trips or rotations, is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market enabling the packaging to be refilled” (European Parliament and Council Directive 94/62/EC, 1994: 241).

The second type of automated activities is related to the collection of product packaging for recycling which through “the reprocessing in a production process of the waste materials for the original purpose or for other purposes” (European Parliament and Council Directive 94/62/EC, 1994: 241). Regardless of the subsequent possibility to directly reuse or the need for reprocessing, the major role of reverse vending is the automation of the process of redeeming and the implementation of economic instruments for stimulating the interest of the participants in this process. Thus the system of returning deposits is “a specific type of extended responsibility of the producer, where part of the responsibility is transferred over to the end consumer... , who is offered economic benefits for collecting used packaging” (Kjær et al., 2012: 17). Moreover, “the major limitations usually associated with automatic vending can be classified as mechanical (or technological) and consumer acceptance” (Morris, 1968: 31). However, in the current conditions of continuous technological innovations, most of the physical or mechanical limitations of the automated service can be easily overcome in the foreseeable future. While the restrictions relating to the adoption of consumers can be overcome by the essential concept of reverse vending, which is aimed to help the environmental improving and resource renewable.

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Viewing the world practice

At international level, such a mechanism for packaging waste management has been functioning in Sweden since 1984 for metal product packaging (cans) which was expanded in 1984, and for plastic packages (bottles), where to the end price of the product a minimal value deposit is added and it could not influence the consumption preferences but is enough to motivate the consumer to return the product packaging and to receive back the deposit paid when acquiring it. In this manner the waste management scheme for this product packaging reaches up to 85% of recycling and ensures that companies have a suitable resource for utilizing packaging waste. The success of the Returpack model has been predetermined by the two operator companies which utilize product packaging made of metal and plastic. They are owned by the Swedish Trade Associations of Brewers, soft drink, cider and bottled water producers (50% of ownership), the Swedish association of retailers (25% of ownership) and the Swedish trade association which covers the segment of FMCG (25% of ownership) (Returpack AB). This formulates the orientation and possibility to combine the public and the private business interests in favour of the social-economic development and in fulfillment of the mission of the Swedish Environmental Protection Agency, according to which the main goal is 90% of all metal and plastic product packaging to be recycled.

A similar scheme has also been developed in Denmark (Dansk Retursystem A/S is a private non-profit organization which holds the exclusive right to operate through the Danish deposit and utilization system) (further see: Dansk Retursystem A/S), where in 2013 consumers deposited 950 million packages or about 3 million a day returned in more than 16 700 points, of which 3 000 is the number of reverse vending machines located in 2 400 points of sale spread across the entire country, which generate 85% of the total utilized volume of waste from product packaging, for which trade operators have received 26.7 million euro as consideration for separating and preparing packaging for utilization (Facts and figures, 2014).

In Norway, before 2014 *Norsk Resirk*, now *Infinitum*, collected 445 billion metal and 410 billion plastic packages in 2013 marked by a deposit sticker, which are returned through the 3,700 deposit machines capable of recognizing almost 2,600 foreign product packages, which makes it possible for the level of utilization to reach 96% with a volume of newly created resources amounting to 6,639 tonnes aluminum and 12,946 tonnes of plastic (Deposit-facts of 2013).

Similar more developed or simplified systems have also been imposed through legislation in other countries – Australia, Canada, Croatia, Estonia, Finland, Germany, Hungary, the Netherlands, New Zealand, Switzerland, and in some parts of the USA. This concept of utilizing waste from product packaging not only closes the resource cycle, but also contributes to economic growth by creating more industrial production, jobs, etc., for example – in 1970 a similar scheme functioned in Adelaide (Australia). The objective of market-based instruments for environmental management is based “on the premise that these instruments offer the potential to achieve efficiency gains over more traditional regulatory instruments” (Whitten, 2004: 1), by “providing incentives for the greatest reductions in pollution by those firms that can achieve these reductions most cheaply” (Stavins, 2001: 2).

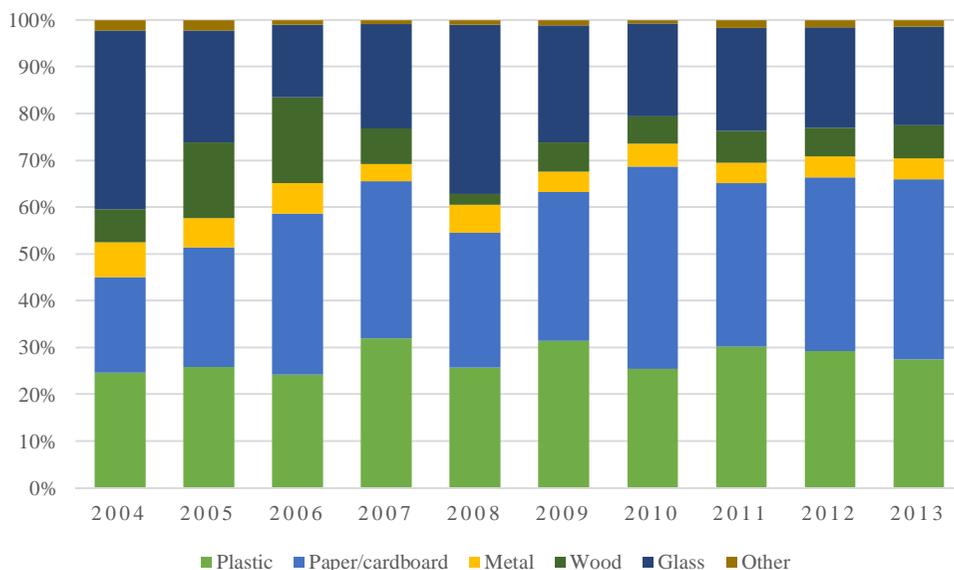
International experience clearly shows the commitment not only of producers in the applied model of extended responsibility of the producer since “the polluter pays”, but also of the state to sustainable and longlasting solution of the problems with the utilization of waste and mainly of plastic and metal packaging. According the Global Reverse

Vending Market: Trends and Opportunities (2014-2019) report the market of RVM is highly concentrated, the top largest players are *Tomra*, *Wincor* and *Envipco* (Global Reverse Vending Machine (RVM) Market: Trends and Opportunities (2014-2019), 2015). The *Tomra* company dominates with 65% market share (Tomra: Investor presentation, 2014: 13).

Study of waste management in Bulgaria

The findings of the extensive study of NSI covering all major packaging and packaged goods producers revealed that in the years between 2004 and 2013 we had a general increase in generated packaging waste from 296,756 tonnes in 2004 to 362,043 tonnes in 2014 or a relative change of 122% at an average annual growth rate of 2.2% (see Fig. 1). In the structure of created packaging waste based on the criterion of distinguishing by basic materials at the beginning of the period in 2004 glass waste dominated (38%), and by the end of the period in 2013 paper/cardboard waste prevailed (37%) which increased its volume from 221.6% (from 60,584 t in 2004 to 134,270 t in 2013). We could search for the reasons for such a change in the mass use of paper/cardboard packaging for consumer goods for primary, group or secondary, and transport or tertiary packaging. At that the use of paper secondary and tertiary packaging at the end of the realization channel of the product increases the chances for its complete utilization by creating clean fractions from this waste at the agent of the end exchange (National Statistics Institute, Sofia, 2015, http://www.nsi.bg/sites/default/files/files/data/timeseries/Ecology_11.1.xls).

Figure 1. Generated packaging waste in Bulgaria annual data for period 2004-2013 (tonnes)



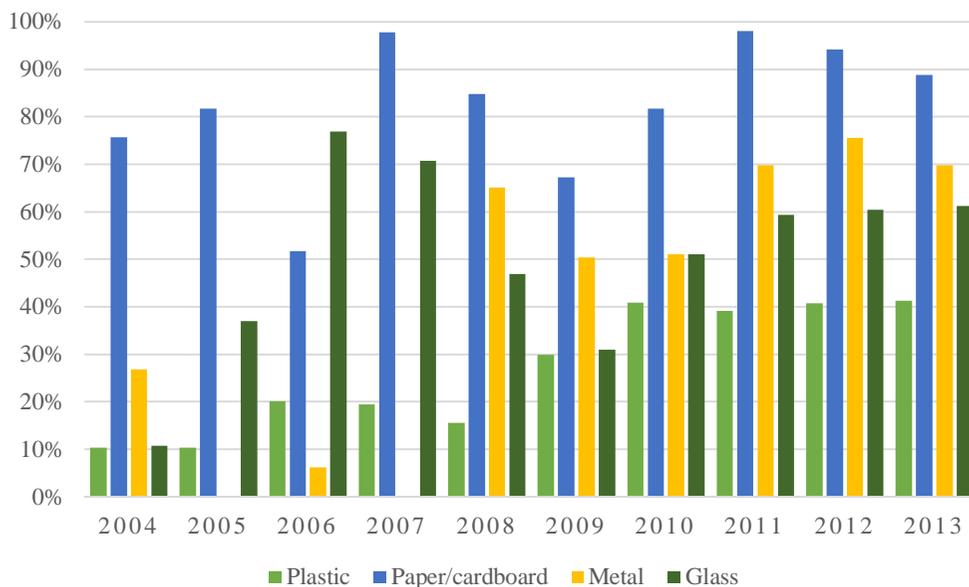
Source: National Statistical Institute, Sofia, 2015.

As to the degree of achieved level of waste recycling in Bulgaria, the average for the 2004-2013 period oscillates around being half of the total amount of waste generated. Over the years this level kept rising, since in 2004 it was 24.1%, and in 2013 it reached the significant 63.5%, although its highest value of 66.5% total amount of recycled packaging

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waste was reached in 2012. Nevertheless, in respect of packaging waste the relative share of recycling reaches higher values – for example, for paper/cardboard we have 82.2% average recyclability with the record significant 98.1% achieved in 2011 (see Fig. 2). In comparative terms, high values in various periods were also reached by glass – 76.9% in 2006, metal packaging waste – 75.6% in 2012, and plastic – 41.3% in 2013 (National Statistics Institute, Sofia, 2015, http://www.nsi.bg/sites/default/files/files/data/timeseries/Ecology_11.2.xls).

Figure 2. Relative share of recycled packaging waste in generated packaging waste in Bulgaria annual data for the period 2004-2013



Source: National Statistical Institute, Sofia, 2015.

The sensible use of resources allows for the creation of products which in the post-use phase provide options for extracting additional economic benefit by utilizing their waste and mostly in the reuse of product packaging. This contributes both to the general decrease of waste discharged in nature and to the more efficient utilization of resources by all participants. The beneficial effects are felt by the business too which can economize production operational costs. These effects in respect of ecology are spreading over the entire society and the environment.

We have witnessed a notable change in consumer behavior over the last decennia, strongly influenced by mass culture and the availability of more information. Owing to them, today the consumer understands their significant position in respect of the consumption of products which have the proper effects on their life, the life of others and mostly in respect of future generations. The intelligent buyer takes not only the right decisions at the point of sale, where they look out for the optimal economic benefit from their resource, but they also dispose of the information capacity required to plan the future consequences of their decisions.

Application

Reverse vending is also the answer to the trade business commitment in respect of the sustainable development concept. Furthermore, considering that the economic benefit for all participants has been proven, the pronounced support for its wide use is also growing. The technology of reverse vending can be implemented for an overwhelmingly large range of product packaging types (glass, paper, plastic, etc.), provided that they can be standardized and mainly for packaging received as products of mass production. In addition, as objects of utilization it is also possible to include other mass products with extremely high need for proper storage and utilization. Such are for instance electrical batteries, electrical lamps, and in view of the progressive reduction of the useful life of modern information and communication technologies (mobile phones, chargers), other components and products with high risk for the environment or possibility to utilize. In this manner the producer's or importer's responsibility may be regulated legally with the requirement to include a deposit for each product packaging released on the market. This will allow for the simultaneous stimulation of the interest of all market players in the complex care, and the economic motivation in respect of the commitment in product packaging waste management. Another key point is that retailer should take back the types of returned packaging that they sell, regardless of whether they have been previously sold as part of their stock assortment in their commercial network. This means the in-store collecting point takes back and store packaging waste sold in the retail chains of their competitors, that aspect is mainly driven by the interest provided by their suppliers. Innovative development of vending technology allows operators of the modern reverse vending machines "with the opportunity to further encourage consumers to choose the convenience of a vending machine over a high street shop" (Reverse vending machines help Europeans recycle, 2007: 18). They are further competitive tool because they can be more efficient than manual sorting and moreover machines attract new consumers. The latter is caused by the fact that "the recycling machine can help give retailers an image of being environmentally conscious and dedicated to customer service" (Reverse vending machines' turn recycling into profit for retailers, 1983: 4). Companies that have taken a strategic decision to use the deposit product packaging clearly demonstrate its commitment to environmental protection and business commitment to efficient use of natural resources. In same context the reverse machines located in public usually apply a universal approach for collection of packaging waste of all types (shape, volume, outer diameter and height) and serves the interest of various fillers, bottlers or importers which place different products on the market. And finally the waste collector organizations can use the reverse vending technology to gather all type of product packages who can be later recycled.

There exists the hybrid option of one and the same vending machine servicing both the process of selling ready products and tracing the waste or packaging returned for utilization. In this manner by means of a single machine a complex solution is created which ensures the collection of used product packaging by paying direct stimuli to consumers.

With the advantages of reverse vending thus described, there are also some disadvantages worth mentioning. Some of the most significant ones are related to the inability to cover a wide variety of types of product packaging of one and the same material, which necessitates reverse vending machines to be limited to the collection of a precisely defined set or more exactly to be specialized (for instance, for beer or soft drink bottles, etc.) Furthermore, we must point out that the placement of reverse vending machines may be further from the place where this packaging is located, which

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provisionally complicates the consumer's commitment to return it for utilization, since this may be related to extra transport costs and not to mention the time required to perform this activity.

Conclusions

The economic crisis and the growing awareness of ecological issues point towards the alarming degree in which national economies are interdependent in the context of globalization. The processes of transformation in the beginning of the 20s of the XX century intensified by the wave of globalization move the focus onto the changing consumer and the awareness of their responsibility for the future of the planet. Today reverse vending is the adequate response of the client-oriented and responsible behavior of business agents, which equally stimulates the interest of participants in the technology for utilizing product packaging.

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