

Anna STRONCZEK • Łukasz WAKSMUNDZKI

MSGO-ECOTECH SYSTEM AS A TOOL TO SUPPORT ENTERPRISES IN THE IMPLEMENTATION OF EXTENDED PRODUCER RESPONSIBILITY (EPR)

Anna **Stronczerk**, PhD (ORCID 0000-0001-9343-936X) – *AGH University of Science and Technology*

Łukasz **Waksmundzki**, MSc Eng. – *EcoTech System*

Correspondence address:

Gramatyka Street 10, 30-067, Kraków, Poland

e-mail: astronc@zarz.agh.edu.pl

ABSTRACT: The purpose of this paper is to demonstrate the possibilities of the EcoTech System's solution to support the implementation of the assumptions of the Extended Producer Responsibility. The research methods used to accomplish this goal are literature studies and case study – "MSGO – EcoTech System". EU standards impose a high level of recovery and recycling on the Member States. It is clear that, in order to fulfil the sense of social justice, those who directly contributed to this situation, i.e. consumers and producers, should also participate in this process. However, manufacturers need tools to monitor the efficiency and effectiveness of their operations. The presented "MSGO – EcoTech System" is based on the incentives scheme. The basis is the assumption that companies which declare CSR in their business strategy will join and will participate in the creation of new incentives for citizens. The example confirms that there are modern solutions which can support companies in the implementation of EPR. The obtained results provide guidelines for companies seeking solutions in this area.

KEY WORDS: Extended Producer Responsibility, EPR, waste, EcoTech System

Introduction

The growing world population is accompanied by higher demand for food and other goods. In turn, the increased production of food products leads to an increased amount of packaging waste, such as bottles, boxes and foil (Gómez et al., 2009). The problem of packaging is, first of all, a burden for the environment and a disturbance in sustainable development. Waste perceived as “any substance or object which the holder discards or intends or is required to discard” (Article 3 of Directive 2008/98/EC) accompanies us in everyday life and, as many people imagine, is unavoidable. We create it in our immediate neighbourhood, sometimes even without noticing this fact. In addition, we are rarely aware of the amount of waste we produce. The primary sources of generated municipal waste related to human activity are mainly households and public utility facilities. Collection and accumulation of waste at the place of its generation is the first stage in the system for its removal and neutralization. The most important element of a properly designed municipal waste management system is waste segregation. This segregation may be performed in two ways: through a selective collection system “at source” (in households and other places of human residence) or through secondary segregation.

The European Commission has obliged the Member States to standardize waste management as well as implement the waste handling hierarchy by transposing it to the national legislation (2008/98/EC). This means preference of waste generation prevention, reuse and recycling over any other recovery and neutralization processes. Target levels of packaging waste recycling have also been set.

EU standards impose high recovery and recycling levels on the Member States. The realization of the assumed levels is not only a task of the municipality, or more broadly: the Member States. It is obvious that, in order to satisfy a sense of social justice, also those who directly contributed to the resulting situation should participate in this process, i.e. consumers and manufacturers. The Extended Producer Responsibility (EPR) postulate has been constructed in this spirit. This idea is intensively promoted especially in the context of a circular economy.

Minimum requirements have also been established for all Extended Producer Responsibility systems. Manufacturers of goods covered by these systems must take responsibility for the management of the waste stage for their products: “In addition, obligatory extended producer responsibility systems have also been introduced for all packaging, as reflected in the statement (item 20 of preamble 2018/852/EC). Producers of products should cover the costs necessary to meet the waste management targets and other

targets and objectives, including on waste prevention, defined for the relevant extended producer responsibility scheme” (UE 2018/851/EC): „As the amount and type of packaging used generally depends on choices made by the producer rather than the consumer, extended producer responsibility schemes should be established.”

The purpose of this paper is to demonstrate possibilities of the “Motivational Waste Management System” by EcoTech System as a support tool in implementing the assumptions of Extended Producer Responsibility.

Literature review

The common denominator for the Extended Producer Responsibility (EPR) definitions that appear in the literature and normative acts is its perception as an environmental protection strategy/policy under which the manufacturer’s responsibility for the product is extended to the whole life cycle of this product¹.

A complex EPR definition was proposed by T. Lindhqvist², for whom: „Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product. Producer Responsibility is implemented through administrative, economic and informative instruments. The composition of these instruments determines the precise form of the Extended Producer Responsibility” (Lindhqvist, 2000, pp. 37-38). This author indicates several aspects of responsibility: legal, economic, physical, informational. In doing so, EPR legislation, in principle, shifts the responsibility for, and costs of, negative environmental externalities of products from taxpayers to producers, consistent with the polluter pays principle.

In the EU law, EPR was introduced in the Waste Framework Directive (2008/98/EC), although only the 2018 amendment introduces a definition

¹ In addition, the Organization for Economic Cooperation and Development (OECD) published several reports on EPR policies such as: “Extended Producer Responsibility: A Guidance Manual for Governments” (OECD, 2001), “Economic Aspects of Extended Producer Responsibility” (OECD, 2004) and “Analytical Framework for Evaluating the Costs and Benefits of Extended Producer Responsibility Programmes” (OECD, 2005), which are available at: <https://www.oecd.org/env/tools-evaluation/extended-producerresponsibility.htm>.

² In 1990, he presented the formal definition of EPR in a report for the Ministry of Environment of Sweden, and it seems that this was the first definition-based approach to this strategy. The inspiration for this definition should be sought in the Swedish 1975 draft Act on Waste Recovery and Management.

of Article 3 p. 21 of the mentioned Directive stating that: ‘„extended producer responsibility scheme” means a set of measures taken by the Member States to ensure that producers of products bear financial responsibility or financial and organisational responsibility for the management of the waste stage of a product’s life cycle’ (2018/851/EC. Clarifying that this responsibility includes: (item 14 of the preamble 2018/851/EC) ‘separate collection, sorting and treatment operations. That obligation can also include organisational responsibility and a responsibility to contribute to waste prevention and to the reusability and recyclability of products. Producers of products can fulfil the obligations of the extended producer responsibility scheme individually or collectively.’ The responsibility imposed can be individual, where a producer takes responsibility for its own products, or collective, where producers in the same product group pay a variable or fixed fee for participation in a Producer Responsibility Organisation (Bio Intelligence Service, 2014).

The Extended Producer Responsibility principle pursues the following waste management objectives (Rosiak-Tatulińska, 2011; Kempa, 1983):

- 1) maximum reduction in the quantities of municipal waste during any business operations and in people’s households,
- 2) immediate incorporation of production residues again into production,
- 3) recovery of raw materials from collected waste,
- 4) application of waste neutralization processes,
- 5) waste storage in an ordered manner with a guaranteed minimum burden for the environment.

The main purpose of this principle is to apply legal instruments encouraging producers to take actions that will prevent waste generation, reduce the material and energy consumption level at every stage of the product life cycle and offering incentives for introducing changes in the product design phase and the manufacturing phase. In a broad perspective, the extended producer responsibility principle is combined with the principle of material producer responsibility for the product (Karpus, 2014). The final aim of EPR is to address issues related to resource consumption and growing waste generation, a key rationale being that producers are best suited to make the required changes to achieve a reduction in the environmental, social and economic impacts of their products.

The EU legislator determined the instruments that can be used in the process of implementing EPR (table 1). Still, prescriptive instruments may only be used in the life cycle phase when the product has already become waste. In the product life cycle phases that precede generation of waste, the instruments can assume incentives to reduce adverse impacts on the environment (Piontek, 2018). And it is the incentives system the model proposed by EcoTech System is based on.

Table 1. Typologies of EPR policy instruments

Typologies of instruments	Policy Instruments
Administrative	landfill and incineration bans material restrictions eco-design requirements related to reuse/recycling, minimum recycled material content standards source separation/collection requirements waste prevention requirements waste prevention targets collection targets landfill/incineration diversion targets reuse targets recycling targets recovery targets
Administrative/economic	producer take-back requirements
Economic/Market Based	deposit-refund systems producer responsibility taxes on virgin materials taxes on hazardous substances landfill and incineration taxes/charges waste disposal taxes/fees/charges recycling fees/charges product taxes/charges tradable recycling credits
Informative	information provision requirements, eco-labels

Source: Saki, 2011.

Proposed support tool for EPR Conceptual assumptions of MSGO-EcoTech System

The amount of municipal waste generated in Poland in 2017 reaches 312 kg per citizen, which together gives almost 12 million tons of waste (GUS, Environmental protection 2018). Packaging waste accounts for a substantial part of this quantity. According to a report prepared to the order of Zero Waste Europe, only 45% (by weight) of the packaging waste manufactured in European cities is managed within ROP systems, which is only 18% of the total mass of generated municipal waste (Zero Waste Europe, 2017, p. 9).

The EPR idea has also been extended to responsibility for packaging introduced into production. It is the implementation of the EPR assumptions in the area of packaging that requires relevant support.

EcoTech System starts a new service on the Polish market for effective recycling of packaging waste, called "Motivational Waste Management System by EcoTech System" – *Motywacyjny System Gospodarki Odpadami EcoTech System* (MSGO-EcoTech System). The proposed solution is an innovation of process nature, the aim of which is to ensure an effective and pro-social way of waste segregation causing a change in behaviour and habits of residents and common education with the use of motivational factors. The innovation for effective recycling of packaging waste at "source" supplements the current segregation methods. The novelty consists of rewarding segregation and activating people for its proper implementation. MSGO EcoTech System is also an innovation in the product aspect, utilizing two elements: IT system

(EcoTech System Platform) and reverse vending machine, the so-called recyclomats. Recyclomat and MSGO Eco-Tech System are the trade mark of EcoTech System.

The central element of the system is EcoTech System Platform – the IT system for managing, counting, monitoring, and managing the whole flow of information and recyclable materials in real-time. Recyclomats are synchronized with the central platform and the mobile application, allowing the users to use the network of machines installed anywhere. Recyclomats installed in public places should ensure an automatic system for direct waste segregation, offering a motivational discount program in return – e.g. discount coupons for use in retail and service outlets of business partners associated on the EcoTech System Platform (figure 1).

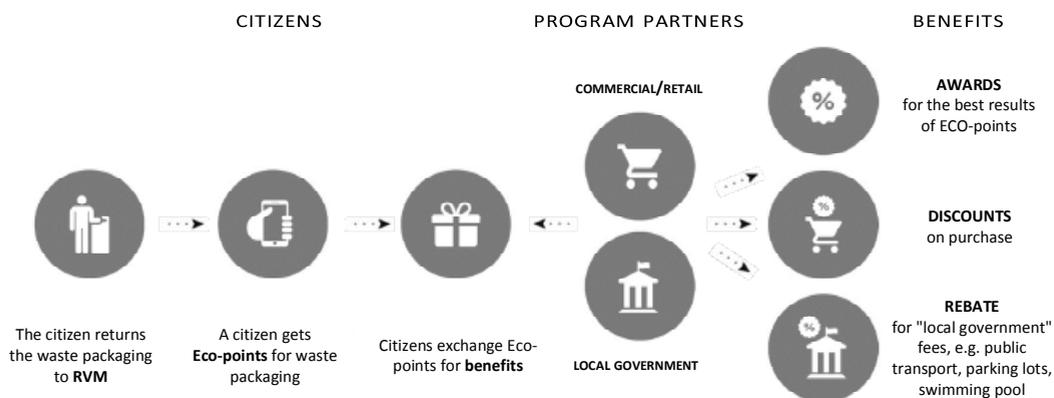


Figure 1. MSGO-EcoTech System functioning principle

Source: EcoTech System's internal materials.

Kunz, Mayers, and Wassenhove (2018, p. 53) included the following in the EPR stakeholder groups:

- Producers.
- PROs – Producer Responsibility Organizations (organize the collection, treatment, and recycling activities under EPR on behalf of producers, sts by charging a fee to the producers they represent). EPR on behalf of producers. 60 PROs cover their operating costs by charging a fee to the producers they represent.
- Waste operators – Waste operators, carry out waste collection, transport, treatment, and recycling of waste on behalf of PROs. This stakeholder group is commonly referred to as “recyclers”.

- National authorities – are the regulatory bodies responsible for transposing EU directives into national legislation and ensuring targets imposed by the directives are achieved.
- Municipalities – are local authorities providing and organizing waste collection activities within their area.
- Trade associations – all professional associations that represent a given sector.
- Clearing houses – Clearing houses are organizations created by national authorities to register producers and collect data on their sales volumes. They also compile information on waste collection from PROs and determine the obligations for each producer.

It should be highlighted that the above indicated groups of stakeholders were separated within institutional solutions being in force in the United States, where the quoted authors conducted their research. “Clearing houses” have not been formed in the Polish reality.

The foundation for “MSGO-EcoTech System” is a synergy of all the model participants creating the so-called 4 x WIN strategy. The project beneficiaries are all the parties involved. And so:

- 1) citizens – motivation for segregation,
- 2) local government – achieving required recovery and recycling levels,
- 3) recycling industry – access to clean recyclable materials,
- 4) business partners – promotion by environmental protection, implementation of CSR assumptions.

As it can be easily noticed, the parties are the same as those indicated in the earlier deliberations as the EPR stakeholders.

Recyclomats installed in public places should ensure the automatic system for daily waste segregation, offering in return a motivational discount program – e.g. discount coupons for use in retail and service outlets of business partners associated on the EcoTech System Platform.

The reverse vending machines are connected with ECO-Wallet mobile application which should be launched before starting packaging waste segregation. In the next step, bottles or cans should be thrown into the machine slot, the individual QR code should be read from the phone, and the process should be continued until all waste is disposed of. The process ends with the calculation of ECO-points, which can be exchanged for various types of discounts (for example in public transport or in cinemas).

The collected points may be used in competition for prizes and exchanged for discounts in retail and service outlets of the business partners associated on the EcoTech System Platform. Thanks to this cooperation, business partners obtain not only new eco-customers, but have an opportunity to run their own advertising campaigns, promote a selected product group or determine

the discount level depending on the amount spent. The platform provides access to data and reports in real-time in the scope of the realized recovery and recycling levels in the given area, with a breakdown into the amount of raw material, type, weight and exact collection point. Thanks to this cooperation, business partners have an opportunity to run their own advertising campaigns, promote a selected product group or determine the discount level depending on the amount spent. The platform provides access to data and reports in real-time in the scope of the realized recovery and recycling levels in the given area, with a breakdown into the amount of raw material, type, weight and exact collection point (Waksmundzki, Stroncsek, 2018). The proposed solution, on the one hand, is compatible with the assumptions of the circular economy (figure 2) but, on the other hand, constitutes a tool supporting EPR (figure 3).

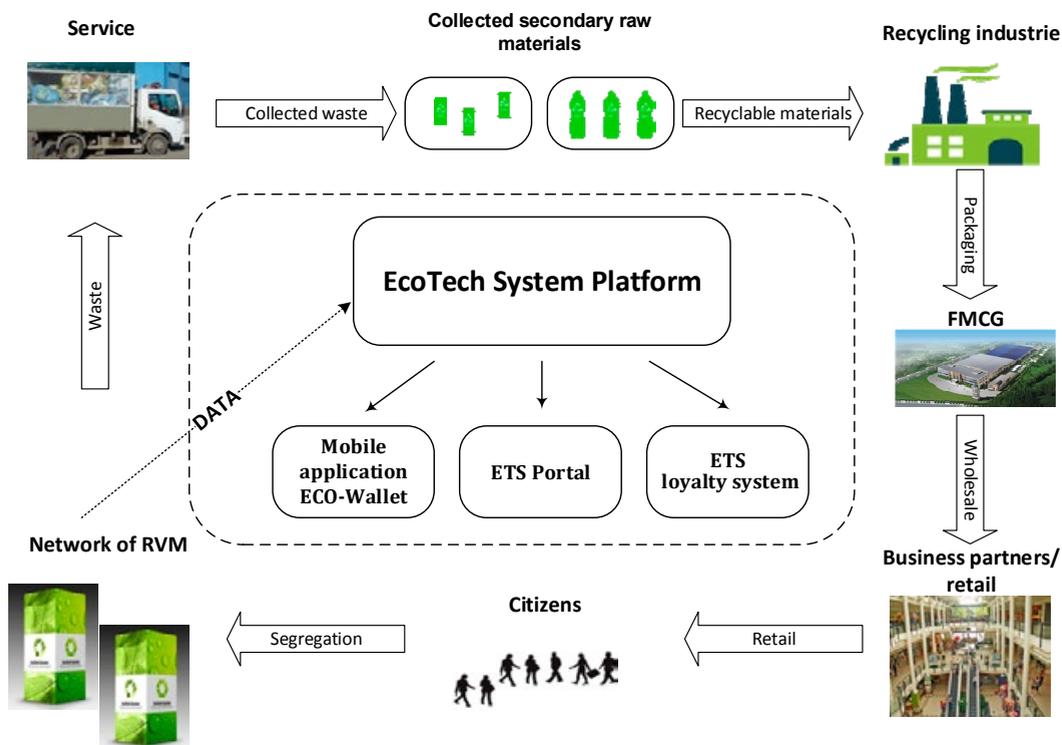


Figure 2. Circulation of waste/recycled material with the use of the EcoTech System Platform as a Circular Economy tool

Source: EcoTech System’s internal materials.

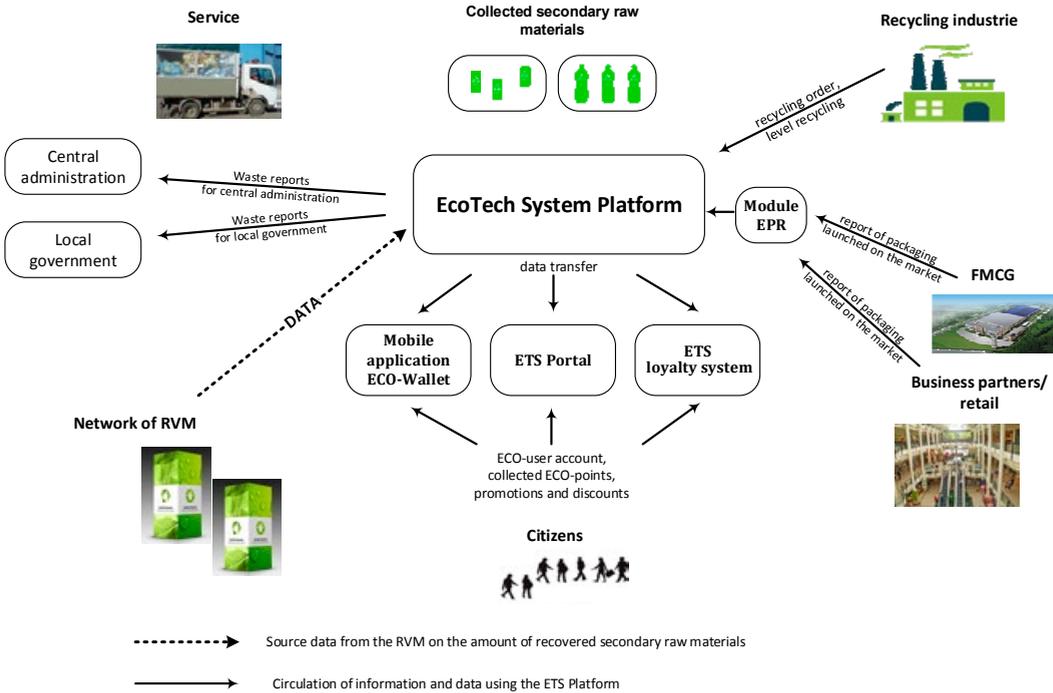


Figure 3. Circulation of information/data on the EcoTech System Platform as a tool supporting EPR

Source: EcoTech System’s internal materials.

MSGO-EcoTech System – Coca-Cola case study

An example of using MSGO to implement tasks from the EPR area is Coca-Cola’s action, taken as part of the global campaign: #neversettle. Coca-Cola Company’s ambitious goal until 2030 is to collect and transfer for recycling as much packaging as it hands over to the consumers, and that all marketed packages are composed of recycled material in at least 50 percent by 2030. It is not difficult to notice that the company’s strategy is shaped by EPR and Circular Economy. EPR aims to achieve environmental improvement throughout the product life cycle and has two primary environmental goals. The first is to encourage manufacturers to design resource-efficient and low-harmful products. The second is to ensure the effective collection of used products and environmentally friendly processing of collected products and better reuse and recycling. The foundation of the EPR approach is, therefore, to establish a feedback loop so that improvements in product design help optimize their environmental performance and minimize decommissioning

management costs. In this way, EPR is linked to both product design and mandatory policy goals, ensuring a link between product design and post-use processing, and between policy and implementation (Zero Waste Europe, 2017).

Under the project, 10 recyclomats will finally be installed within the capital city of Warsaw. In the first stage, 2 pieces of recyclomats were launched, and a system of incentives (reductions and discounts) was provided by 4 project partners: Costa Coffee, Multikino, Teatr Dramatyczny (Dramatic Theater) and Capitol Theater. The interest of residents in the modern way of segregation using the ECO-Wallet application and in collecting ECO-points exceeded optimistic forecasts. During the first two months, the ECO-Wallet application was downloaded by 9,630 users, 14,026 transactions were carried out, 147,964 pieces of packaging waste for recycling were collected (see table 2).

Table 2. Project data

registered users	7 643
registered transactions	14 026
installed applications including:	9630
• IOS	• 3 720
• Android	• 5 910
of collected waste including:	147 964 (100%)
• PET	• 89 196 (60.28%)
• ALU	• 41 338 (27.94%)
• glass	• 17 430 (11.78%)

Source: EcoTech System's internal materials.

The project lasted 8 weeks. In that time, a registered user used a recyclomat on average 1.8 times, providing 19.35 pieces of waste in the transactions. PET packages were disposed of most frequently (there were 11.67 of them per transaction). The largest registered transaction (2019/08/25; 09:00:25) for a total of 328 returned packages was carried out by a person who visited the recyclomat 4 times in total.

At the moment, works are underway in the area of the module recognizing the packaging type, in order to identify the producer that it was marketed by, in the event that there is no label.

It turned out that the incentives system proposed by the partners was sufficient for the residents to segregate waste using recyclomats on a regular basis. The project confirmed that the residents want to be environmentally friendly, want to segregate waste and want to create EcoSmart City.

In addition, in the first week after the project launch, the ECO-Wallet application (in polish called: ECO-Portfel) was one of the three most frequently downloaded (popular) apps on play.google.com and appstore.com.

Conclusions

The realization of the circular economy model requires the extended producer liability systems to be shaped and developed on the basis of a properly defined social interest. As rightly noticed by W. Piontek (2018), this process cannot be limited solely to the transposition of EU directives into the national law, or be conducted under the influence of lobbying institutions representing industry interests. Therefore, the introduction of incentives systems within EPR should be considered. A tool supporting such a policy can be the proposed MSGO-EcoTech System model. The more so that it is a powerful tool of multi-dimensional information management (Big Data, BI, IoT, AI, predictive analysis)³.

For the effectiveness of the project, it is important to prepare a wide range of incentives and rewards. The innovation assumes that companies which declare CSR in their business strategy can join by participating in an incentive scheme for citizens. At the same time, it should be believed that the legislator will notice that participation in such a voluntary program is a realistic way of fulfilling the obligations from extended producer responsibility.

The research by Elinor Ostrom, a Noble Prize winner in economics, on effective management of common goods proved that surprisingly many people, institutions and organizations voluntarily take common action for nature and environmental protection (Ostrom, 2010). She also denied the traditional views that desirable goals in the field of environmental protection can be achieved only with orders and prohibitions (Poteete et al., 2010).

Therefore, we should remember that manufacturers do not necessarily need legal regulations to demonstrate their willingness to take action for environmental protection. They often pursue such initiatives without any compulsion from a normative act, within the implemented CSR strategy. However, manufacturers need tools for monitoring the effectiveness and efficiency of their actions.

Presented solution confirms there is a modern way for companies to support EPR obligation. Received results can be used as best practises for companies which are looking for any solution in this area.

The strengthening and expansion of producer-led program development and autonomy in EPR policy are arguably necessary to truly fulfil the intent of integration of EPR into the business model of firms.

³ This issue goes beyond the scope of this study.

It is necessary to consider conducting field research in Polish companies using the presented system. The research will determine the impact of the innovation on the realization of assumed recovery levels by company.

Acknowledgements

The publication is financed by the AGH University of Science and Technology in Krakow (subsidy for maintaining the research potential), contract no: 16/16.200.396.

The contribution of the authors

Anna Stroncsek – 60%

Łukasz Waksmundzki – 40%

Literature

- Bio Intelligence Service, 2014. Development of Guidance on Extended Producer Responsibility (EPR), http://ec.europa.eu/environment/waste/pdf/target_review/Guidance%20on%20EPR%20-%20Final%20Report.pdf [06-12-2019].
- Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (Text with EEA relevance), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32018L0851> [06-12-2019].
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098> [06-12-2019].
- Gomez, G. et al., 2009. Seasonal characterization of municipal solid waste (MSW) in the city of Chihuahua, Mexico. *Waste Management*, 29(7), 2018-2024, <http://dx.doi.org/10.1016/j.wasman.2009.02.006>.
- GUS, 2018. *Ochrona środowiska*, Warszawa.
- Karpus, K., 2014. „Rozszerzona odpowiedzialność producenta” jako instytucja prawna prawa o odpadach. In: Rakoczy, B., Szalewska, M., Karpus, K. (Eds.), *Prawne aspekty gospodarowania zasobami środowiska: oddziaływanie na zasoby środowiska. Towarzystwo Naukowe Organizacji i Kierownictwa” Dom Organizatora*, Toruń, 239-254.
- Kempa, E.S., 1983. *Gospodarka odpadami miejskimi*. Arkady, Warszawa.
- Kunz, N., Mayers, K., Van Wassenhove, L.N., 2018. Stakeholder views on extended producer responsibility and the circular economy. *California Management Review*, 60(3), 45-70.
- Lindhqvist, T., 2000. *Extended Producer Responsibility in Cleaner Production. Policy Principle to Promote Environmental Improvements of Product Systems*, Lund University.

- OECD, 2001. *Extended Producer Responsibility: A Guidance Manual for Governments*, Organisation for Economic Co-operation and Development. OECD Publishing, Paris.
- OECD, 2004. *Economic Aspects of Extended Producer Responsibility*, Organisation for Economic Co-operation and Development. OECD Publishing, Paris.
- OECD, 2005. *Analytical framework for evaluating the costs and benefits of extended producer responsibility programmes*, OECD Papers ENV. EPOC/WGWPR 2005, 6. OECD Publishing, Paris.
- Ostrom, E., 2010. *A Multi-Scale Approach to Coping with Climate Change And Other collective Action Problems*. *Solutions*, 1(1), 27-36.
- Piontek, W., 2018. *Implementacja rozszerzonej odpowiedzialności producenta do systemu gospodarowania odpadami w Polsce (Implementation of Extended Producer Responsibility to the Waste Management System in Poland)*. *Rocznik Ochrona Środowiska*, 20, 1597-1624.
- Poteete, A.R., Janssen, M.A., Ostrom, E., 2010. *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*, Princeton University Press, Princeton, US.
- Rosiak-Tatulińska, A., 2011. *Odzysk metali nieżelaznych*. *Recykling*, 3, 27-30.
- Saki, Ö., 2011. *Trends in Recycling in Europe*, http://www.iswa.org/uploads/tx_iswa-knowledgebase/Ozgur_Saki.pdf [06-12-2019].
- Waksmundzki, Ł., Stroncsek, A., 2018. *“Motywacyjny system gospodarki odpadami” – innowacja procesowa autorstwa EcoTech System jako sposób na realizację założonych poziomów odzysku (“Motivating waste management system” – process innovation by ecotech system as a method for the implementation of the assumed levels of recovery)*. In: Kulczycka, J., Ginda, G. (Eds.), *Elementy zarządzania w zrównoważonym rozwoju i gospodarce o obiegu zamkniętym*. Wydawnictwo IGSMiE PAN, Kraków, 137-147.
- Zero Waste Europe, 2017. *Extended Producer Responsibility – Creating the frame for circular products*, Zero Waste Europe, Brussels.