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# Segregation and recycling of packaging waste in central Poland

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**Abstract.** Due to the increasing consumption of earth resources, new term "scarcity" appeared. Scarcity is the fundamental economic problem of having seemingly unlimited human needs and wants, in a world of limited resources. It states that society has insufficient productive resources to fulfil all human wants and needs [1]. And we must remember that, in accordance with the concept of sustainable development, these resources should be enough also for future generations. Limited access to raw materials and a large amount of waste affect the need for waste recycling [2]. Especially in the case of packaging waste it is very important, because its life cycle is very short, and materials used for packaging production can be recycled. However, to make recycling of these materials possible, its previous segregation should take place. The organization of waste segregation was introduced and described by the Act of 11 July 2011 amending the Act on maintaining cleanliness and order in municipalities and some other acts. This Act introduced compulsory segregation of waste [3]. The purpose of this paper is to analyze the approach of individual consumers to segregation of packaging waste after a few years of the operation of the new Act in Poland. The research was conducted in the form of an electronic survey among different types of households from the central Poland. The paper includes the most important results of the survey.

## 1. Introduction

The effects of unsustainable, extensive development have begun to arouse both science and public opinion, both in terms of resource depletion and environmental devastation, or significant social stratification in individual countries and globally. A breakthrough in the political approach to development was Conference in Rio de Janeiro in 1992 on Environment and Development, which finished with so called Rio Declaration which consisted of 27 principles intended to guide countries in future sustainable development. It was signed by over 170 countries [4].

The sustainable development of the Earth is a development that meets the basic needs of all human beings and which conserve, protect and restore the health and integrity of the Earth's ecosystem, without compromising the ability of future generations to meet their own needs and without going over the limits of long term capacity of the earth's ecosystem [5]. In Poland the concept of the sustainable development has gained a constitutional status – has been enshrined in Article. 5 in the Constitution of Poland [6].

Limited access to raw materials and a large amount of such type of waste affect the need for waste recycling. At the beginning a suitable segregation of packaging waste is required. People's attitudes to



separate packaging waste also slowly changes. Varieties of advertising campaigns, frequent publications, packaging collection actions lead people to change their behavior for better [7].

The purpose of this paper is to analyze the approach of individual consumers to segregation of packaging waste after a few years of the operation of the new Act in Poland. The research was conducted in the form of an electronic survey among different types of households from the central Poland. The paper includes the most important results of the survey.

## 2. Scarcity

Scarcity is the fundamental economic problem of having seemingly unlimited human wants in a world of limited resources. It states that society has insufficient productive resources to fulfill all human wants and needs [8].

A typical example of the scarcity is the periodicity of occurrence of vegetables and fruits. They can be treated as scarcity in markets because some fruit and vegetable grow only at certain times of the year. Since the supply of fruit and vegetable is lower, there is a greater chance that they will quickly disappear from the market or may simply be unavailable.

People living in poor countries tend to suffer from scarcity more than people from rich countries. In such countries, water or food shortages may be the most common problem. It is impossible to live without these two things. Unfortunately, not everyone is aware of that fact, and thus does not respect what he has [9].

Generally, there are three substantial causes, the growth of population, the affluence, meaning the equipment with goods of individuals, as well as the technical progress. Environmental Impact Index made by Commoner [10]:

$$I = P * A * T \quad (1)$$

where:

P - population,

A - affluence (the individual's equipment with goods),

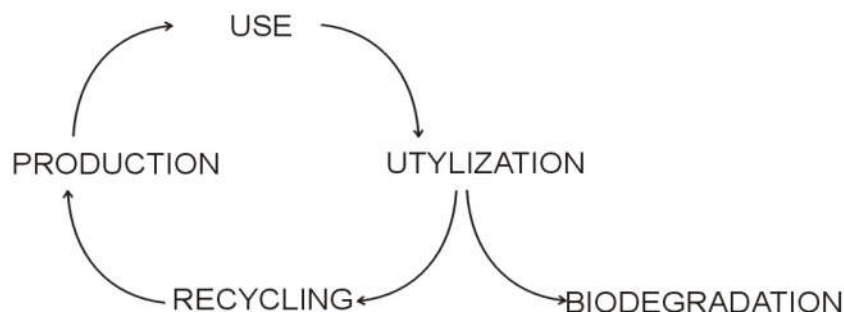
T - technology (harm done by economic goods technological reason).

Scarcity is caused not only by climate and natural environment. Very often these are people who are responsible. Thus people should think about what to do to reduce the scarcity of some products. We also need to think about how the earth's natural resources are used and how we should use them in proper way. One of the way to fight against scarcity, and at the same time to improve the natural environment, is proper segregation and recycling of waste, for example packaging waste [11-12].

## 3. Packaging waste

New approach to environmental protection, especially sustainable development concept forced change of the attitude to packaging waste management. Now the manufacturer not only produces goods, has to organize shipping not only of the defective product, testing the product, dismantling, repairing, but also, what is important in this case, has to organize recycling or disposal of used product and its packaging (Figure 1).

Circulation of packaging and its waste is regulated by the Act on packaging and packaging waste. According to this Act „packaging should be designed and executed in a way that allows their re-use and recycling later, and if this is not possible, at least recycling, and if this is not possible, another form of recovery” [13].



**Figure 1.** The environmental-oriented production process [14].

Packaging should follow the 3R's hierarchy. The first R as reduce. Packaging should be reduced prior to the manufacturing stage, by designing and marketing products for the first "R". This means reducing the number of layers, materials and toxins at source. The second R as reuse. Packaging should be designed to be reusable, refillable, returnable and durable to the greatest extent possible. The third R as recycle. Packaging should be designed to be recyclable and/or made with recycled content.

Act amending the Act on maintaining cleanliness and order in municipalities and other acts introduces the need to segregate the municipal waste, including packaging of products purchased by residents of the municipality [3]. So it includes the 3R's hierarchy. Polish law defines a specific way of dealing with packaging waste, including, among others a method of collecting of the packaging waste made of : paper, glass, plastic, aluminum, steel, multi-material.

#### 4. Methodology

The study was conducted in the form of the survey in central Poland. The survey was developed in electronic way which facilitated the collection of the answers. Respondents were people from different types of households from the central Poland. The research is a part of bigger project on waste segregation conducted by Eng. Manuela Ingaldi PhD in cooperation with other scientific centers in Poland and the Czech Republic. It will show attitude of different group of people, from different regions, countries to waste management and waste recycling.

The survey was composed of two parts. The first part includes demographics, it is characteristics of respondents. Respondent feature were following: gender, age, education and place of living. This part of the survey will not be presented due to the limitations of publication.

The main part of the survey includes 11 questions. Three first questions were connected to the perception of need to protect the environment and recycling of packaging waste by respondents. At the beginning the respondents were asked how important for them the environment protect was. The second question was: "what is recycling of packaging?". Then the respondents had to answer if and how much the recycling of packaging was important according to them and why.

Next questions were focused on packaging waste segregation. At first the respondents had to estimate how much packaging waste they produced annually (in kg). Then they had to answer the question if they segregated packaging waste. Further question referred to frequency of segregation of most popular groups of packaging waste (plastic, glass, metal, paper and cardboard, wood). The respondents had to also evaluate the access to the container for segregated packaging waste.

Very important question was connected to difficulties in recycling of packaging waste. So the respondents indicated if they took part in any large event connected to packaging waste segregation. In Poland collection of plastic caps from bottles and plastic packaging, collection of waste paper by students of primary and secondary schools, for which the best collectors receives awards, are very popular. In such actions all members of families of these students are involved.

The respondents had to also indicate the suitability for recycling of most popular groups of packaging waste. In the end respondents had to reply if they verified that the packaging was suitable for the recycling when bought products.

In the paper chosen results of the research conducted among different types of households from the central Poland were presented. The participants of the survey were 317 people. Due to editorial limit it was possible to present answers only to the most important question.

## 5. Results

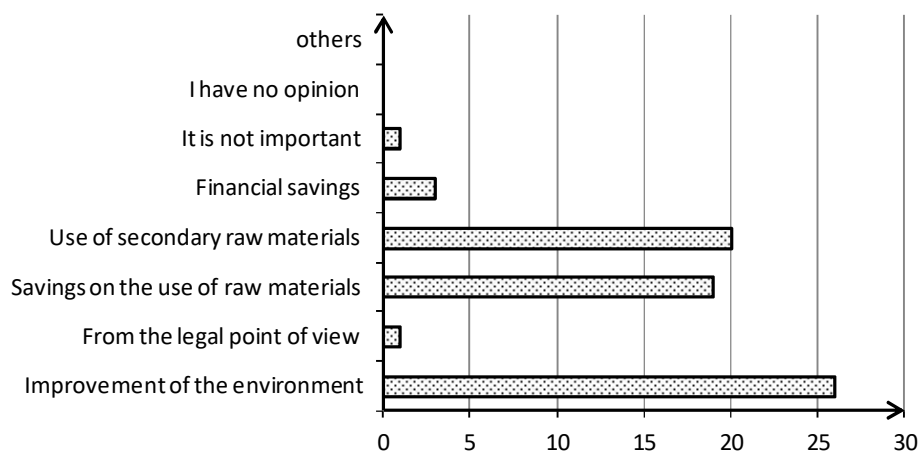
First question was: What is, according to you, recycling of packaging waste? Respondents could choose more than 1 answer. The results are presented in Table 1.

As the most important reason of recycling of packaging waste, respondents indicated the ability to reuse waste (35.1% of answers). Other important reasons are: environmental protection (21.8%) and recovery of already used materials (19.2%). These are elements which can help to avoid scarcity of materials which are used to produce packaging. According to 15.1% of respondents recycling of packaging waste is an obligation towards future generations, so element of sustainable development concept.

**Table 1.** What is, according to you, recycling of packaging waste?, % [own study].

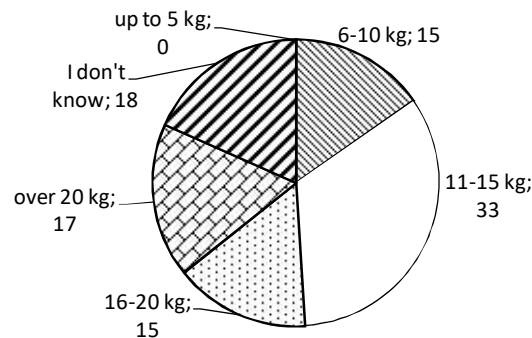
Possible answers	Percentage fraction
Obligation towards future generations	15.1
Recovery of already used materials	19.2
The ability to reuse waste	35.1
Environmental protection	21.8
Reduction of costs due to the use of recyclable materials	7.8
Lower product prices	1.0
I have no opinion	0.0
Others	0.0

Respondents were asked also if and why recycling of packaging waste was so important (Figure 2). Again respondents could choose more than one answer. The answers were similar like for the previous question. As the most important reason respondents indicated improvement of the environment. It means that the natural environment which is around them is an important element of the lives (over 25%). Other important reasons are use of secondary raw materials and savings on the use of raw materials (both around 20%). Again element connected to sustainable development concept, but also prevention of scarcity.



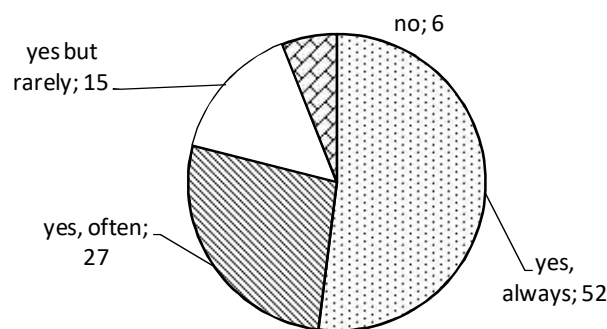
**Figure 2.** Why is the recycling of packaging important?, % [own study].

Respondents were asked to estimate how much packaging waste they produced per year (Figure 3). Of course it is a very difficult question, because the respondents in their households produce different types of waste and they stock and throw away all of them together. 33% of respondents answered that they produced 11-15 kg of packaging waste per year. 17% of them said it was over 20 kg. We have to remember that packaging is light, however, has large volume. The respondents regularly or from time to time get rid of them. Maybe that's why it is so difficult to evaluate the amount of the packaging waste.



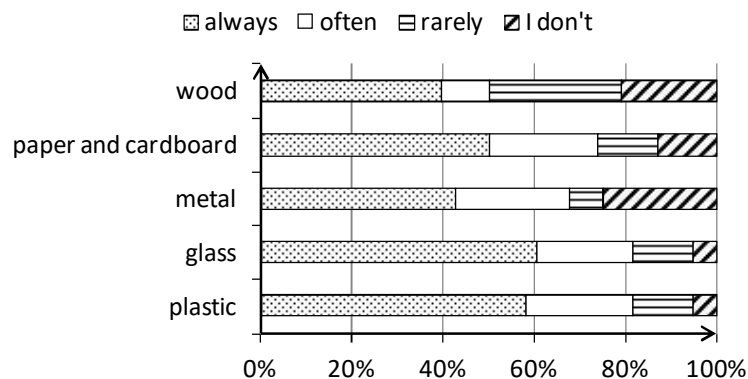
**Figure 3.** How much packaging waste per year do you produce?, % [own study].

According to Polish law, people in Poland should segregate all waste they produce, also packaging waste. Thus, the respondents were asked if they did it (Figure 4). 52% of respondents declared that they always did it, 27% often. Only 6% of respondents gave answer No. It can be concluded that people understand that the packaging waste is an important element of their everyday lives. It can be caused by the fact that people pay smaller fees in case of waste segregation. In many places most of municipalities set containers to segregate different types of waste so people don't have to worry where to leave them.



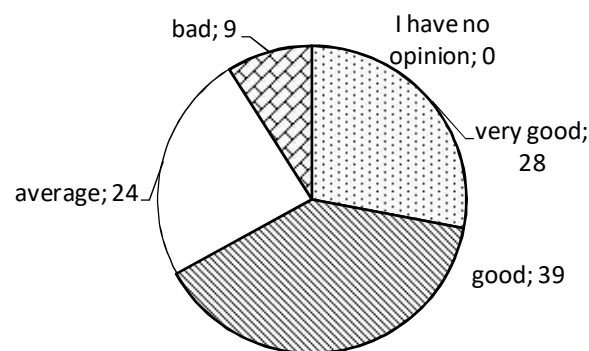
**Figure 4.** Do you segregate packaging waste?, % [own study].

Respondents indicated also how often they segregate different type of packaging waste (Figure 5). People declare that they always segregate plastic and glass (both around 60%), and often (both answers over 20%). People don't segregate too much wood and metals. Strange answers especially in case of metals, particularly that in Poland there is a big group of people, often unemployed, who sells glass bottles in shops, metals in scrap collection points [15] to earn money to live. This phenomenon is particularly observed on large housing estates, where the individual waste containers are public, so open 24/7.



**Figure 5.** How often do you segregate following packaging waste?, % [own study].

Segregation of waste, including packaging waste, is connected to the access to the container for their segregation. That is why respondents were asked to evaluate this access (Figure 6). According to 39% of respondents, there is good access to the segregation containers. 28% of respondents evaluated it as very good and 24% as good. According to new Act on maintaining cleanliness and order in municipalities and other acts [3] in big cities, especially on large housing estates, city centres, important parts of the cities, the municipalities should provide access to the segregation containers. It should be emphasized that in Poland the presence of such containers in small towns and tourist villages was earlier observed than in big cities. In private houses, places people can choose if to segregate waste or pay higher waste fees. In this way people slowly get used to the fact that they should segregate their waste.



**Figure 6.** How can you evaluate the access to the container for segregated packaging waste?, % [own study].

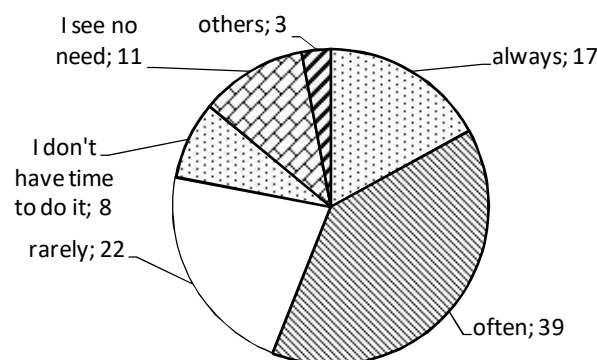
Respondents have to answer if they found it difficult to recycle packaging waste (Table 2). They mentioned also the biggest difficulties. In case of this question, respondents could choose more than 1 answer.

Only 15% of respondents didn't find it difficult to recycle packaging waste. As the most important difficulty (32.9% of answers) they mentioned lack of place where buy back. There are not enough places where people can give back bottles or other packaging. Even if they find such place, they are often asked to show a bill to confirm they bought packaging in this place. So it is easier to throw it away. There are no vending machines in stores to buy back (22.7%), so similar reason. People complained also that they did not have space to store all segregated packaging at home (23.2%).

**Table 2.** Do you find it difficult to recycle packaging waste?, % [own study].

Possible answers	Percentage fraction
No	15.0
The lack of space to store them at home	23.2
No containers	14.8
Container are too far	5.1
Lack of place where buy back	32.9
Lack of vending machines in stores to buy back	22.7
No deposit per packaging	9.1
I have no opinion	1.4
Others	1.4

In last question people were asked if they verified during making shopping if the packaging is suitable for the recycling or not (Figure 7). Only 17% of respondents always did it, 39% often. 11% of respondents declared that they did not see any need to do it. These are probably people who are not interested in packaging waste segregation. It should be underline that already this stage of packaging life cycle is very important for its segregation and recycling from point of view of customers and their shopping decisions.

**Figure 7.** Do you verify if the packaging is suitable for the recycling?, % [own study].

## 6. Conclusions

The concept of the sustainable development and European Union environmental regulations have forced Poland to change legislation on waste and its segregation. These regulations refer also to waste packaging.

It should be remembered that appropriate segregation of packaging waste is not tiring task, and most of it, e.g. glass, paper, plastic and metal, is a valuable resource of secondary raw materials, which, when properly sorted, can be recycled and reused.

Recycling of the packaging waste is an important part of sustainable development. Well organized packaging waste management will reduce its number in the environment and save resources of the natural environment.

From the results of the survey presented in paper it is seen that people in central Poland are aware of research problem, they think it is important to segregate packaging waste. They do it, even if sometimes they find it difficult.



## References

- [1] Günther E, Meyr D 2016 *Scarcity*. [In:] Jereb B., Kukovič D., Meyr D. (eds.) *Environmental Management & Audit 1. Scarcity & Introduction To Environmental Management*. SPH – Scientific Publishing Hub, Czestochowa – Žilina – Celje – Osijek – Kotor, pp. 1-19.
- [2] Ingaldi M 2015 *Management of the packaging waste in companies in Poland*[In:] 15th Int.Multidisciplinary Scientific GeoConf. SGEM 2015, www.sgem.org, SGEM2015 Conf. Proc., June 18-24, Book5 Vol. 3, pp.385-392.
- [3] Ustawa z dnia 11 lipca 2011 roku o zmianie ustawy o utrzymaniu czystości i porządku w gminach oraz niektórych innych ustaw (Act of 11th July 2011 on maintaining cleanliness and order in municipalities and other acts OJ 2011, No 152, item 897).
- [4] Shaker R R 2015 *The spatial distribution of development in Europe and its underlying sustainability correlations*. Applied Geography, **63**, pp. 304-314.
- [5] World commission on environment and development. "our common future, Chapter 2: towards sustainable development". Un-documents.net. 2011-09-28.
- [6] Konstytucja Rzeczypospolitej Polskiej (Constitution of Poland.OJ 1997, No 8, item. 483).
- [7] Konstanciak A, Brozova Sand Pustejovska P 2013 *Wykorzystanie alternatywnych źródeł energii w Polsce i Republice Czeskiej*. Rynek energii, Vol. **107**, Iss. 4, pp. 33-36.
- [8] Begg D, Fischer S and Dornbusch R 2007 *Mikroekonomia*. PWE, Warszawa, 211p.
- [9] Ingaldi M, Ociepa-Kubicka A and Serocha-Stolka O 2016 *Proekologiczne zarządzanie w przedsiębiorstwie - współczesne problemy i uwarunkowania*. Wydawnictwo Wydziału Zarządzania Politechniki Częstochowskiej, Częstochowa, 120p.
- [10] Commoner B 1972 *The environmental cost of economic growth*. Ridker R.G.(eds). *Population, resources and the environment*. DC, Washington, pp. 351.
- [11] Kardas E 2016 *The analysis of the environmental management system in one of municipal plants in Poland*. 16th Int. Multidisciplinary Scientific GeoConf. SGEM 2016, www.sgem.org, Economics, Education and legislation, Conf. Proc., vol. **3**, pp. 619-626.
- [12] Pustějovská P, Brožová S and Jursová S 2010 *Environmental benefits of coke consumption decrease*. [In:] METAL 2010:19th Anniversary Int. Conf. on Metallurgy and Materials. Conf. Proc., Ostrava, Tanger, Ltd., pp. 79-83.
- [13] Ustawa z dnia 11 maja 2001 roku o opakowaniach i odpadach opakowaniowych (Act of 11th May 2001 on packaging and packaging waste OJ 2001 No **63**, item 638).
- [14] [online] [access: 4.02.2013] <http://projekttechnologiczny.blogspot.com/2009/06/cykl-zycia-produktu-zamkniety-obieg.html>.
- [15] Dulski A, Studnicki A and Szajnar J 2017 *Reinforcing Cast Iron with Composite Insert*. Arch. Metall. Mater. vol. **62**, iss. 1, pp. 365-367.