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Impact of Circular Economy on Food Waste in the Slovak Economy

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Abstract

In the context of the circular economy, our article will be focused on research in the field of production and generation of waste and food waste in the Slovak Republic. The European Commission aims to ensure coherence between industrial, environmental, climate and energy policy to create an optimal business environment for sustainable growth, job creation and innovation. The Slovak economy is characterized by the positive economic development, however, at the same time, by growing consumption of material resources and limited base of its natural resources. Consequently, the country is highly dependent on external markets both when importing raw materials and exporting products. When introducing the circular economy, changes in production and consumption are inevitable. It is necessary for the sectors of economy, such as industry, construction sector or services, producing and consuming materials and products, as well as households, to decrease the quantity of waste they generate.

Keywords: circular economy, food waste, waste management, economic development, households, self-sufficiency

INTRODUCTION

The Slovak economy is characterized by the positive economic development, however, at the same time, by growing consumption of material resources and limited base of its natural resources. Consequently, the country is highly dependent on external markets both when importing raw materials and exporting products. Therefore, the increased resource effectiveness and the transition to the circular model of the economy are of the primary importance for the sustainable growth of the country and its increased prosperity. According to OECD (2017) The Slovak Republic is a country with a limited natural resource base, an important manufacturing sector and rising materials consumption. Coherent polices that aim at increasing resource efficiency and achieving green growth are vital for sustainable growth and increased prosperity. Producing more and better with less has the potential to lower production costs, increase supply security and secure competitiveness in the long term, while at the same time alleviating pressures on the environment. The sooner the Slovak Republic implements such policies, the greater will be the economic and environmental benefits. European Commission (2019) states that the current strong economic growth offers a unique opportunity to make the necessary investments to facilitate the transition.

LITERATURE REVIEW

While the Slovak Republic does not generate more waste per inhabitant than similar economies, it is facing significant challenges in improving the way this waste is managed. Almost 70% of municipal waste is currently still landfilled and almost 80% of landfilled municipal waste is mixed municipal waste of non-defined content. Only about 15% of the municipal solid waste is currently recycled, while other Visegrad countries (i.e., Czech Republic, Hungary, and Poland) achieve one quarter and the EU more than one third on average (Bodík, I., Sedláček, S., Kubaská, M., & Hutňan, M., 2011). More progress has been achieved in the management of industrial waste, where 39% now goes for recycling, while only 36% is landfilled. As in other OECD countries, food waste remains a challenge, despite recent efforts. The 2011 environmental performance review of the Slovak Republic identified waste management as an important challenge for the country (OECD, 2011).

Despite some advances, further progress is still needed in Slovakia to reach the average EU performance. At the same time, the European Union is discussing significantly more ambitious waste management objectives in the framework of its circular economy package, which, if adopted, would mark the beginning of a major transformation of the region's economy, towards much increased levels of resource efficiency. In this context, further reform efforts are becoming more urgent. In the following a number of key options that would allow the Slovak Republic to transition towards a more resource efficient economy is outlined (OECD, 2022). They are structured into measures that can support better waste management and instruments that can help to prevent waste from being generated in the first place.

The Slovak Republic developed a waste prevention plan, in line with EU obligations, for the period 2014 to 2018 (Ministry of the Environment of the Slovak Republic, 2013). This plan aims at a wide range of waste streams but has a particular focus on biodegradable municipal waste for which quantitative targets have been set: (i) a 40% reduction of the amount of landfilled biodegradable municipal waste compared to 1995, (ii) increasing the share of municipalities that use house and community composting to 54% of municipalities larger than 1,500 inhabitants. The implementation of food waste prevention objectives set out in the plan could be further strengthened by banning the landfilling of retail food waste and re-considering legislation on the durability of food. One option that

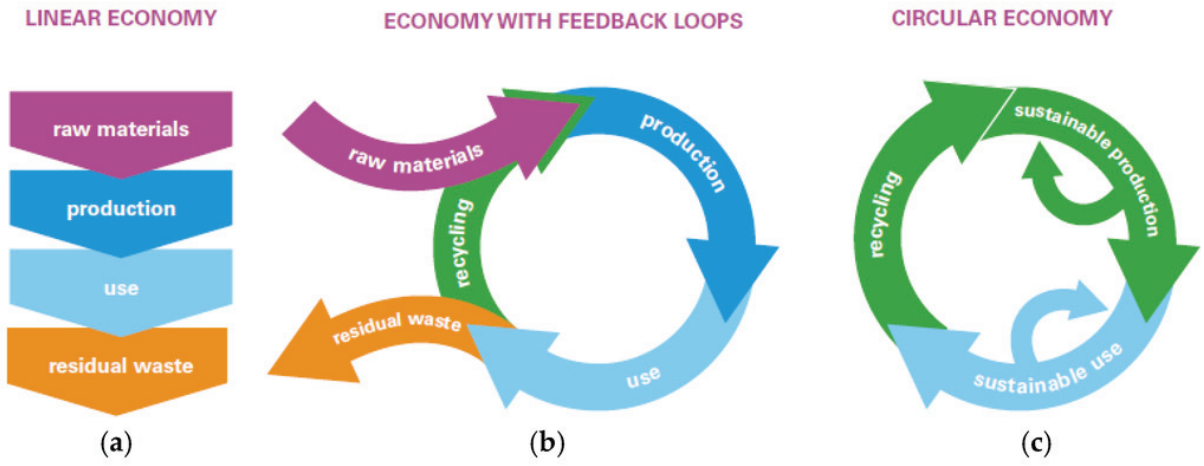
could help to further strengthen the implementation of food waste prevention is the introduction of a landfill ban for food waste originating from the retail sector. This measure has been implemented successfully in a few OECD member countries (e.g., Scotland, France, Germany, Korea, Massachusetts and Norway) (The Story of FoodCloud in Ireland, 2023) and produced positive results, by encouraging retailers find ways to give food away that has reached the expiration date to charities and producers of livestock feed. There is also a possibility to extend the measure to cover restaurants, food producers and agricultural sector. In Ireland, retailers use an app called FoodCloud7 that allows holders of food waste to connect with potential users through a smart phone-based app. Local charities connected to the retailer through the app receive a notification about food available for collection at a given time.

In Germany, supermarkets that specialise on selling food waste have developed ("Germany's First Food-waste Supermarket – DW – 02/06/2017,"2023). The possible introduction of a landfill ban for retail food waste would need to be preceded by a few other measures and reforms, including proper quantification of food waste and losses, investments in infrastructure and the removal of administrative obstacles to the effective allocation of food waste to charities and other potential users. Although the EU explicitly allows products to be sold after the "best before" date that they carry, the Slovak Republic is one of few member states where this practice is illegal (European Court of Auditors, 2016). Food that is past the "best before" date may not have quality of fresh food, but it is usually still edible – a fact that is unknown to most consumers and leads to confusion and unnecessary food waste. According to Aschemann-Witzel, de Hooge, Amani, Bech-Larsen, & Oostindjer (2015) date labelling legislation and food producer's usage of it can be improved to better match how consumers perceive date labelling, other obstacles to reducing food waste are linked to the criteria that charities that wish to receive food that is past its "best before" date need to fulfil. A review of legislation that addresses food security would be useful and could lead to lifting some of these obstacles, where food security is not compromised. (Aschemann-Witzel, et al. (2015) average food waste was estimated at 40 percent of food available for consumption over almost five decades.

The conclusion can also be drawn that food waste is positively correlated with per capital GDP and per capita income. Abdulla, M., Martin, R., Gooch, M., & Jovel, E. (2013) present recommendations for quantifying food waste and understanding the combination of reasons and factors that drive up food waste. In a circular economy, growth is decoupled from the use of scarce resources through disruptive technology and business models based on longevity, renewability, reuse, repair, upgrade, refurbishment, capacity sharing, and dematerialization. Many companies across the globe have already adopted circular principles to close the loop on energy and material through efforts such as renewable energy investments and recycling (Abdulla M. et al., 2013). In the literature, we can find many authors who deal with the issue of transforming the linear economy into a circular economy. Some of them are Rocchi, L., Paolotti, L., Cortina, C., Fagioli, F. F., & Boggia, A. (2021) who deal with this issue. According to their opinion the transition from a linear to a circular economy is a research trend topic, as well as the possibility to measure the degree of circularity of products and systems. In a linear economy, raw materials are taken from nature and transformed into final products, which are subsequently used and become waste. On the contrary, a circular economy is an economic model that is restorative by intent and design. To measure the degree of circularity is fundamental for understanding processes and improving them (Sariatli, F., 2017). Moreover, this kind of measure could be useful for driving policies on the topic and achieving a higher level of sustainability. Until now, only few studies have been focusing on how to effectively measure the circularity level of a product, a supply chain, or a service (Rocchi, et al., 2021).

Circular economy and its implications for sustainability have gained momentum in several socio-economic domains (e.g., academia, industry, politics, society), even though the relationship between them remains poorly understood. To counteract this situation, scholars and policymakers are approaching Circular Economy as able to inspire the development of sustainable development strategies and to increase the sustainability of the current economic system, balancing the need for economic development and the importance of protecting environmental resources and people wellbeing (Faggini, M., Cosimato, S., & Parziale, A. 2021). While recycling and energy-recovery are at the heart of a recycling-based economy, a circular economy clearly entails more and comprises more levels. Figure 1 expresses the basic models of respectively a linear economy, a recycling economy (called "economy with feedback loops" in the figure), and a circular economy. The recycling economy and a fully circular economy differ from each other in that the recycling economy does still involve the input of raw materials and the generation of waste (residuals), while the loops are closed in a circular economy. In the circular economy, the (re)use of materials is an integrated factor in the optimization of the delivery of functionality (Van Buren, N., Demmers, M., Van der Heijden, R., & Witlox, F., 2016).

Picture 1: Differences between linear economy, economy with feedback loops, and circular economy



Adapted from (Council for the Environment and Infrastructure, 2015)

Moreover, food production and consumption are transforming rapidly according (Camanzi & Troiano, 2021). On the one hand, the aim of reaching both food security and safety are big global challenges; on the other hand, food waste and losses are also phenomena that need to be addressed both at local and global levels. Furthermore, the affirmation of conscious and responsible consumption models offers new opportunities for sustainability enhancement, both at local and global scale. In addition, it is necessary to take into consideration the role that agriculture can play within an alternative, not conventional linear economic model, such as a circular economy

METHODS

Data for this research paper come from online questionnaire survey via Google Forms in January 2022. Questionnaire questions were answered by 295 respondents that were asked categorical questions, as well as questions related to the one of the biggest issues connected to circular economy of nowadays on the side of consumers – food waste (Tamasiga, P., Miri, T., Onyeaka, H., & Hart, A., 2022). For the

hypotheses testing was used statistical program SAS on Demand and for other computing and creation of tables was used also MS Excel. Contingency tables and statistics were computed using chi-square test of contingency in SAS on Demand. In this statistical test we conclude about the fit or difference between empirically gotten and theoretically expected multiplicity according to hypothesis testing (Connelly, L., 2019). We compute test characteristic as:

$x^2 = \sum \frac{(O_{ij}-E_{ij})^2}{E_{ij}}$, where:

Oij = observed value,

Eij = expected value.

Research population chosen for testing consists of 295 respondents, from which more than 90% belong to age group from 18-30. Around the half of them lives in the cities in Slovakia, the other half lives in the villages. Most of respondents from the sample are students, since we wanted to focus mostly on young people in Slovak Republic.

RESULTS AND DISCUSSION

As studies show food waste on the side of consumers stems from their habits, like for example planning what will they buy beforehand (Stancu, V., Haugaard, P., & Lähteenmäki, L., 2016). We wanted to go further and see whether there is dependence between this habit and that, whether they live in the cities or villages. H_0 = There is no dependence between the place of living of respondents and their habits related to planning groceries. H_1 = There is significant dependence between the place of living of respondents and their habits related to planning groceries. According to results of chi-square test of contingency is P-value 0.0196, which means we reject null hypothesis and accept H_1, so there is significant difference between the place of living of respondents and their habits related to planning of groceries. Also, when we want to examine more, according to Tab. 1 out of all respondents living in the village almost 80 % (102 respondents) plan what products and how many they will buy, meanwhile out of all respondents living in the city almost 40 % (59 respondents) do not plan their shopping in advance.

Tab. 1: Contingency table explaining results of first hypotheses testing

	Do not plan	**Plan**	**Total**
Village	33	102	135
City	59	100	159
Total	92	202	294

For the purpose of solving our research question: whether people that live in villages waste less food than those who live in cities was created contingency table with numbers of respondents that belong to group of those that waste food often, sometimes or rarely, minding whether they live in village or city. Afterwards, percentages of all respondents belonging to each group according to whether they live in the village or city were computed, as it is shown in table 2.

Tab. 2: Frequency of wasting food according to where respondents live

	Often	Sometimes	Rarely
Village	17%	36%	47%
City	16%	51%	33%

According to the contingency table showing the frequency of wasting food according to whether respondents live in the village or city we found out that most of those that live in villages waste food rarely, while respondents living in the city waste food more often than those that live in villages. However, the statistical testing showed, there is no significant relationship between these variables, using chi-square contingency test.

Tab. 3: Frequency of wasting food according to number of people living in the household

frequency of wasting food		**often**	**sometimes**	**rarely**
people in household	**1 to 3**	6%	26%	20%
	4 and more	11%	18%	19%

We also wanted to find out how often do people waste food according to how many people live in one household. Out of all respondents 26% live in the household with less than 3 people and waste food sometimes, 20% percent of respondents belonging to this group waste food only rarely and almost 20% of respondents living with 3 or more people in one household also waste food rarely, which is the highest percentage in this group, which may indicate, the more people live in the household, the more rarely is wasted food. We as well as tested dependency between these variables, so whether there is significant relationship between the frequency of wasting food and number of people living in the household and according to this testing, there is no significant relationship between these two variables.

CONCLUSION

All in all, we found out that according to statistical testing using chi-square test of contingency there is no significant relationship between variables frequency of wasting food and place where respondents live, neither between frequency of wasting food and number of people living in the household. On the other side, we confirmed significant relationship between the place of living of respondents and their habits related to planning groceries. More people that do not plan what will they buy live in the cities than in villages. We also found out that the highest percentage share of respondents living in the village waste food rarely, meanwhile the highest percentage share of respondents living in the city claim they waste food more often – sometimes. Also, the smallest percentage shares in both groups of respondents according to number of people living in the household waste food often. According to results of the questionnaire survey we got the opportunity to answer questions related to behaviour of young Slovak consumers towards buying and consuming food and towards food waste, which is very important, since

we think food waste is such a great issue it needs to be surveyed, discussed and observed more to find out what really determines whether some households waste a lot of food and some do not and which variables are important in relation to which.

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