PRINCIPLES OF A CIRCULAR ECONOMY IN THE FOOD SECTOR: A SYSTEMATIC LITERATURE REVIEW

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Abstract. *Since the transition to a circular economy (CE) in various sectors is a priority strategic goal of policy planning in the European Union (EU), the goal of this article is to reveal the principles of the CE in the food sector. To achieve the goal, the study is based on a systematic literature review using the literature synthesis and analysis method and the PRISMA 2020 approach for the selection of appropriate literature. From 25 articles, which were selected from the SCOPUS database, 20 were left for final analysis. Based on the literature review, it was discovered that the main principles of the CE in the food sector are management of resources and waste, emission control, natural and production resource sustainability, increase in energy efficiency, reduction and prevention of food waste, recycling and reuse of food waste and public involvement in the transition to the CE. The determination of CE principles in the food sector is the basis for choosing goals and a right strategy for the implementation of CE principles in practice in this area.*

Keywords: *circular economy principles, food sector, circularity, sustainability.*
JEL code: *O10, Q01.*

Received: *21 October 2022* ***Revised:*** *3 November 2022* ***Accepted:*** *9 November 2022*
Published: *19 December 2022*

Introduction

The essence of the CE is to maintain the maximum value of products, materials and resources in the economy by minimizing the consumption of raw materials, the amount of waste and the impact on the environment, thereby extending the life cycle of products (European Parliament, 2022). Global adoption of the CE and its principles is now more important than ever in order to maintain the speed of production of goods and services and to meet the ever-increasing consumer demand that burdens the environment and society (Patwa et al., 2021).

Problems with food security and environmental impacts such as resource depletion and greenhouse gas emissions, related to food waste, have increased the attention to this topic of local, national and European policymakers, as well as international organizations and researchers from various sectors (Schanes et al., 2018). Achieving sustainable food consumption requires a deep understanding of aspects of food production and consumption, including food waste as a problem that is increasingly

https://doi.org/10.17770/jresd2022vol14.6969

perceived as a systemic failure in developed countries (García-Herrero et al., 2021).

It has been researched that food service companies can implement several responsible practices by implementing preventive measures and recycling practices to limit food loss and waste generation, as well as reduce environmental impact (Camilleri, 2021; Lopez et al., 2019). Therefore, the food sector can become one of the main areas where the CE model can be applied, but the current level of implementation of the CE into the food system makes it difficult to combine theory with practice (Fassio & Tecco, 2019).

Aspects of the CE vary between industries because each has its scope, and different stages of the industry life cycle have different characteristics (Ngan et al., 2019).

The authors hypothesize that it is possible to determine the principles of the circular economy for a specific industry based on the analysis of scientific literature.

As the focus and principles of the CE vary from industry to industry, the aim of the research is to determine the principles of the CE in the food sector, based on the literature analysis.

To achieve the goal, the study is based on a systematic literature review using the literature synthesis and analysis method and the Page et al. (2021) approach – a PRISMA 2020 flow diagram for the selection of appropriate literature.

Determination of CE principles in the food sector could be the basis for determining goals and choosing a right strategy for the implementation of CE principles in practice in the food sector.

Research results and discussion

The following qualitative methods were used in the study: systematic literature review, literature synthesis and analysis, as well as the monographic method. Using the PRISMA 2020 approach, 25 articles from the SCOPUS database were selected, of which 20 were left for in-depth analysis.

Systematic literature reviews are a widely used review methodology to synthesize and analyse the existing literature in a specific field (Kraus et al., 2020). To select relevant literature, it is important to choose the right keywords (Marcos-Pablos & García-Peñalvo, 2018).

The process of selection of literature using the PRISMA 2020 flow diagram is shown in Figure 1.

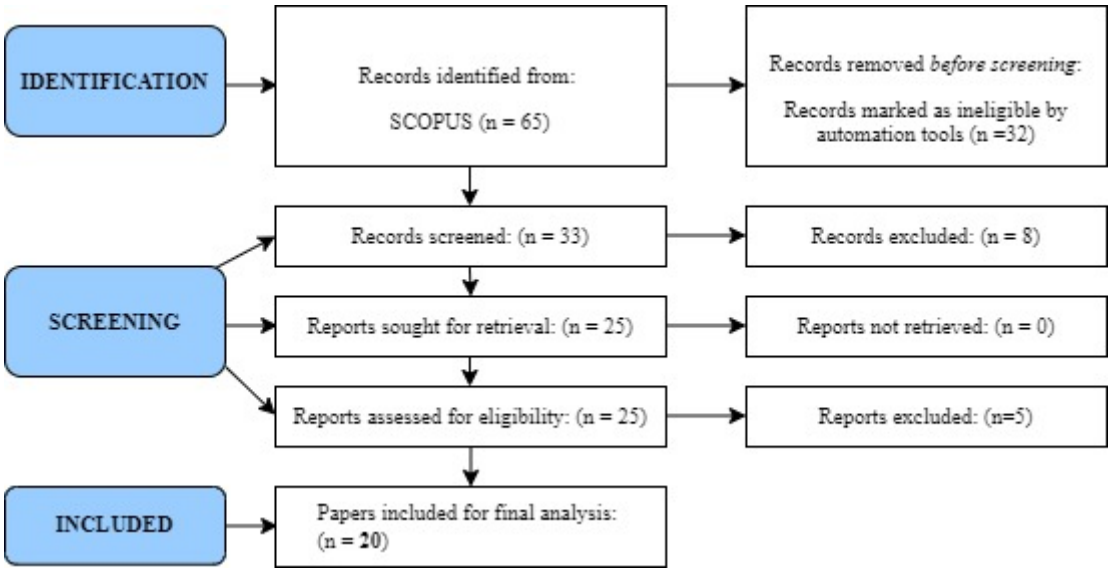

Fig.1 PRISMA 2020 flow diagram for new systematic literature reviews
(authors' construction based on Page et al., (2021))

The SCOPUS database was used to identify the articles for this study. To select appropriate literature, there were used the keywords "Circular economic principles in the food sector". 65 articles were found, of which 33 articles were selected using the advanced analysis tool. Following the titles, another 8 articles were discarded because they related to a different industry. 25 articles were left for reading, 20 of which were selected for final analysis.

To discover the principles of the CE in the food sector, an analysis of the selected literature was carried out. The results are visible in Table 1.

Table 1 CE principles in the food sector based on the literature review
(authors' own compilation)

Source	The CE principles mentioned in the articles
Aznar-Sánchez et al., (2020); Kusumowardani & Tjahjono, (2020); Niero & Rivera, (2018);	• resource (e.g., water, packaging) management; • waste management; • emission control;
Aznar-Sánchez et al., (2020); Kusumowardani & Tjahjono, (2020); Niero & Rivera, (2018); Poponi et al., (2021); Rada et al., (2019); Wysokińska, (2020);	• increasing energy efficiency, minimizing the use of natural resources; • improving the efficiency of water and energy use; • resource recovery; • sustainable energy and soil use; • unconventional pretreatment of food waste for energy recovery; • sustainability of resources; • resource and energy efficiency; • integrated renewable resources

Continuation of the Table 1

Aznar-Sánchez et al., (2020); Borrello et al., (2017); Ezeudu & Ezeudu, (2019); Fiameni et al., (2021); Greer et al., (2020); Hodson de Jaramillo, (2018); Jackowski et al. (2020); Visco et al., (2022); Wysokińska, (2020);	• reduction and prevention of food waste; • prevention of product wastage; • zero waste; • reducing food waste by using it as reusable raw materials; • reuse of products; • processing of food waste and leftovers; • waste reuse; • reuse of residues; • recycling of waste generated at the stages of the supply chain; • reuse of materials at the end of their life cycle; • recycling of by-products of the food industry;
Caporusso et al., (2021); Colley et al., (2020); Madau et al., (2020); Montone et al., (2021); Palermito et al., (2021); Rada et al., (2019); Visco et al., (2022); Wysokińska, (2020); Zhou et al., (2021);	• creation of new product value; • creating a new product from waste; • revaluation of by-products; • creation of new value - materials are nutrients that circulate in closed circulation metabolism; • residues can become raw material for new processes; • waste and by-products as a resource;
Borrello et al., (2017); Hodson de Jaramillo, (2018); Kusumowardani & Tjahjono, (2020); Núñez-Cacho et al., (2020);	• consumer involvement in CE mechanisms; • public involvement in decision-making, participation; • adoption of more sustainable production and consumption patterns; • social welfare of employees and implementation of social responsibility;

Based on the research results, it is concluded that the main principles of the CE in the food sector are:

- **management of resources and food waste** - catering firms must be responsible and must know how to manage food waste and control emissions, so as not to harm society, and be environmentally responsible to the wider community by not contributing to global warming and climate change (Kusumowardani & Tjahjono, 2020);
- **natural and production resource sustainability** - adopting CE principles has the potential to optimize the use of resources, reduce business costs and create a culture of sustainability (Poponi et al., 2021; Wysokińska, 2020), for example, in relation to water resources, the opportunities to increase circularity in this area are based on promoting the use of reused water. In terms of energy use, there is a

great opportunity to increase the energy efficiency of farms using solar energy (Aznar-Sánchez et al., 2020);

- **reduction, recycling and reuse of food waste** - catering and its related production and consumption practices are relevant aspects within the food system (Greer et al., 2020), and practices such as zero waste, reuse of products, materials and waste are noted as some of the most important in the transition to a circular economy;
- **creation of new product value -** food waste is produced in very large quantities every year, causing serious environmental and economic problems, and the waste can be used as secondary raw materials to produce goods with value added (Visco et al., 2022), for example, the revaluation of whey, which is the main by-product of cheese production (Montone et al., 2021);
- **public involvement in the transition to the CE** – it is also important to involve consumers in CE mechanisms (Borrello et al., 2017) and sustainable purchase decisions (Núñez-Cacho et al., 2020), as well as achieve inclusive social participation in adopting sustainable models and promote sustainable consumption (Hodson de Jaramillo, 2018).

For comparison, the European Commission's 11/03/2020 *"A new Circular Economy Action Plan. For a cleaner and more competitive Europe"* was reviewed, where the CE is based on the following principles (European Commission, 2020):

- make sustainable products the norm in the EU;
- empower consumers and public buyers;
- focus on the sectors that use the most resources and where the potential for circularity is high such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients;
- ensure less waste;
- make circularity work for people, regions and cities;
- lead global efforts on the CE.

Comparing the general principles of the CE and principles of the CE in the food sector, the authors conclude that although the principles of the CE in the industry relate to the general principles of the CE, they are focused on more specific activities.

It should also be noted that CE strategies are based on the United Nations General Assembly *"Transforming our World: the 2030 Agenda for Sustainable Development"* goals (UNGA, 2015).

There is a consensus that the global food system does not provide good nutrition for all, and leads to environmental degradation and loss of biodiversity; therefore, a deep transformation is needed to solve problems caused by persistent malnutrition and rural poverty, exacerbated by the

increasing effects of climate (Wezel et al., 2020). The food sector has recognized its role and concerns about climate change and the challenges of sustainable food and drink production and consumption (Niero & Rivera, 2018), and since food production is a major contributor to greenhouse gas emissions and a source of environmental degradation, it can increase and accelerate climate change (Gomez-Zavaglia et al., 2020).

Despite the intensive use of valuable natural resources for the production and distribution of food products, no effort is made to recycle the waste generated in the supply chain, so CE strategies play a crucial role to restructure the linear economy model with the active participation of all actors in the supply chain (Borrello et al., 2017). The transition to a CE, in addition to new technologies, infrastructures and innovations, requires changes in society and changes in daily practices (Lehtokunnas et al., 2022).

The authors believe that the negative impact on the environment and other problems on the planet are the consequences of human action or inaction, and only humans can change it. Therefore, the main principle of the CE in the food sector discovered as a result of the systematic literature review could be public involvement in CE mechanisms, participation in decision-making and in adopting more sustainable patterns of production and consumption, creating new value and realizing social welfare and social responsibility. Because with the help of society, it will be possible to successfully manage waste and resources, control emissions, prevent, recycle and reuse food waste and in this way help to achieve the goals of sustainable development.

Conclusions and suggestions

1. Specific CE principles can be highlighted in each sector, whose focus is on the operation of the relevant industry.
2. Determining the principles of the CE in the food sector can be the basis for choosing the right objectives and strategy for the implementation of CE principles in practice in the food sector.
3. The main principles of the CE in the food sector are management of resources and food waste, natural and production resource sustainability, reduction, recycling and reuse of food waste, creation of new product value and public involvement in the transition to the CE.
4. Although the principles of the CE in the food sector relate to the general EU principles of the CE, they are focused on more specific activities.
5. CE strategies are based on the United Nations General Assembly' Sustainable Development Goals.

6. Successful implementation of CE principles and implementation of a CE strategy requires public involvement and participation in CE mechanisms.

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