

SOLUTIONS MODELS FOR COFFEE WASTE PRODUCTS: EVIDENCE FROM EUROPE AND ASIA

MODELE ZASTOSOWAŃ ODPADÓW PO KAWIE W DZIAŁALNOŚCI PRODUKCYJNEJ:
PRZYKŁADY Z EUROPY I AZJI

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Abstract: In the light of current pandemic-related events, the exacerbation of the armed conflict on Ukrainian territory, and the increase in the price of fossil fuels, there has been a serious threat to the maintenance of resilient food chains, which can be countered by rationalizing the usage of raw materials and production sources, and increasing the use of post-production wastes of plant origin as a substitute for non-renewable energy. The aim of this research is to present the use of e-commerce instruments in sell-buy transactions of chosen coffee waste products. The theoretical part of the study consists of comparative and synthetic analyses. The revised public source of information coming from well-known organizations are used. The practical part of the study consists of in-depth expert structured interviews (N = 8). The results of the study are multi-faceted. The practical business examples shown in the article demonstrates the possibility of introducing a bio-circular economy on a large scale in Europe and Asia. The results can be used by state institutions for the implementation of a bio-circular economy policy in various types of production activities, e.g. biomass, bioenergy, feed, supplements, drugs to fight obesity and diabetes, cosmetics.

Keywords: coffee waste products, e-commerce tools, food supply chain, bio-circular economy, cross-continental case-studies, Europe, Asia

Streszczenie: W świetle aktualnych wydarzeń związanych z zażegnaniem pandemii COVID-19, zaostrzeniem konfliktu zbrojnego na terytorium Ukrainy, wzrostem cen paliw kopalnianych, ma miejsce poważne zagrożenie utrzymania odpornych łańcuchów żywności. Racjonalizowanie użycia surowców i czynników produkcji, zwiększenie wykorzystania odpadów poprodukcyjnych pochodzenia roślinnego, stanowiącego substytut nieodnawialnej energii to przykłady działań, które pozwalają włączać zasady bio-circular economy do łańcucha dostaw żywności, by je odbudować. Celem pracy jest zaprezentowanie wykorzystania narzędzi e-commerce w transakcjach kupna–sprzedaży wybranych produktów z odpadów kawowych. W części teoretycznej opracowania przedstawiono analizy porównawcze i syntetyczne. Pierwotne dane literaturowe pochodzą ze zweryfikowanych ogólnodostępnych informacji organizacji międzynarodowych. W części praktycznej zaprezentowano pogłębione wywiady z ekspertami (N = 8). Wyniki badania są wieloaspektowe. Przedstawione w artykule praktyczne przykłady biznesowe zastosowania odpadów pokawowych do produkcji naczyń wielokrotnego użytku, dekoracji wnętrz oraz wysokogatunkowego, wodoodpornego i przeciw-wiatrowego materiału do produkcji ubrań przy użyciu narzędzi e-commerce wskazują na możliwość wprowadzenia gospodarki obiegu zamkniętego na szeroką skalę w Europie i Azji. Wyniki mogą być wykorzystane przez instytucje państwowe poprzez wdrożenie polityki gospodarki o obiegu zamkniętym w różnych rodzajach działalności produkcyjnej, np. biomasa, bioenergia, pasze, suplementy, leki do walki z otyłością i cukrzycą, kosmetyki.

Słowa kluczowe: odpady pokawowe, narzędzia e-commerce, łańcuch dostaw żywności, gospodarka obiegu zamkniętego, międzykontynentalne studia przypadków, Europa, Azja

Introduction

Food economy belongs to one of the key sectors of each country's economy (Carlsson-Kanyama, et al., 2003; Zielińska-Chmielewska et. al. 2021).

Food processing enterprises require the continuity of good quality supplies of raw materials in order to produce food which adapts to changing consumers' eating habits (Bendeković, Naletina, Iva, 2015; Cachon, Lariviere, 2005; Gazdecki, et al.,

2021; Łuczka, Kalinowski 2020; Rossi, 2020; Watson, 2020).

One way to achieve the bio-circular economy is to implement the idea of closing the life cycle of a product (Esposito, Sessa, Sica, Malandrino, 2020). The European Commission has approved measures to improve the Action Plan for a Sustainable Bioeconomy. This plan includes proposals to create a market for secondary raw materials; to identify tools to improve the quality of secondary raw materials, and to act on plastics, bioproducts, demolition waste, construction waste, food waste (EP, 2021). The use of e-commerce tools is ever-present due to the on-going changes related to increasing quality standards, abiding by the rules, and the introduction of updated production technology among many competing enterprises for potential clients.

The reason for the undertaken research is the observable need to adapt the inland food sector to secure food supply chains in the frame of the bio-circular economy (Han, Roy, Hossain, Byun, Choi, Ha, 2021; Reddy, Singh, Anbumozhi, 2016). There is a need to conduct various quantitative and qualitative studies, in which classification and the assessment of bio-waste can be used by everyone, every day, and on a large scale.

The main aim of the research is to demonstrate the use of e-commerce tools in sell-buy transactions of chosen coffee waste products. The practical business examples shown in the article demonstrate the possibility of introducing a bio-circular economy on a large scale in Europe and Asia. The results can be used implemented by state institutions in different production activities, f. ex. biomass, bioenergy, feeds, supplements and medicines to fight obesity and diabetes, cosmetics, in chosen countries.

In the article two hypotheses were formulated and verified.

Hypothesis 1: It is possible to generate new value chains for products from coffee waste with e-commerce tools.

Hypothesis 2: Coffee waste from linear processes can be used as a raw material input in other production by creating complex and branching production systems in on-line stores.

The chapter is divided into 5 sections: Introduction, which addresses the problem out along with two scientific hypotheses, Discussion on the concept of a sustainable development, bio-circular economy, resistant food supply chain, coffee waste products and e-commerce tools, presentation of Methodology, empirical data and analysis subjected to re-testing

existing documentation background, Results and discussion on the application of coffee waste products focused on explaining its significance and insights, and conclusions supplemented by the verification of hypotheses, study results and its restrictions. In the last section of the article references are listed.

The contribution of this article is manifested in the following three aspects. First, it sets out a new model for an agricultural supply chain. Second, it assumes that the individual entities in the chain can operate more independently from each other. Third, it can promote resilience mechanisms in a crisis. Therefore, this paper specifies the range of possible short- and long-period recommendations, so that the optimal decision is of a more realistic guidance.

A model for the food supply chain in the food system

The concept and definitions of sustainability come from the natural sciences. In the most general terms, sustainability is the ability of an ecosystem to self-renew the basic functions of supporting various forms of life, or species, indefinitely. This means that the following changes in the ecosystem are characterized by an evolutionary nature, and the expansion of species does not exceed the absorption capacity of the ecosystem (Zhang, Patwary, Sun, Raza, Taghizadeh-Hesary, Iram, 2021).

According to Florczak (2007) and Baum (2021), sustainable development:

- Enhances the quality of human life within the existing restrictions of environmental capacity IUCN (International Union for Conservation of Nature), UNEP (United Nations Environment Program) (accessed on 1.10.2022), WWF (World Wide Fund for Nature) (accessed on 1.10.2022);
- Our globe's resources can be granted to a certain amount within the defined period of time (Friends of the Earth Scotland) (<https://www.foe-scotland.org.uk/campaigns/sustainable-scot> (accessed on 1.10.2022));
- Is combined with three goals: ecological sustainability, economic development and social equity between and within each generation (United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, 2005–2014);
- Positive changes which mean no damage to the social and ecological systems on which the functioning of societies depends (Poland's sustainable development strategy)

www.access.zgwrp.org.pl (accessed on 1.10.2022);

- Eco-development includes social and economic structural changes in which actual and future generations preserve natural processes going (Ustawa o ochronie i kształtowaniu środowiska w Polsce, 1997 [Act on the Protection and Development of the Environment in Poland, 1997] (Dz.U. z 1997 r. Nr 133, poz. 885 z późn. zm.)¹.

Figure 1 presents a sustainable development model. A circular economy is a way in which production and co-consumption come together. People share, borrow, reuse, repair and recycle for a very long time. The idea of a circular economy maximizes the life of a product. In this sense, segregation can be a new beginning for a product. Consumers are paying more attention to where their food comes from. They care whether food is produced in a morally responsible way, from farm to fork, from a social justice perspective and also regarding food safety standards (Zielińska-Chmielewska, 2020; www.thepeoplesfoodrevolution.com). In food supply chains, information plays a crucial role at various stages, such as production, processing and distribution. This information both relates directly to the customer, such as their purchasing preferences or their financial capabilities, as well as market external conditions, such as legal, political, economic situation of the country, exchange rate, and climate conditions.

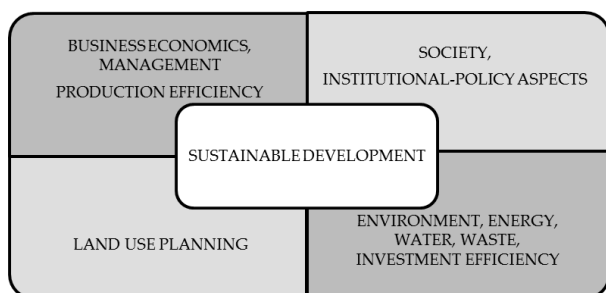


Figure 1. Presentation of sustainable development model
Source: Own authors' preparation.

E-commerce means selling a product or service electronically over the Internet (Manzoor, 2010). E-commerce is the process of buying and selling through a computer or smartphone. This multi-channel strategy is widely popular, especially as mobile commerce becomes more prevalent with

the advent of new technologies (Krause, 2000). For companies or individuals, if the purchase of products or services is done remotely, payment is also made online, through an electronic transaction. E-commerce is available around the clock, unlike traditional commerce.

In practice, a cyber-shopper goes through almost the same buying process as when visiting a physical store. They search for product information and compares prices using a search engine. E-commerce tools are: a) apps, b) platforms, c) plug-ins, that help business owners manage their online stores. The e-commerce tools simplify and sort out the processes of launching and developing an e-commerce shop, f. ex.: website builders, inventory management software, and analytics tools.

Tools for building and hosting an online store are the building blocks of any online shop. E-commerce platforms presents instruments like website builders to create online store and web hosting, which allow customers to buy (Lampe, 2013).

Analytics tools: supporting online shops to determine what works well and what does not. For instance, Google Analytics tracks records and provides insight into profit. SEO analytics suggests how to increase sales by better e-store positioning.

Day-to-day tools: facilitating the day-to-day business operations of a shop, such as making sure that internal business activities are performed along with organizational needs.

Marketing tools: helping e-commerce sites identify the brand, increase traffic and turn potential customers into regular clients. E-businesses using tailored e-marketing tools can shape their products' portfolio and the business viability (Strauss, Frost, Sinha, 2014).

E-commerce offers many advantages to a buyer and to a seller (Milder, 2103):

- 1) E-commerce can extend the marketing of its products far beyond the country, which provides more potential customers for sellers;
- 2) E-commerce stores have lower operating costs than conventional stores;
- 3) E-commerce stores need less staff or space to function;
- 4) E-commerce offers competitive prices while providing very good profitability;
- 5) It is easier to manage the inventory in an online retailer than in a physical business.

¹ Act on the Protection and Development of the Environment in Poland, 1997; Environmental Protection Law Act, 2001. This is due to the fact that in UN standards and documents Sustainable Earth Development is defined as "development that meets the basic needs of all people, while taking care

to protect, preserve and restore the health and integrity of the Earth's ecological systems, without the risk that the needs of future generations cannot be met and the limits of Earth's endurance will be exceeded".

E-commerce inventory management is less tedious, which, again, reduces operating and inventory costs for e-sellers.

E-commerce has a number of drawbacks (Wanniarachchi, Rajakaruna, 2022) such as:

- 1) Consumers are very well informed and don't shy away from attracting competitors. This tends to drive down margins, which can influence the profitability of a business;
- 2) Even though most e-commerce stores are available by mail or phone, have a multi-channel strategy and have a social media presence, many consumers regret the lack of contact while shopping online;
- 3) Getting personalized information online is much more difficult than in-store. For online commerce to work, a good technical infrastructure will definitely be needed,
- 4) The fear of becoming a victim of hackers is one of the major drawbacks of e-commerce;
- 5) E-commerce can also hold back the most rushed customers;
- 6) Delivery services are becoming increasingly competitive and now offer 24-hour or 48-hour options. This is an opportunity for any e-commerce business that wants to retain its customer base quickly.

Methodology, empirical data and analysis

For the purposes of the article, primary and secondary research sources were drawn upon. The first study measure is a literature review on domestic and foreign literature accessed from reports, bulletins and information services from European Commission (EC), World Commission on Environment and Development (WCED), International Union for Conservation of Nature

(IUCUN), United Nations Environment Program (UNEP), World Wide Fund for Nature (WWF), Friends of the Earth Scotland, United Nations Educational, Scientific and Cultural Organization (UNESCO) on production and processing solutions on coffee waste.

The second study measure were interviews (N = 8) conducted in the form of semi-structures in-depth interviews led in remote mode (Table 2). The collected data were transcribed and coded using QDA Miner software, LITE v2.0.8 to create the database and code the responses. The analysis of in-depth interviews covered 5 stages suggested by Yin (2015).

According to Adams and Cox (2008, pp. 17-34), an in-depth interview is a typical qualitative method of social research. Minichiello et al. (2008) proved that an in-depth interview is a focused conversation between the interviewer and the interviewee on a certain topic. DiCicco-Bloom and Crabtree (2006) are of the opinion that the success of this method is due to the increasing acceptance of qualitative methods, which allow to capture and give a rational explanation of the results in a socio-cultural background.

Furthermore, the conducted IDIs were focused on experts' identification of the main factors affecting the use of coffee waste products in the production cycle of products. The main reason for using this method was to obtain reliable knowledge from experts on a subject that is little recognized and not well organized, indicating the relevance of particular problems. IDIs were intended to provide different application possibilities of coffee waste into reusable utensils in Europe and Asia.

The article draws on the use of descriptive and comparative data analysis, supplemented with pictures and tables.

Table 1. Characteristics of the study

Study subject	Objects, territory, time	Methods and instruments	Today's state of the art
Application of coffee waste products in a resistant food and non-food production	Solutions in food and non-food production on cross-continental level	Literature review IDIs interviews	To deepen and widen the analyses of the use of coffee waste products in food and non-food production

Source: Own authors' preparation.

Research results and discussion

The results of interviews with experts made it possible to identify innovative production solutions using coffee grounds in food and non-food production on the example of specific companies located in Europe and Asia (Table 2). Other examples pointed out by the experts are reusable

utensils from coffee waste for everyday life (Fig. 2). The undisputed benefits of using reusable utensils are the cost reduction and environmental issues. According to experts' knowledge over three years of use, the reusable utensils will result in an estimated life-cycle reduction of 88% of greenhouse gasses, air pollutants and water

consumption over the disposables. Roasted coffee grounds are mixed with polyester, recycled from PET bottles, to form coffee yarn. The coffee yarn is used to make fabric. The fabric, launched in 2009, is used to make clothes, which are water-resistant, absorb body odors and reflect UV rays.

One shirt is made from three cups of coffee grounds and five recycled plastic bottles (www.textiletoday.com.bd). The coffee grounds come, with no charge, from coffee shops and stores in Taiwan of the Starbucks and 7-Eleven chains. S.Café technology is now used by more than 110 brands.

Table 2. The application possibilities of coffee waste into reusable utensils in Europe and Asia

Organization of the reusable utensils production	Recycled coffee grounds and renewable raw materials have been turned into the durable, robust material Kaffeeform. The company Kaffeeform produces, mainly from coffee grounds, partly from other waste and renewable raw materials, a durable, robust material that becomes a coffee cup. Kaffeeform makes it possible to carry out thoughtful purchases. The reusable cup is the solution for zero waste and a plastic-free future.
Organization of the purchase of everyday items, decorative articles, outdoor shoes	<ul style="list-style-type: none"> – The e-commerce tools lead to the expansion of online shops. – The analyzed production activities design and build an e-commerce site that are easy to use by customers. – The use of analytics instruments to check a customer behavior and identify what works on an e-commerce website. – The automat work flows and the organization of the daily operations help to create marketing campaigns in order to establish brand identity and increase customer awareness. They offer a solid customer support that e-commerce tools maintain online businesses, but leads to growth.
Advantages	<p>These innovative productions bring</p> <ul style="list-style-type: none"> – economic benefits by: <ul style="list-style-type: none"> a) reducing the cost of coffee waste disposal, b) earning an income from set-up productions, – environmental benefits by: <ul style="list-style-type: none"> a) reusing organic substances and other substances in the technological cycle, – social benefits by: <ul style="list-style-type: none"> a) employment of new workers and reduction of landfill waste.
Insights	This set of a coffee cup with a saucer, the travel coffee mug, the watch, the decorative articles, the outdoor shoes are the first completely post-waste products

Source: Authors' own preparation.

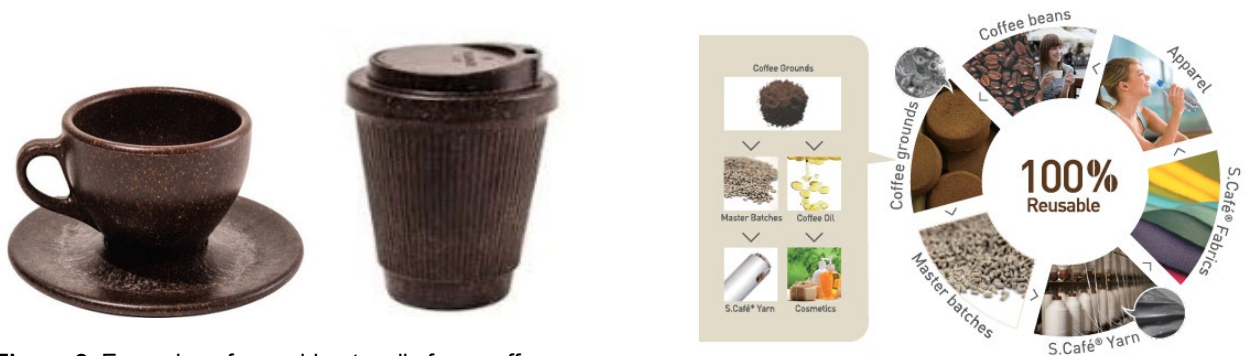


Figure 2. Examples of reusable utensils from coffee waste

Source: Own preparation based on: www.kaffeeform.com. Accessed on 1.11.2022.



Figure 3. S.Café@SSINGTEX® fabric use to make T-shirts

Source: Own preparation based on: www.S.CafeSSINGTEX. Accessed on 1.11.2022.

Conclusions

The general findings based on the analysis of domestic and international literature on the use of post-production wastes of plant origin demonstrate that the concept is locally diverse. The difficulties concerning the use of post-production wastes of plant origin depend on the specificity and diversity of food market products' in the analyzed countries. Both hypotheses of the research have been positively verified. The specific conclusions from the experts' interviews are as follows:

- The main factors motivating companies to set up production activities from coffee waste are the existence of a market niche in this area, finding a use for coffee waste for a product and the demand reported for it by potential consumers;
- The main factors motivating consumers to purchase products from coffee waste are the product's better performance compared to standard products, lower price and the need to demonstrate their environmentally friendly attitudes.

The limitations of the study in presenting optimal solutions are due to the specific supply and demand of the analyzed food markets; and consumers' willingness to apply the principle of reusing raw materials and products in a closed product life cycle. To reduce the study restriction, the authors took advantage of variety of primary and secondary source of materials.

Based on the interviews with experts, the following proposals for the implementation of production activities on coffee waste may be stated as:

- Popularization of best-practice recommendations for food industry enterprises by employment bureaus;
- Legal, economic and environmental support in the establishment of production activities using coffee waste;
- Encouragement of potential buyers to purchase products made from coffee waste.

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