SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2022
ORGANIZATION AND MANAGEMENT SERIES NO. 155

CIRCULAR ECONOMY FROM THE PERSPECTIVE OF SMES SECTOR

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Purpose: The main objective of the paper is to determine the way SMEs perceive the circular economy concept and to establish factors influencing introduction of CE pratices. In particular, answers to the following research questions are sought: (1) Is the CE concept familiar to and well-understood by entrepreneurs?; (2) What are the strongest challenges and barriers for SMEs with regard to the introduction of the CE?; (3) Which factors determine SMEs' introduction CE practices.
Design/methodology/approach: SMEs were selected as the subject of the research. The study was quantitative in character. A questionnaire study and statistical analysis (structural equation modeling in it) were used.
Findings: The paper focuses upon challenges associated with the implementation of the circular economy in SMEs, barriers for implementation and determinants. The results revealed that the concept is familiar and well-understood. However, businesses do not perceive it as a source of economic benefits. The following fields were considered as problematic: improvement of recycling efficiency, exploitation of production by-products, and substitution of non-renewable resources. Structural equation modeling revealed that introduction of CE practices is determined by several institutional factors, perceived risk and external standards and norms.
Originality/value: The paper extends previous work concerning the management of SMEs by undertaking the issue of CE introduction. In particular, it focuses on the perception of barriers and stimulators CE practices and responding to several recent calls for research on CE awareness in SMEs. Another novel element can be find in using the theory of reasoned action (TRA) to explain the factors conditioning the introduction of CE practices into SMEs.

Keywords: circular economy, SME sector.

Category of the paper: Research paper.

1. Introduction

The hitherto economic system has been characterized by the linear flow of materials and resources. The past decade brought about a new concept – circular economy (CE) – which revolves around recycling/reuse and reintroduction of resources from preceding economic cycles (Feng, Yan, 2007; Allwood, 2014; Lehmann et al., 2014; Bicket et al., 2014). The CE has been defined as "an economic system that represents a change of paradigm in the way that human society is interrelated with nature and aims to prevent the depletion of resources, close energy and materials loops, and facilitate sustainable development through its implementation at the micro (enterprises and consumers), meso (economic agents integrated in symbiosis) and macro (city, regions and governments) levels" (Prieto-Sandoval et al., 2018). This concept aims to conserve natural resources, limit waste and offer economic benefits. It is estimated that the introduction of the circular economy will enable the demand for resources to be decreased by 17-24% by 2030 (Towards a circular economy, 2014). In addition, it will result in 600 billion EUR savings in the European industry sector (Guide to resource efficiency, 2012). Environment-related benefits will also emerge. These will include an annual greenhouse gasses reduction of 2-4% (The European Commission, 2019) and a general improvement of the quality of life (Wijkman, and Skånberg, 2018). The transition from the linear to circular economy has already been researched. Previous studies focused upon society level (e.g. Hobson, and Lynch, 2016; Scheel, 2016) or investigating the CE at the regional (e.g. Geng et al., 2009), provincial (e.g., Ormazabal et al., 2016; Du et al., 2009) or national levels (e.g. van Buren et al., 2016; Yaduvanshi et al., 2016). Our considerations were focused on the level of the organization. From the perspective of organizations, the transition to a CE implies a change at the strategic level of business model innovation, with modifications in terms of product design, supply chain design and commercial strategy (Bocken et al., 2016). Such changes require growing awareness and interest among managers, who have a central position in putting CE into practice (Carayannis, and Campbell, 2012). Knowledge of their views and beliefs about this concept constitutes important, first step in introduction. Earlier work on the perception of the concept of a circular economy is of a general nature and does not take into account the specifics of SMEs (Xue et al., 2010; Liu, and Bai, 2014; Masi et al., 2018). Empirical studies carried out on this group of organizations focused only on business areas most suitable for the implementation of CE actions (Cristoni, Tonelli, 2018), business models (Ceptureanu et al., 2018), decision models for undertaking circular economy practices (Zamfir et al., 2017). Moreover, motivations, barriers and enablers for CE implementation into SMEs have been explored only by focusing on a single segment of firms (Gusmerotti et al., 2019) or have experienced only limited investigation (Agyemang et al., 2019; Núñez-Cacho et al., 2018). Studies that provide wider evidence are still lacking (Lieder, and Rashid, 2016). In the light of these gaps, this paper presents the results from a survey-based study from the perspective of 630 polish SMEs.

The main objective of the paper is to determine the way SMEs perceive the circular economy concept and to establish factors influencing introduction of CE pratices. In particular, answers to the following research questions are sought: (1) Is the CE concept familiar to and well-understood by entrepreneurs?; (2) What are the strongest challenges and barriers for SMEs with regard to the introduction of the CE?; (3) Which factors determine SMEs' introduction CE practices. Considering the previous studies in the field, paper extends previous work concerning the management of SMEs by undertaking the issue of CE introduction. In particular, it focuses on the perception of barriers and stimulators CE practices and responding to several recent calls for research on CE awareness in SMEs (Liakos et al., 2019). Another novel element can be find in using the theory of reasoned action (TRA) to explain the factors conditioning the introduction of CE practices into SMEs. We expand the interpretative schema of the study with perceived risk and internal norms as additional predictive components. To the best of our knowledge, additional components and CE practices have never been used in conjunction with TRA model to address the issue of circular economy. The research results will endow information for encourage further normative research on CE introduction at the level SMEs.

This paper is structured as follows: Section 2 describes the theoretical framework, including the circular economy concept and its significance for further economic development (Section 2.1), theories the study is based upon (Section 2.2), grounds for hypotheses development (Section 2.3). Section 3 presents research methodology. Section 4 explains research results, and Section 5 outlines the discussion and final implications of the study.

2. Conceptual background

2.1. Literature review

A modern economic system is characterized by the linear flow of resources, materials and products (Ness, 2008). According to several scholars (Geng et al., 2012; Lehmann et al., 2014; Fletcher, and Dunk, 2018), due to growing consumerism, the linear process management system leads to the emergence of numerous negative phenomena, the most critical of which include: 1) repletion of natural resources, 2) degradation of the natural environment due to the diversification of waste types and the growth of their volume, 3) development of restrictions for prospective industrial production (Feng, and Yan, 2007). The negative outcomes of the linear model threaten the stability of economies and integrity of natural ecosystems (Ellen MacArthur Foundation, 2013; Park, and Chertow, 2014; Song et al., 2015). The circular economy is to offer a response to the threats. The concept is built upon the retention of products and materials in economy, which will satisfy the demand by the exploitation of resources

derived from preceding economic cycles (Allwood, 2014; Ghisellini et al., 2016; Moreau et al., 2017).

The Three Rs (replace, reduce, recycle) illustrate the circular economy concept. It is founded upon effective waste management and its integration with industrial production (Chiu, and Yong, 2004). The effectiveness is delivered by the reuse of products, components and materials, renovation and modernization, as well as the exploitation of renewable energy throughout the value chain and product life-cycle (McDonough, and Braungart, 2002). In addition, the circular economy is connected with the concept of clear production (Ghisellini et al., 2016; Lieder, and Rashid, 2016). The concept is grounded in the improvement of resources' productivity and production performance, it facilitates the minimization of waste by its reduction at the source as well as the circulation.

From the perspective of organizations, the CE is perceived as the impetus for economic development with an alternative flow model which is cyclical and regenerative (Kok et al., 2013; Geissdoerfer et al., 2017). It provides opportunities for new value creation (Linder, and Williander, 2015), innovation (Schulte, 2013) and achieving synergy-related benefits (Dong et al., 2016). The analysis of success concerning CE-based business models (especially sustainable business models) confirmed positive outcomes of the CE in organizations which primarily pertain to the reduction of costs (The European Commission, 2019), job creation (Bastein et al., 2013; Behrens, 2016). Economic, social and environmental benefits emerging from the circular economy result in the concept's increasing popularity also at microeconomic level.

A systematic literature review on the circular economy and organizations identified 9 main thematic research areas: systematic literature review on CE and environmental economics, design, socio-political issues, performance measurement, manufacturing specific technique focused on CE, business case framework, organizational symbiosis, alternative concepts, barriers and enablers (Thorley et al., 2019). This paper fits into the last area. The preliminary studies on the entrepreneurs' perception combine this factor with conditions, barriers, challenges. The results of various survey studies published in peer-reviewed scientific journals and identified by the authors through a review of the literature are summarised in Table 1.

Table. 1.
Survey studies published in peer-reviewed scientific journals on the perception and others determinants of the CE

Attribution	Reference
Determinants	Geng and Doberstein (2008); Xue et al. (2010); Zhang et al. (2013); Van Eijk (2015); Agyemang et al. (2019); Gusmerotti et al. (2019); Govindan and Hasanagic (2018); Pichlak (2018)
Barriers	Shi et al. (2008); Geng et al. (2012); Kok et al. (2013); Mutz (2015); Rizos et al. (2015); Agnello et.al (2015); Möllemann (2016); Masi et al. (2018); Ormazabal et al. (2018); Tura et al. (2019); Bjoern and Upadhyay (2019); Mura et al. (2020)
Enablers	Zhang et al. (2013) ; Singh (2017); Zamfir et al. (2017); Tura et al. (2019); Mura et al. (2020)
Awareness	Xue et al. (2010); Liu et al. (2009); Zhu, Geng, and Lai (2010) ; Liu and Bai (2014)

An analysis of the studies suggests three key conclusions. First, an introducing CE practices at a firm level requires a comprehensive analysis and understanding all determinants, including the motivational factors and barriers. Secondly, awareness/ knowledge of the CE concept is a factor that should be considered in research on the introduction of CE practices. Thirdly, these papers have based their analyses on firms in general, or specifically on SMEs. In relation to SMEs further works on determinants of the the introduction of CE practices should also be interpreted from the perspective of well-established, scientific theories. They will be presented in the next section.

2.2. Supporting theories

For the theoretical grounding of the present considerations, a search for innovative and critical literature, one which provides a base for further discussion, was conducted. Focus was placed upon the model of behavioral change and two theories: reasoned action, and environmentally responsible behavior.

In light of the behavioral change model, the level of knowledge influences the awareness and beliefs, which in turn, results in a change of behavior. With regard to environment-friendly actions, this means that when knowledge increases, environmentally favorable attitudes and responsible environmental actions are developed (Hungerford, and Volk, 1980). The behavioral model, though very simplistic, provides a base for the consideration of possible relationships existing between environmental knowledge, environmental awareness and attitude and how these can translate into action or inaction. Based upon the model, the change of a company's behavior – the transition towards circularity – results from the change in entrepreneurs' awareness. The level of awareness determines behaviors, CE practices in this case. At the same time, good knowledge of the CE may not necessarily imply the introduction of CE practices. These are also determined by other intervening factors.

The reasoned action theory stipulates that the intention of acting has a direct impact on behavior, and that it can be predicted by attitudes. These attitudes are shaped by subjective norms and beliefs. Situational factors influence these variables' relative importance (Ajzen, and Fishbein, 1980). Studies by Hanna (1995) confirmed that developing environmentally favorable attitudes towards relevant issues leads to the intention to act responsibly becoming reinforced. Attitudes and subjective norms contribute to behavioral intentions, which can be used to predict behavior. Subjective norms denote an individual's beliefs concerning the involvement in a specific behavior. The application of the reasoned action theory in this study acknowledges the connection between knowledge, attitude and behavior. In the context of the CE, this means that attitudes towards the CE generate the intention to undertake action. In more general terms, a premise ought to be made that the way entrepreneurs perceive the CE determines the intention concerning the introduction or abandonment of CE practices.

This paper fits well within the environmentally responsible behavior theory (Hines et al., 1987). The ERB theory indicates that the following variables: intention to act, locus of control (an internalized sense of personal control over the events in one's own life), attitudes, sense of personal responsibility, and knowledge, suggest whether a person would adopt a behavior or not (these factors ought to be considered conjunctively). In relation to the circular economy, no single factor is responsible for current practices or is sufficient to initiate the implementation of practices. Separate constructs of attitudes, locus of control and intention to act may not be enough to create an intention to act. United under one overarching concept, they become a base on which predispositions for pro-environmental behavior are formed. The implementation of CE practices is likely to be determined by several factors. For that reason, studies of the issue ought to involve predictors and variables which can affect behavior towards the circular economy.

The mentioned theories form a basis of theoretical reasoning for hypotheses development.

2.3. Hypotheses development

In developed countries, the circular economy concept is perceived as a direction of prospective growth and has the support of political decision-makers and research community (Ghisellini et al., 2016; Manninen et al., 2018). This support focuses primarily on promoting this concept (Ladan, 2018; EU Circular Economy Action Plan) and introducing solutions dedicated to her (Zhu et al., 2015). Strong emphasis is also placed on building awareness about the benefits of circular economy practices, in effect of what the term is intuitively perceived as a field which may prospectively offer benefits for users (Geng et al., 2012; Smol et al., 2018) and new business opportunities (Rizos et al., 2015; Ormazabal et al., 2016). In addition, the emerging environmental education programs in schools and universities increase people's interest in the value of nature, which results in a change in preferences customers in the direction of firms that use CE strategies (Prieto-Sandoval et al., 2018). Along with the growing public awareness, one can notice the growing knowledge of entrepreneurs about circular economy. Results obtained by World Business Council on Sustainable Development indicate that 76% of respondents effectively monitor circularity aspects related to their companies, (WBCSD, 2018). Carried out by Liakos et al. (2019) on a group of 103 people, the study showed that with the growing emphasis on CE across the globe by governing bodies, organizations are becoming more aware of CE. So it increases knowledge of how to transform the firm's current operations into circular business. An expression of this awareness in the group SMEs are managerial practices for circular economy business models (Unal et al., 2018). Bassi and Diaz confirm variability in the adoption of CE practices. They found that 73.2% of the organizations undertook or were in the process of undertaking at least one CE activity in the past three years. The contrary results were obtained by Mura et al. (2020). They indicate that circular economy practices appear weakly developed among the SMEs, with the exception of separated waste collection, which is likely to have been influenced by the stricter regulation in this field.

What's more, Yongtao (2015) notes that SMEs are characterized by lack awareness of technological innovation cycle and insufficient understanding of circular economy. The diversity of CE practices used, confirmed by other authors, however, contradicts its conclusions. According to Law and Gunasekaran (2012), "It is clear that for a SME working towards a circular economy, that individual mind-sets, the way an individual thinks and behaves, are key factors supporting this transition". Liu and Bai (2014) confirm good understanding and a high willingness of firms to move to a circular. Pursuant to the above, the following may be argued:

H1*: The circular economy concept is familiar to and well-understood by SMEs.*

TRA theory can be the basis for prediction of organization's readiness to introduce circular economy approach (Singh and Chakraborty, 2017). According to it, one of the main factors conditioning the intention to implement CE practices are external norms. They are identified with social pressure from the government, customers, market, which shapes the perception of the organization regarding the desired behavior. Many papers demonstrate that policymakers have a key role to play in advancing CE practices by a) enacting effective regulations or eliminating regulatory hurdles to CE practices; b) providing incentives to organizations engaged in such practices, c) providing financial support, and d) raising awareness about the issue. Legal context, plays an important role in explaining the business decision in favor of green innovation and waste minimization (Singh et al., 2016; Dong et al., 2016; Velis, and Vrancken, 2015; Witjes, and Lozano, 2016). Directing regulations and standard requirements encourage entrepreneurs toward more proecological behaviors and it is inevitable that introduction of CE is led from government policy and regulation. Apart from legal regulations factor exerting pressure on the introduction of CE is market internalization (Zhu et al., 2011). Planing (2015) draws attention to the importance changing consumer behavior toward proecological activities. Confirms it Sharma et al. (2010) reports that an important driver for product reuse and remanufacturing is the growing segment of marginal customers. Macroeconomic conditions are also an external norm. Gumley (2014) highlights the roles taxation policies, funding and royalty regimes. Providing financial support to entrepreneurs in the form of grants, low interest loans, or business incubators, is critical for supporting smaller companies (Iacondini et al., 2015). Furthermore, few studies explored the importance of technological development. New technologies not only provide cleaner solutions for the future, but also help in avoiding and overcoming problems caused by the current technologies (Ghisellini et al., 2016). They generate potential for improving existing operations and increased information sharing, so they can stimulate introduction of CE practices. Our study considered environmental, economic, institutional and technological factors as the components of external norms.

The other important factor pointed out by TRA theory are perceived benefits associated with attitude. If CE introduction associate with economic benefit, cost effectiveness and resourcefulness, the attitude will tend to be positive (Tseng et al., 2009), and a situation in which organizations do not see the benefits of the concept results in reluctance in its implementation (Lieder, and Rashid, 2016). Linder and Williander (2015) summarize the key drivers for implementing circular business models, including cost savings, differentiation, improved customer relations, improved margins, reduced environmental impacts and increased brand protection. Previous studies have confirmed that CE is seen to provide opportunities for cost savings (Murray et al., 2017; Pitt, and Heinemeyer, 2015) and business development (Kok et al., 2013).

The behavioral change model and ERP theory indicated in section 2.2 indicate the importance of knowledge and awareness of the CE concept for its introduction. This is confirmed by further studies (Xue et al., 2010; Liu, and Bai, 2014; Rizos et al., 2015). It can be concluded that there is a high agreement of the authors as to the significant role of knowledge in readiness to implement CE practices. Scientific knowledge and research will give a clear idea of the environmental impacts. Thus, knowledge on the circular economy, attained by different means and ways, will work as a strong driver to implementing CE practices (Diabat, and Govindan, 2011; Moktadir et al., 2018).

Two additional factors have been added to earlier theories. The first is perceived risk. Liu and Bai (2014) indicate the significance of uncertainty regarding the marketplace and risk aversion. A strong risk aversion on the part of entrepreneurs can hinder the enactment of the circular economy, even following the evaluation of the benefits associated with its implementation. If entrepreneurs perceive the financial risk to be low, it can be assumed that they invest in circularity sooner. They take this position for example Bechtel et al. (2013).

The second factor introduced is internal standards. They are conditions that can stimulate or limit readiness to introduce CE practices through the availability of resources and competences. Various research has demonstrated that organization's CE activities are positively predisposed by environmental objectives (Tonelli, Cristoni, 2018). Circular economy is often seen as a possibility to conciliate the competing objectives of economic, environmental and social benefits (Velte, and Steinhilper, 2016). Hart et al. (2018) suggest combining these goals with stakeholder management and a long-term perspective. As a bundle of goals, they should be a reference point for the practices introduced. Strategies are also included in the internal norms. Circular strategies have the potential to save embodied energy and reduce resource intensive primary production and waste generation by first slowing resource loops and then closing resource loops (Bocken et al., 2016; Laubscher, and Marinelli, 2014). They can be part of a sustainable development approach. Stewart and Niero (2018) show that circular economy has started to be integrated into the corporate sustainability agenda. Strong relationships between circular economy-oriented and sustainability-oriented business model emphasize Pieroni et al. (2019). Hence the definition of circular strategy as well as the adoption of

sustainability orientation enable CE practices. The last factor shaping internal norms is supply chain pressure. The supply chain is a critical unit of action for the implementation of a circular economy model. Implementing a circular business model encourages the design of circular or reverse supply chains, allowing products at the end of their life cycle to reenter the supply chain as production inputs through recycling, reuse, or remanufacturing (Nasir et al., 2017). As a results the supply chain is seen as an important platform for CE activities (De Mattos, and De Albuquerque, 2018). Lack of coordination and collaboration among supply chain members, as well as being dependent on other network members is a barrier to pro-ecological initiatives (Mangla et al., 2018). Thus, present study considered environmental objectives, supply chain, chain network management, organizations' sustainable development strategies to explain SMEs' perceived external norms.

H2: *Introduction of CE practices in SMEs largely depends upon external norms (a), internal norms (b), perceived benefits (c), perceived risk (d) and CE familiarity level (e).*

Despite diverse limitations, several pro-environment companies have implemented the circular economy. Various models have been adopted including slowing, closing and narrowing resource loops (Bocken et al., 2016), short cycle, long cycle, cascading, pure cycles, digitization, and produce on demand (Wolde, 2016). Bocken et al. (2014) introduced eight sustainable business model archetypes, described as businesses that a) maximize material and energy efficiency, b) create value from waste, c) substitute with renewables and natural processes, d) deliver functionality rather than ownership, e) adopt a stewardship role, f) encourage sufficiency, g) re-purpose the business for society/environment, and h) develop scale-up solutions. Product design/material composition for high quality reuse of products, components and materials, constitutes one of the most frequently employed models. The role of design has been widely acknowledged as DfX practices by many authors (design for remanufacturing and reuse, df recycling, df environment) (De los Rios, and Charnley, 2017; Moreno et al., 2016). It is believed that organizations which implement practices of DfX nature have a high (or medium-high) degree of circularity (Urbinati et al., 2017).

In recent years, the popularity of the rationalization of energy consumption, i.e. restriction of energy consumption, and the exploitation of alternative energy sources, has been growing. A business model based upon these aspects was developed by Sądeckie Wodociągi (Nowy Sącz Waterworks). The company has been focusing upon limiting greenhouse gasses emission by replacing traditional energy sources with renewable energy produced in-house, as well as reducing electric energy and conventional fuel consumption. Actions in the field are delivered via the introduction of high-performance and energy-saving equipment (multi-step pump systems, automatic pressure regulators) in water purification stations and sewerage and waterworks infrastructure (Kudlik, and Wysowska, 2017). The analysis examining value creation revealed that companies primarily focus upon limiting energy consumption and

reduction of the need for new materials in the course of materials' recovery. Pursuant to the above, the following may be argued:

H3: *SMEs are the closest to introducing a business model based upon material/ resource efficiency.*

3. Research methodology

3.1. Survey development

The awareness and behavior of entrepreneurs towards developing a circular economy constitute multidimensional constructs. Therefore, Churchill's (1979) research paradigm was applicable to create measures. Aimed at developing constructs, this paradigm was successfully employed in previous research (Liu, 2009; Bai, and Liu, 2013). The objective of our study was to determine the way in which Polish businesses perceive the circular economy concept and establish factors influencing their transition towards circularity. The choice of country results from its specificity in comparison to other EU countries. Poland is one of the counties where ambitious recycling objectives were introduced but were not accompanied by information campaigns or transition-supporting instruments were missing in the initiatives. As a consequence, at a first glance, Poland may seem to be amongst the lesser, circular-economy-focused EU member states. However, there are a few notable areas where Poland exceeds the majority of the competition, particularly the per capita waste production, and EPR coverage. Additionally, the country ranked very respectably in POLITICO's circular economy index (Hervey, 2018). Such results make Poland an example among the developing countries and those pursuing the introduction of the CE.

SMEs (employing up to 250) were selected as the subject of the research. The study was quantitative in character. The sample is characterized further on. The study was conducted by post. Respondents were notified by telephone on the objective and scope of the study beforehand. Initial consent was obtained. In case of a lack of response, respondents were re-invited after a month's time. Company owners (30%) or designated specialists – environment protection (48%) and quality control (22%) staff – were selected as respondents.

The research had a three-stage character (Figure 1). In the first stage, familiarity with the CE concept and its impact on organizations were determined (section 3.1). In particular, we focused on entrepreneurs' perception of challenges, opportunities, barriers and effects related to introduction CE practices. In the second stage, circular business models used by SMEs (section 3.2) were analyzed. In the third stage, the research model regarding factors determining CE practices was verified (section 3.3, for model – see Figure 2).

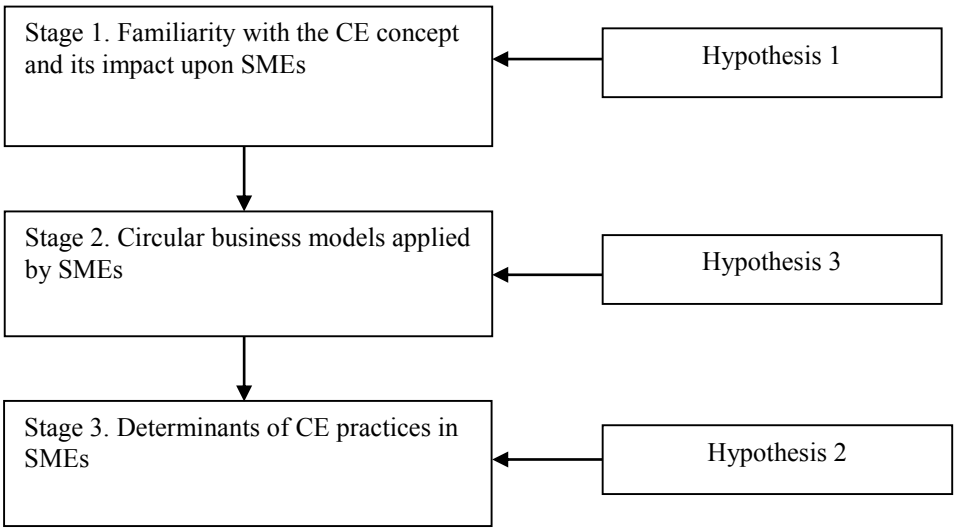


Figure 1. Research framework.

Variables

An original survey questionnaire was applied as the research tool. The questionnaire was developed specifically for the purpose of the study. Closed, cafeteria-type or yes/no questions were employed. The questionnaire consisted of two sections pertaining to 1) familiarity with the CE concept and its perception by companies, and 2) factors determining introduction of CE practices.

The first part of the survey pertained to selected matters associated with respondents' perception of the circular economy, including the familiarity with the concept, challenges associated with its implementation, innovations for the CE, impact of the circular economy upon the operation of companies, implementation barriers, and circular business models. Questions concerning the barriers were drawn from Rizos et al. (2015). Issues connected with opportunities for companies were derived from Ormabazal et al. (2018).

The second part of the survey pertained to factors determining introduction CE practices. The level of delivered circular economy practices was adopted as the dependent variable. The practices were selected on the basis of business models' characteristics featured in literature. Five independent variables were offered (constructs). The first is the level of familiarity with the CE concept as a factor determining potential interest of the management in the CE. The next factor, the perceived risk, was viewed via the company's adaptation to the CE cost and costs/benefits ratio. Pressures managers experience in connection with the implementation of the circular economy were embraced as external and internal norms. Tura et al. (2019) and Su et al. (2013) were employed to identify these. Environmental objectives, supply chain, chain network management, organizations' sustainable development strategies were accepted as internal norms. The external norms were divided into: 1) environmental and health-related (limitedness of resources, opportunity to reduce negative impact upon the environment, health improvement), 2) economic (market internationalization,

customers' demands), 3) institutional (environmental regulations, economic support), 4) technological (technological development). Possible benefits emerging from the transition towards circularity presented the final variable (after: Ormabazal et al., 2018). All variables were operationalized by means of a 1-5 Likert scale (1 as the least significant factor).

In addition, the model included 3 control variables: company size (expressed by employment, divided into small and medium-sized businesses), market the company operates on, and sector of activity. The model verified in the second section of the study was outlined in Figure 2.

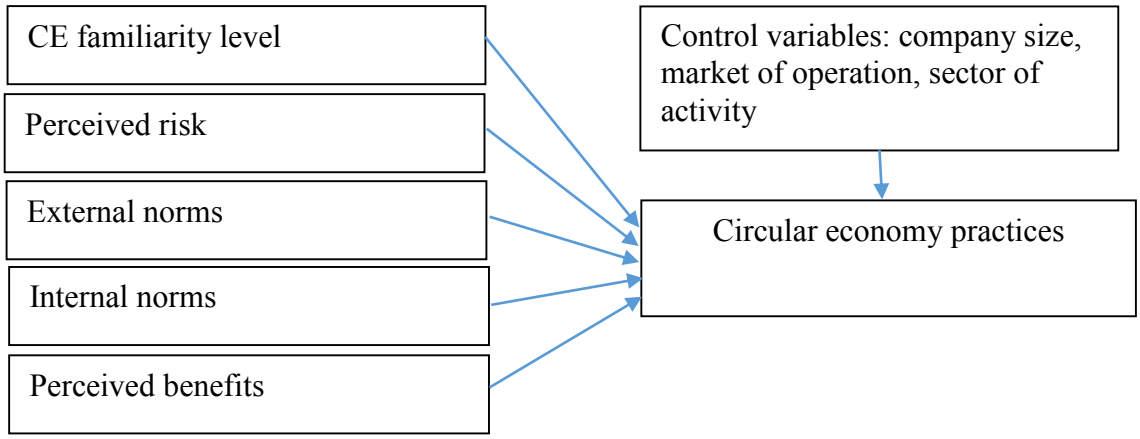


Figure. 2. Research model

The research tool (as a whole) was initially verified in the course of a pilot study which encompassed 3 small, local companies (2 production companies, 1 service company). Feedback was taken into consideration in order to redesign the content of the questionnaire. Subsequently, the questionnaire's reliability was verified.

3.2. Analysis of the reliability of the scale

Unidimensionality was ascertained through exploratory factor analysis (EFA) to determine factor loadings, and the results of factor loadings are presented in Appendix 1 with most items showing significantly high loadings of above 0.50. AVE and CR values were calculated according to the equations given by Fornell and Larcker (1981). For internal consistency of the constructs, the CR values exceeding 0.7 and preferably 0.8 (Hair et al., 2010), and AVE values exceeding 0.5 (Wu, 2002), are regarded to be acceptable. The average variance extracted were less than 0.5 for two constructs in this study, only in the case of one construct (external norms) AVE was below 0.3. The assessment of convergent validity was ascertained through factor loadings of 0.4 (Hair et al., 2010). As shown in Table 2, all the CR values exceed the cut-off values depicting internal consistency. Table 2 also shows information on Cronbach's coefficient with values ranging between 0.7 and 0.9 which indicate significant reliability. Consequently, no item weren't eliminated.

Table. 2.
Analysis of the reliability of the scale

Construct, factors	No. of questions	Cronbach's alpha	CR	AVE	MSV	ASV
External norms	11	0.899	0.85	0.32	0.211	0.115
Internal norms	4	0.847	0.78	0.47	0.135	0.106
Perceived risk	2	0.845	0.88	0.52	0.269	0.138
Perceived benefits	4	0.732	0.81	0.58	0.269	0.153
CE familiarity level	1	0.905	0.92	0.75	0.135	0.069
CE practices	1	0.864	0.89	0.59	0.189	0.125

CR – Construct Reliability; AVE – Average Variance Extracted; MSV – Maximum Shared Squared Variance; ASV – Average Squared Variance.

3.3. Research sample

For the purpose of the study, 1600 SMEs were selected at random (100 in each 16 voivodeship). The selection was made by drawing from GUS database (Central Statistical Office), where the selection criterion was belonging to the SME group (determined by number of employee). Out of the total, 630 responded- the response rate was 39%. The sample was dominated by service sector companies (56.3%, see Tab. 3). The share of small (up to 50 employees) and medium-sized companies (50-250 employees) was similar. The companies operate chiefly in East-Central Europe (36%). To a lesser extent, they operate on the European (25%) and regional (23%) markets.

The lack of time (48%), no knowledge of the issue (37%), absence of the decision-maker or a person competent to supply answers (25%) were offered as the most frequent reasons behind the refusal to participate. With regard to the group of 37% of respondents who refused to participate in the study due to the lack of familiarity with CE-connected issues, the group does not affect the results of the population. Further studies pertaining to the perception of the CE in this group would be groundless.

Table. 3.
Sector-specific distribution of the sample (in %)

Sector	Share
Food & Tobacco Manufactures	8.8
Textile Mill Products/Apparel	3.8
Lumber & Wood Products	1.9
Office, Computing & Accounting	7.4
Communication	5.5
Chemicals & Drugs	5.2
Rubber Products	1.5
Stone & Glass Products	1.9
Ferrous Metal & Products	8.4
Non-ferrous Metal & Products	7.6
Electronic Components & Equipment	4.6
Transport	4.1
Hotels & Gastronomy	2.0
Trade	9.8
Services and other	26.9

3.4. Analysis of results

Statistical tools were applied in order to conduct the analysis of results. The first part of the study employed the frequency of respondents' responses (in %), contingency tables and correlation coefficients. In the second part (analysis of the model), Structural Equation Modelling was applied. This enabled the shape and strength of relations among variables to be determined. Due to the lack of normal distribution, normalization (logarithmic transformations) was conducted. The maximum likelihood estimation method was employed in order to assess the fit of the model. The standardized root mean square residual (SRMR) amounted to 0.06, which is below the threshold of 0.08. The comparative fit index (CFI) equaled 0.954, the Tucker–Lewis index (TLI) 0.945, and the incremental fit index (IFI) 0.955, which exceed the recommended value of 0.90. The remaining fit indexes prove a good fit of the model: $\chi 2 = 641.965$, CMIN/DF = 1.562, RMSEA= 0.048.

4. Research results

4.1. Results pertaining to the familiarity with the CE concept and its impact upon SMEs

The surveyed businesses are, to an extent, familiar with the concept of the circular economy (50%). The familiarity with the concept was declared by 46% of respondents. These were chiefly medium-sized companies which operate on European markets. The familiarity with the CE concept was determined neither by size nor the sector of activity. On the other hand, the relationship between the familiarity with the concept and the market companies operate on was confirmed ($r = 0.26$, $p = 0.03$).

Respondents considered recycling and the reduction of waste volume as the most significant aspects of the circular economy. This is convergent with definitions of the circular economy which highlight the lack of waste accumulation and recycling as characteristic features of such economies. To a lesser extent, the circular economy was associated with materials efficiency and the growth of recycled waste volume (Fig. 3).

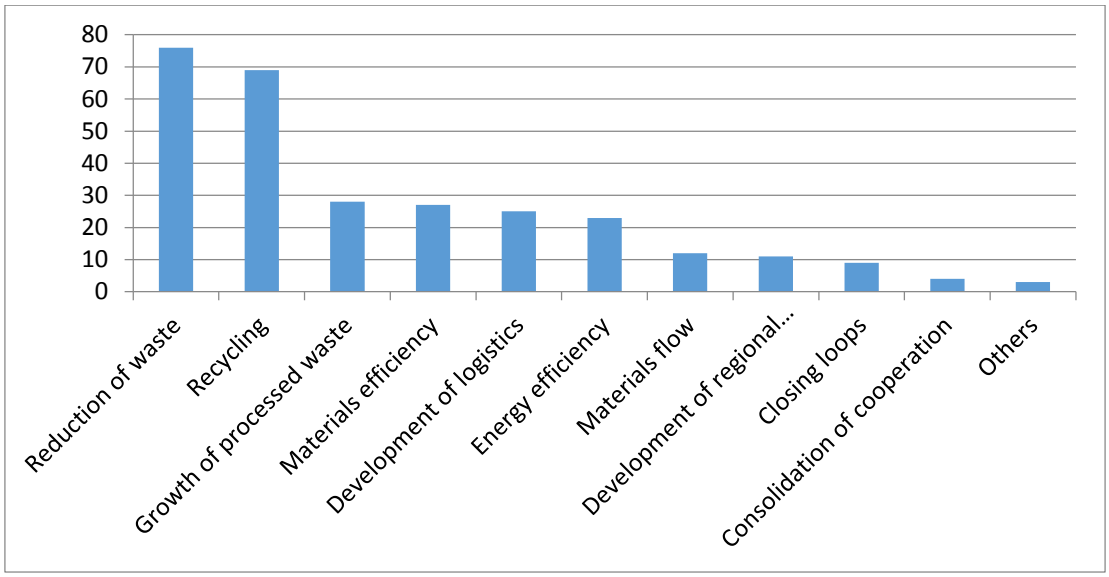


Figure 3. The most significant fields of the circular economy (in %).

Respondents observed that the way in which the circular economy is promoted is insufficient (46%). This is especially valid for government initiatives, which lack reports and incentives associated with the concept. In addition, access to public information pertaining to the circular economy is insufficient (31%). This points to a pressing need for information and promotion initiatives in the public space. The argument was confirmed by respondents, who stressed the need for actions concerning education/ communication (52%), support of environment-friendly innovations (61%), transfer of knowledge on the regional level (22%), and development of legal regulations (42%). Respondents' opinions concerning the promotion of closed-loop systems within companies conducted by the management were much more favorable: 42% of respondents believed information campaigns in organizations were average and 31% claimed these were suitable.

Respondents argued that the following constitute the most significant challenges for the development of the circular economy: increase of the effectiveness of recycling (41%, Fig. 3), improved exploitation of production by-products (35%), and substitution of non-renewable resources (33%). As far as the size of the companies is concerned, small businesses believed the substitution of non-renewable resources was the greatest challenge, while for medium-sized companies it was the growth of recycling's efficiency. For companies operating regionally, the greatest challenge was presented by recycling and the exploitation of production by-products, while for those operating internationally it was recycling.

Respondents argued that the following constitute barriers hampering the implementation of the circular economy: lack of government support (41%), insufficient financial resources (42%), and lack of technical skills (43%). On the other hand, respondents do not perceive organizational culture (15%) and engagement of the management (20%) as barriers.

The weak conviction concerning benefits emerging from the CE application constitutes a factor limiting interest in the concept. This is valid for both cost reduction and image improvement (Fig. 4). Respondents argue that positive outcomes of CE implementation are primarily associated with the state of the natural environment. The results indicate that businesses are not aware of economic benefits generated by the CE. Therefore, these benefits are not stimuli for the introduction of the concept. The results contradict those of Ellen MacArthur Foundation's (2013) where the opportunity to reduce costs constituted the chief premise behind the interest in the CE. This discrepancy emerged from the type of enterprises. The present study (as opposed to the study by the Foundation) encompassed SMEs, whose revenue stream is generated through virtual services/products more frequently.

The impact of the circular economy on SMEs is expressed in the external and internal sphere (Fig. 5). External consequences consist in the increase of connections (mainly cooperative) with stakeholders and redesigning supply chain. In turn, internal nipples result from the creation of closed circuits and better management of materials. Introduction CE practices in approximately 20% of SMEs lead to the transformation of the business model.

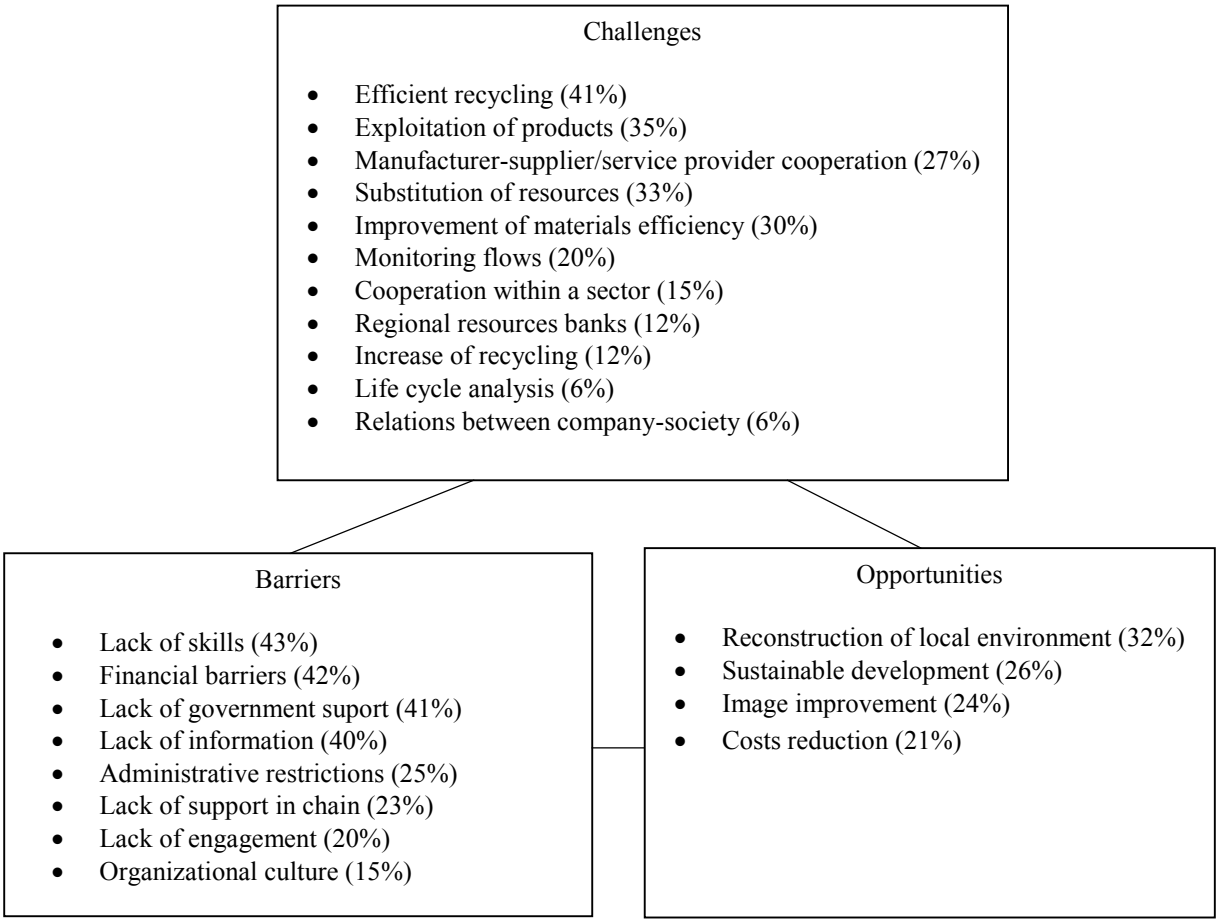


Figure 4. Challenges, barriers and opportunities CE for SMEs.

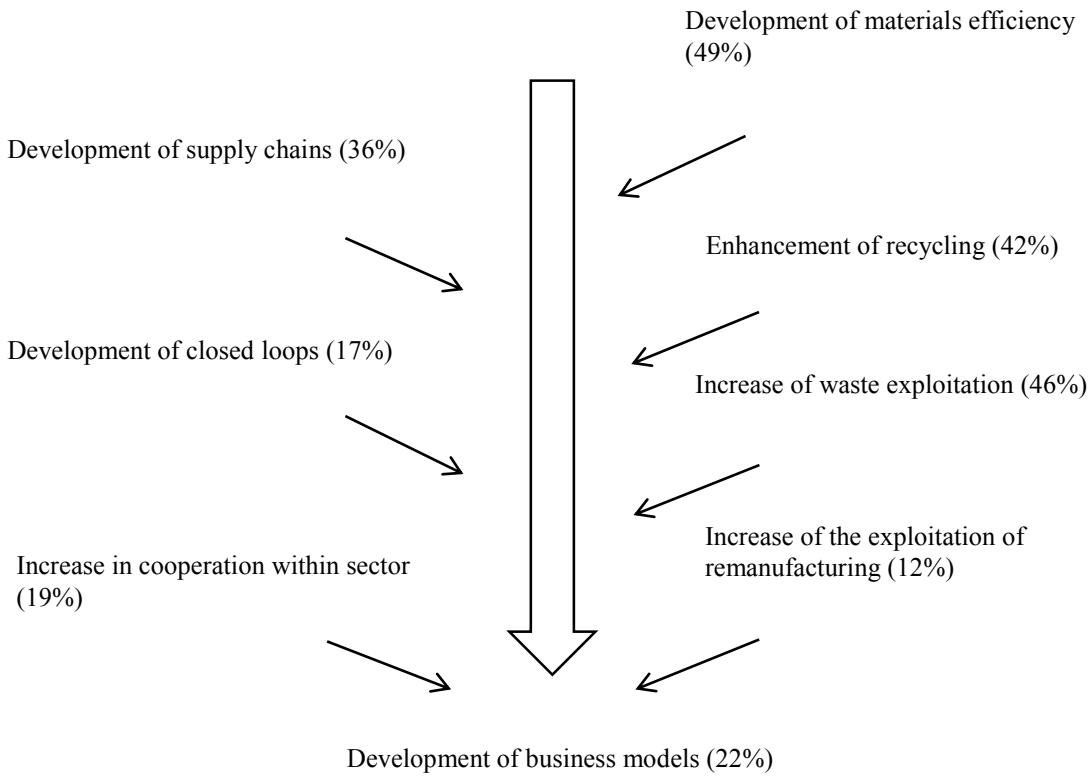


Figure 5. The impact of the circular economy upon the operation of companies.

In the operational aspect, the impact of the circular economy will manifest in the following: applied materials (58%), product design (34%), organizational structure (30%). The impact of changes in recycling, material management and waste exploitation practices on selected functions/areas of SMEs is presented in Appendix 2.

4.2. Results pertaining to the development of circular business models

As far as circular business models are concerned, SMEs are the closest to introducing materials/energy efficiency-based models (41%) or recovering value from waste (39%, Fig. 6). The model based upon scaled solutions emerges sporadically.

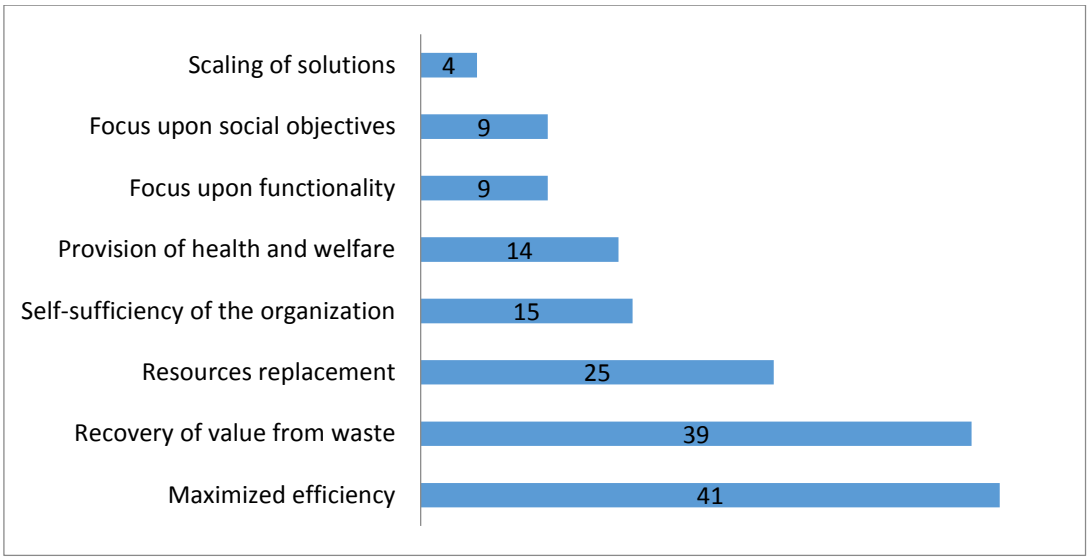


Figure 6. Circular economy models employed by SMEs (in %).

With regard to two most popular models: the maximization of efficiency and value recovery their relationship with control variables, including the market and the familiarity with the CE concept in-depth research was not confirmed[1]. For that reason, we suppose that the selection of models does not depend upon the features of the company but is determined by other factors (e.g. organizational strategy, key competences).

The results indicate that the dominant position is occupied by models which were the most straightforward to introduce because of experience or significant, potential economic benefits. The exploitation of other circularity-related models will occur along with entrepreneurs' growth of awareness. The shift from ownership to usage- and performance-based payment models constitutes an element of such business models. Here, too, we expect an accelerating uptake over time as manufacturers become more familiar with such alternative models.

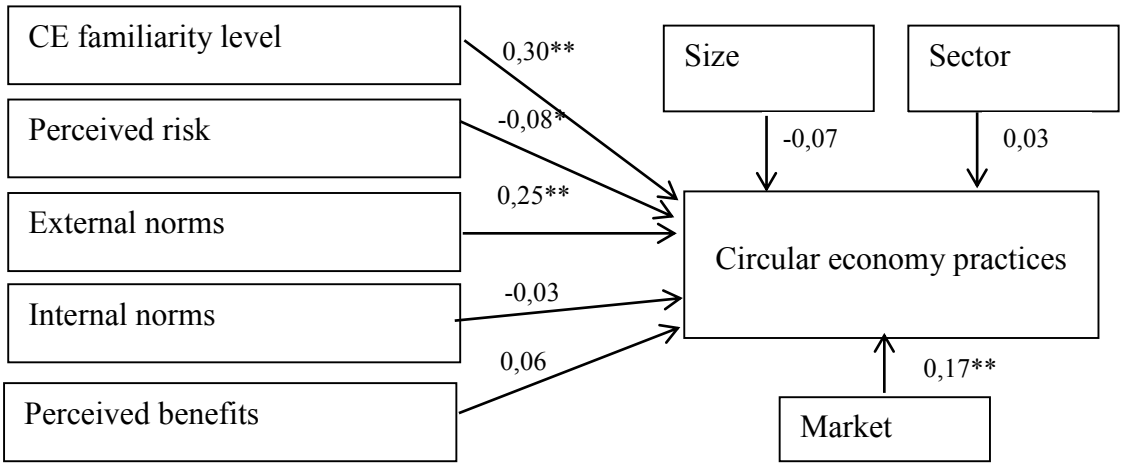
4.3. Results pertaining to the determinants of introduction of CE practices

The level of familiarity with the CE concept, perceived risks, expected benefits, internal and external norms and standards are considered as factors determining the introduction of CE practices by companies (see Methodology). The model's parameters were examined by means of the SEM (Fig. 7). The explained variation amounted to 42%.

The results confirm the relationship between CE practices and external norms ($\beta = 0.25$, $p < 0.001$). The norms include environmental, institutional, technological, economic and social norms whose impact upon the interest in the CE concept is positive and significant. The impact of internal norms (environmental objectives, reduction of supply chain dependence, improvement of chain network management, organization's sustainable development strategy)

[1] The analyzes were carried out for two models most frequently indicated by respondents, i.e. Efficiency maximization and Value recovery. The relationship of these models (Pearson's correlation) with control variables (size, market of operation, CE familiarity level) was determined. In all cases statistically insignificant results were obtained; significance > 0.1.

and perceived benefits upon the introduction of the CE was not confirmed at the statistically significant level (β = -0.03; β = 0.06). On the other hand, the study confirmed the impact of the perceived risk upon the practices. However, the relationship is not strong (β = -0.08, p < 0.05). In addition, the relationship between the familiarity with the concept and the introduction of CE practices was positively verified (β = 0.30, p < 0.001).



*p < 0,05; **p < 0,001

Figure 7. Results of SEM parameters estimation

The results indicate that the perceived risk associated with the introduction of circular economy practices exerts a negative impact upon the interest in these (t= -2.17, p = 0.03). Entrepreneurs perceive actions connected with the implementation of the CE as risky; the practices are not considered as potential investments or sources of prospective profits. On the other hand, the familiarity with the CE concept strongly determines the introduction of the practices (t = 3.68, p < 0.001). A higher level of knowledge increases the likelihood of the practices' application.

As far as the internal and external pressures are concerned, their impact upon CE practices was confirmed merely in relation to selected external factors (t = 6.44, p < 0.001). Environmental and health-related aspects raise the interest in the CE. This is especially valid for the limitedness of resources and minimization of negative environmental impact via the improvement of materials' exploitation and usage of post-production waste. Legal regulations, which may become a foundation for companies transitioning towards circularity, stimulate a strong interest in the CE (Govindan, and Hasanagic, 2018). On the other hand, it ought to be noted that the impact of technological factors is low. The development of technologies, i.e. mobile technologies, the Internet of Things, data analytics, which facilitate the development of innovations concerning the CE (e.g. effective waste collection systems) is not perceived by entrepreneurs as a stimulus for the pursuit of CE practices. This is convergent with the results of Agyemang et al. (2019) where 1% of respondents recognize (in the context of CE) the potential emerging from technological progress. Companies see little significance in the strategy of sustainable development. The CE concept is deeply-rooted in sustainable

development (Esken et al., 2018). However, businesses believe that the strategy offers little contribution to CE-benefiting actions. Entrepreneurs do not perceive the CE as an element supporting sustainable development; they separate it from corporate social responsibility. As far as the final correlation is concerned, the results indicate that there is no relationship between the perceived benefits and CE practices. This denotes that benefits managers associate with the circular economy do not emerge from the applied practices.

5. Conclusions

The main objective of the paper is to determine the way SMEs perceive the circular economy concept and to establish factors influencing introduction of CE practices. Considering the previous studies in the field, the major contributions of the present study lie in the focus posed on SMEs as a specific industrial segment and collection of a representative set of empirical data that encompass different sectors. This paper makes a valuable insights to understanding the core factors that influence SMEs in undertaking CE practices. This can prove to be especially important, since the switch of SMEs to a circular economy is applicable for several sectors and can follow similar paths. At the same time, empirical verification of the conditions of CE practices creates a background for the contextualization of other studies with a narrow focus on specific contexts or on pockets of good practice.

Another major contribution is that this work substantiates the suitability of the three research hypotheses initially discussed. These hypotheses constitute an original contribution to the state of the art.

The present results indicate that Polish enterprises are familiar with and understand the CE concept well. This confirms Hypothesis 1. This result corresponds with the finding of Xue et al.'s (2010) that most entrepreneurs at municipal and county levels have high awareness and understanding of the circular economy concept and its significance. The concept is synonymous with the minimization of waste volume in the course of a variety of actions and recycling, which fits well within the definition by Geissdoerfer et al. (2017). The CE practices introduced by SMEs the most frequently pertain to cleaner production, recycling and energy efficiency. The introduction of these practices stems from the need for the improvement of materials efficiency and increase in the share of waste reuse. However, managers fail to perceive the CE as a source of economic benefits for organizations. They believe that this method of management offers neither a boost in profits nor improved sustainability. Such beliefs do not have a positive impact upon the interest in CE-related solutions. Furthermore, the perceived benefits are not motivating enough to facilitate the transition towards circularity.

Barriers entrepreneurs face in the course of the CE introduction are diverse in character. As a consequence, a variety of strategies to deal with these is required. The strongest barriers include the lack of government institutions' support, insufficient financing, and the lack of technical skills. Actions removing the barriers may encompass the introduction of economic and legal instruments supporting the circular economy (e.g. dedicated credits/loans, tax reliefs for companies developing closed-loop systems, recycling subsidies or tradable permits), information and promotion campaigns (including trainings, publications, support of research). Another barrier is posed by the strong risk associated with the implementation of the CE. This supports the findings of Song et al. (2005) showing that strong risk aversion hindered the development of the circular economy. Managers who perceive the risk as high are likely to show little engagement in the introduction of CE practices. Only the change in risk perception may contribute to a stronger interest in the CE and may translate into investments in circular business models.

The study did not confirm the impact of all organizational factors upon the introduction of CE practices. As a consequence, Hypothesis 2 has been partially confirmed. The factors, i.e. environmental objectives, reduction of the supply chain dependence, improvement of chain network management, and organizations' sustainable development strategies do not determine introduction of CE practices in SMEs. Businesses argue that there is no relationship between the above factors and the circular economy. At the same time, the study confirmed the significance of institutional factors and the familiarity with the CE concept. Environmental aspects, i.e. limitedness of resources, reduction of materials' consumption, improved exploitation of post-production waste, attract interest in practices in the field. Legal regulations constitute a vital aspect stimulating the interest in the CE. This confirms the results of hitherto papers, which highlight that the pressure exerted by governmental regulations is the main factor influencing a firm's environmental behavior, such as waste reduction (Wang et al., 2007; Wen et al., 2009).

Another original contribution to the literature is the suggestion of the suitability of Hypothesis 3. The hypothesis argues that SMEs are the closest to introducing the model based upon the efficiency of materials/energy or recovering value from waste. Other business models are employed sporadically.

As far as implications for enterprises are concerned, the present study confirms the significance of CE-related knowledge for the economy's perception by mangers and for the introduction of CE practices in SMEs. The familiarity with the circular economy is positively correlated with the pursued practices. It ought to be noted that the higher the CE knowledge, the greater variety of CE practices is employed. The greater the companies' familiarity with the concept, the more benefits from the application of CE practices they recognize, and the lower the risk they perceive. This translates into positive decisions made concerning the implementation of the concept. SMEs' high awareness level appears to be necessarily pivotal in making decisions regarding the circular economy. Secondly, the study revealed a striking

gap between awareness and actual behavior. The in-depth interview results showed that many factors contributed to the gap, e.g. financial and competence-related ones. Therefore, managers of SMEs should focus on the use of incentives to build an effective modern management system to overcome the barriers. Third of all, on the society level, the CE's significance for future growth, and changes the transition towards this type of economy entails, ought to be presented. Educational initiatives which will facilitate the social reception of the concept are of critical importance. From the point of view of SMEs, information and promotion actions, including the presentation of the most suitable solutions, business models, and support mechanisms will facilitate the transition of the concept from the theoretical domain to implementation. In addition, changes in the enterprises' environment are also required. These will involve legal regulations and economic mechanisms in support of CE introduction which will stimulate the companies' transition towards circularity. Consequently, without appropriate external determinants, most firms may be unable to actively develop a circular economy.

The study is limited by the sample, which was narrowed down to a single country. As a consequence, the final sample does not represent the whole economy. Therefore, further studies ought to include more regions with more diversified external conditions. The selection of organizational factors constitutes a next limitation. Prospective studies may encompass an additional variable, i.e. companies' environment-friendly policies, businesses' level of technological development, firms' structure, or may focus upon the characteristics of entrepreneurs (age, experience). This explorative research helps to further the study relating to the development of the circular economy. Furthermore we also suggest breaking down the analysis to specific CE processes, as well as expand research from a single location to an international context. A comparison of different countries might also be interesting with regard to cultural differences and levels of acceptance of CE by SMEs in different geographies.

Acknowledgements

The research presented in the publication was carried out as part of the project entitled Modelling of reverse logistics processes of municipal plastic waste in the perspective of international experience, financed by the National Science Center (Poland) under the grant number: 2019/35/B/HS4/03702.

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Appendix 1.
Factor loadings, Cronbach's alpha, AVE, CR

Factor	Item	Factor Loading	Cronbach's α	AVE, CR
External norms	EN1	,591	,899	AVE=,32 CR=,85
	EN2	,604		
	EN3	,504		
	EN4	,636		
	EN5	,582		
	EN6	,535		
	EN7	,566		
	EN8	,613		
	EN9	,502		
	EN10	,634		
	EN11	,368		
Internal norms	IN1	,708	,847	AVE=,47 CR=,78
	IN2	,769		
	IN3	,640		
	IN4	,630		
Perceived risk	PR1	,758	,845	AVE=,52 CR=,88
	PR2	,897		
Perceived benefits	PB1	,827	0,732	AVE=,28 CR=,81
	PB2	,606		
	PB3	,512		
	PB4	,822		
CE Familiarity level	Fam	,850	0,905	AVE=,75 CR=,92
CE practices	Prac	,776	0,864	AVE=,59 CR=,89

Appendix 2.
The impact of materials efficiency improvement, waste exploitation and recycling upon companies [in%]

	Materials efficiency	Waste exploitation	Improved recycling
Management style	22.2	24.1	34.8
Applied materials	44.4	58.6	65.2
Profits model	29.6	31.0	21.7
Offer for clients	22.2	20.7	30.4
Clients groups	11.1	13.8	8.7
Companies competences	37.0	27.6	13
Supply chain	11.1	17.2	4.3
Product design	25.9	37.9	43.5
HR practices	0	0	0
IT systems	0	3.4	21.7
Organizational culture	48.1	41.4	26.1