

Article

Circular Economy Business Models in the SME Sector

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Abstract: The article focuses on a bottom-up approach to implementing the concept of circular economy. All enterprises, not only the most aware ones, face the challenges of this economy. The modification of business models towards circular economy becomes a necessity. However, questions arise as to whether the use of circular economy business models is widely practiced and how enterprises are coping with the implementation of these models. This article presents the results of research aimed at assessing the organizational maturity of enterprises in terms of implementing the principles of circular economy. Based on the concept of organizational maturity levels of the CMMI model, the classification of circular business models according to R2Pi and the integrated business model (the so-called business model canvas), the maturity index of the circular economy business model is constructed. The results obtained do not allow one to formulate very optimistic conclusions. First of all, a competency gap in the field of circular business models is identified, which translates into a limited application of these models in practice. The most frequently implemented models are: circular raw materials, recovery of raw materials, modification and repair. Most enterprises tend to undertake activities that are characteristic of circular economy. Furthermore, the importance of these activities increases with the age of the enterprise.

Keywords: circular economy; circular business models; SME sector; enterprises



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1. Introduction

Circular economy (CE) is an alternative to the open and linear business model, which is replaced by a closed loop of material flows, creating return cycles: resources–products–resources. The growing popularity of the CE concept results from the deteriorating condition of the natural environment and, consequently, from the necessity to search for production and consumption methods that are less dependent on depleted natural resources and reduce the negative impact on the environment [1–3]. Among the growing number of theoretical studies on the implementation of the CE concept, two research perspectives can be identified, which can be considered top-down and bottom-up. The top-down approach emphasizes the leading role of political and social initiatives in the context of CE implementation [4–8], while the bottom-up approach assumes the priority of actions taken at the enterprise level [9–11]. Researchers note that the environment is a public good, hence the environmental benefits (or costs) resulting from the activities of enterprises are derived (or incurred) by the entire society [12]. This is a reason why practices implemented by enterprises are so important and consist of offering products made of less hazardous substances; offering products that can be easily repaired, modified and reused; and using innovative recycling technologies or implementing sustainable business models [13]. Such activities of enterprises are the basis of sustainable development and present the opportunity to achieve some goals of sustainable development (SDGs) [14].

Stahel and Börlin pointed out that companies applying the concept of circular economy can achieve higher profitability than their competitors in a linear economy [15]. According to World Economic Forum, “companies are poised to make an additional \$4.5 trillion in profits by 2030 just by using circular economy models. If we do not put this idea into practice, it will not only mean a waste of resources that we throw away as garbage, but

also an under-utilization of natural resources, products and fixed assets" [16]. Similarly, the European Commission points out that a closed-loop economy approach will bring huge benefits not only ecologically but also economically [17]. The communication states that: "By 2030, the European Union could record a 30% increase in productivity with the transition to a circular economy, which would simultaneously influence job creation and GDP growth" [18]. A closed-loop economy system makes it possible to preserve the added value of products for as long as possible and to eliminate waste completely, thus saving raw materials. It involves closing the life cycle of products, where the product does not end up in the bin or landfill at the end of its life but is reused through recovery and recycling. This concept also applies to in-production recycling and so-called waste exchanges. An important element of this concept is effective product design. The design assumes that the final product should have the least possible impact on the environment throughout its life cycle and a smaller negative effect after its use (design in terms of increasing the efficiency and productivity of products-maintenance, reuse/multiple use, refurbishment/remanufacturing, and recycling) [19,20].

De los Rios and Charnley state that the greatest challenge for enterprises in the context of CE implementation is the development of circular business models that promote sustainable use of resources and reduce dependence on critical resources [11]. Reducing the dependence of enterprises on critical resources may provide a strategic advantage and also increase their resistance to material shortages and price volatility [21,22]. The design process of circular business models promoting new forms of consumption (i.e., product-service systems or consumer-consumer systems) [23–25] is based on: (1) using renewable energy sources and reducing the total energy content of products and services, (2) minimizing product waste through selection of appropriate materials, (3) designing disassembly options for products to facilitate recycling and striving to standardize solutions whenever possible and (4) maximizing flexibility by designing long-life products that can be easily repaired or modified [13,26,27].

The article focuses on important areas of managerial practice: business models and circular economy. This economy is no longer only participated in only by the most conscious enterprises. Modification of business models towards circular economy is becoming a necessity that will allow entrepreneurs to create new opportunities. A question arises: 'How do enterprises cope with the implementation of circular business models?' Reports indicate that very few companies have managed to transform their activities by adjusting them to the CE principles [23,28–31]. A literature review indicates a research gap regarding the design of circular business models in the SME sector. The concepts for designing and implementing circular business models are very numerous and diverse. Most of the research relates to a specific type of circular business model, its specifics and its context, very often are based on examples of large companies. Furthermore, these models are linked to different thinking methods underlying the concept of circular economy [32–37]. Literature also indicates numerous adoption factors as well as design and management tools for circular business models [38]. This may explain the difficulties with implementing these models into business practice. Therefore, it is justified to conduct research on determining the level of organizational skills of enterprises proving the degree of their preparation to implement the principles of circular economy. The objective of the study is to assess the organizational maturity of enterprises in terms of implementing the assumptions of circular economy. The research was carried out on a group of small and medium-sized enterprises, due to their importance in the economy and the assumption that these entities have particular difficulties in implementing CE principles (due to limited organizational and financial resources). The concept of organizational maturity levels of the capability maturity model integration (CMMI) [39,40], classification of circular business models according to R2Pi (Horizon 2020 program) [41] and the business model canvas [42,43] tool were used. Based on the above maturity index of the circular economy, a business model was designed (BMMI_{CE}). The classification of circular business models according to R2Pi

was considered the most useful in business practice because of its simplicity. It was also assumed that it is the most commonly used for business model design by companies.

The research allowed one to formulate important conclusions about organizational maturity in terms of implementing CE principles into business practice. It showed, above all, that the state of the level of knowledge about circular economy among enterprises is unsatisfactory, including low environmental awareness and the lack of qualifications or skills necessary to redesign existing models into circular business models. This is why implementing circular economy business models is not a common activity. The necessity to develop practical tools supporting enterprises in this area was also identified. The business model canvas is a good example. It is a tool commonly known and used in business practice that can be helpful in implementing CE principles.

2. Circular Economy Business Models

2.1. Definitions

Circular economy (CO) refers to many already recognized concepts, such as, e.g., industrial ecology, cleaner production, ecological efficiency, zero emissions, the concept called *from cradle to cradle* (C2C) [44] or regenerative design, biomimicry and blue economy [45], and LCA and industrial symbiosis [46]. Due to the above reason, it is difficult to talk about a single, universally accepted definition of circular economy. As noted by J. Korhonen, A. Honkasalo and J. Seppälä, as a practical concept of circular economy from the scientific and research point of view, it is superficial and disordered, seeming to be more of a set of ideas from various fields [44]. This also converts into numerous concepts for designing circular business models.

Circular economy generally requires human business activity compliant with the 3R principles: reduce, reuse and recycle [47,48]. Enterprises must replace the linear production model with a circular model based on the above principles. Where possible, reuse and remanufacturing are preferable to recycling for economic reasons as a significant part of the added value in the original production process remains with the components [49,50]. Circular economy business models (CBM) are business models that enforce the principles of circular economy into practice [28]. This is applicable to every dimension of business activity: business-to-business (B2B), business-to-consumer (B2C) and consumer-to-consumer (C2C). CBMs offer new business opportunities and cause a change in relationships between producers and consumers [51].

Linder and Williander define the circular business model as “a business model in which the conceptual logic of value creation is based on the use of economic value retained in products after applying new offers in production” [30,52]. Due to the above, the goal of the business model changes from making profits by selling products to making profits by moving resources, materials and products over a period of time [53], including reuse of goods, recycling, sharing, refurbishing or repairing [54]. Nevertheless, to achieve such an ambitious transformation, close cooperation and coordination between network actors are required [28]. Defining circular economy as an economic system with closed material loops affects the treatment of the circular business model as a method of how an organization creates, delivers and captures value with and within closed material loops [55].

Renswoude et al. believe that the essence of the circular business model lies in the creation of circular value, ranging from simple product maintenance and repair activities; through extending product life, purchasing recycled waste streams, reusing resources and materials; and ending with selling product functions and customized production [52,56,57]. Researchers have identified four requirements for circular business models in other studies that result from broader concepts such as sustainability [51]. The first is a value proposition reflecting the balance of economic, ecological and social needs. The second is a supply chain engaging suppliers into sustainable supply chain management (materials cycles). The third is a customer interface, motivating customers to take responsibility for their consumption. The fourth is a financial model, mainly reflecting an appropriate distribution of economic costs and benefits among actors involved in the business model [43].

Osterwalder and Pigneur proposed five stages of business model design process, encompassing mobilizing, understanding, designing, implementing, and managing [58]. Parlikad et al. [59] identified the information requirements for end-of-life decision making and established a possible set of characteristics of a lifecycle information system to support management. Another important method is life cycle assessment (LCA), which is explained as “a tool for the analysis of the environmental burden of products at all stages in their life cycle—from the extraction of resources, through the production of materials, product parts and the product itself, and the use of the product to the management after it is discarded, either by reuse, recycling or final disposal (in effect, therefore, ‘from the cradle to the grave’)” [43]. LCA is a standardized methodology, which gives its reliability and transparency. The standards are provided by the International Organisation for Standardisation (ISO) in ISO 14040 and 14044, and describe the four main phases of an LCA: goal and scope definition, inventory analysis, impact assessment and interpretation. LCA is an iterative methodology, where it is possible to refine things with the progress. For instance, the first round of analysis may say that there is need of more data. Or the results of the assessment or interpretation may nudge you to revise your goal and scope. In this sense, every LCA that is done not only gives valuable advice to make changes in the business, it also inform how to best plan the next LCA to learn even more [60]. The circular economy is an inspirational strategy for creating value for the economy, society and business while minimizing resource use and environmental impacts through reducing, re-using and recycling. In contrast, life cycle assessment is a robust and science-based tool to measure the environmental impacts of products, services and business models with a sort of accountancy approach. If you combine both the robustness of the LCA methodology and the inspirational principles of circular economy, you have a holistic approach for innovation [60].

2.2. Classification of Circular Business Models

The Business and Sustainable Development Commission (BSDC) has listed four breakthrough business models of the future that will make it possible for enterprises to respond to the challenges of circular economy. They include the social model (which also creates value other than economic by having a positive social impact), the *lean model* (involving optimization of the use of all forms of capital) and an integrated model (meaning managing the economic and non-economic impact of the process of creating value in the company). The fourth model, characterized by the least negative impact (e.g., on resources, ecosystems or *well-being*), is the closed-loop model. As part of this model, BSDC indicates such activities as: industrial symbiosis (sharing resources and services among related industries), closed-loop production, closed-loop supply (use of renewable or fully recyclable raw materials), waste collection services, dematerialization, rematerialization (acquiring materials from recovered raw materials to create completely new products), *trash to cash* (used products are collected and either sold or transformed into new products) or *peer-to-peer platforms* (enabling users to communicate on an equal basis) [61].

Wayne Visser [62] has underlined a new approach, i.e., a syndustrial approach, which is related to designing towards industrial synergy. It is characterized by four steps reflecting the idea of circular economy: *lend, create, reap the benefits and return*. Visser’s approach is reflected in research conducted by Accenture, among over 120 companies from different parts of the world and various industries, within which 5 effective and scalable business models were identified that are distinguished from the point of view of circular economy: closed-loop supply chain, recovery and recycling, extending product life, sharing platform and product as a service [63].

Circular business models show how the logic of value creation is based on the use of the economic value of closed resource loops. It is possible to structure these loops in areas similar to one another in terms of the character. Such classifications are presented by the ReSOLVE approach developed by the Ellen MacArthur foundation. It lists six business

paths of action that can help enterprises switch to circular economy, namely: *regenerate, share optimize, loop, virtualize and exchange* [64] (Table 1).

Table 1. Circular business models according to ReSOLVE.

Regenerate	all activities aimed at restoring, preserving and repairing the quality of ecosystems, as well as returning recovered biological resources to the biosphere.
Share	sharing resources between different users, e.g., through sharing private products with multiple co-owners or by publicly using a certain group of products; by reusing them during their entire technical lifetime; and by extending their lifetime through maintaining, repairing and designing for durability.
Optimize	increasing the efficiency of a given product, eliminating waste in the production and supply chain at all stages of the cycle.
Loop	keeping components and materials in closed circulation loops and assigning priority to internal loops, which means reusing products or components in production and in material recycling.
Virtualize	dematerialization of resource use by providing a given feature in a virtual way: directly or indirectly
Exchange	exchanging old non-renewable materials with advanced materials, using new technologies or new forms of services

Source: [64].

Potting has identified areas where circular business models can be applied. However, unlike the ReSOLVE approach, he has placed particular types of activities in a hierarchy (referring to the hierarchy of waste management), from the least preferred behaviors in circular concepts to those most consistent with this idea (Table 2) [65].

Table 2. Classification of activities used in circular business models.

Circular Economy	Smarter production process and product use	Making the product redundant (Refuse)
		Increasing product use intensity (Rethink)
	Extending the length of the product and its parts	Increasing production efficiency (Reduce)
		Reuse
		Product repair
		Product modification and update (Refurbish)
		Reusing parts of the product (Remanufacture)
		Using a part of the product for different purposes
		Processing materials to obtain raw materials (Recycle)
Linear Economy	Useful ways of applying materials	Energy recovery (Recover)

Source: Adapted from [65].

Lacy and Rutqvist presented the concept of dividing circular business models into five groups: closed supply chain, recovery and recycling, extending products life and components, sharing platform and product as a service. A closed supply chain ensures the supply of renewable energy and/or bio-based materials that can be fully recycled. This allows the same resources to be used multiple times [63]. Recovery and recycling involve the recovery of useful resources or energy from recycled products, which turns waste management costs into revenues resulting from responsible resource management. Extension of the product life and component life includes repairing, upgrading and reselling to generate income over their life cycle, rather than selling the products themselves. The sharing platform involves

increasing the efficiency of using products by enabling consumers and/or companies to share and exchange goods through a centrally provided service. The last group of models is product as a service, i.e., offering access to a product instead of owning it, i.e., allowing customers to pay only for its effective use while ensuring maximum durability of such a product, its upgrades and its servicing [66].

According to the Forum for the Future, circular business models are ground-breaking innovative business models aimed at increasing the level of sustainability of the economic system through circular concepts. This organization has proposed its own (quite complicated) classification of business models, which consists of five basic circular business models, supported by further five models not directly related to circular concepts (Table 3) [67,68].

Table 3. Classification of circular business models according to the Forum for the Future.

Basic circular business models	Closed-loop recycling using recycled products as raw materials for the production of new products.	Concepts supporting basic circular business models	Product as a service: focusing on offering a solution, not just a product. This leads to the launch of a set of common products and services that can meet the user's needs together.
	Downcycling: transforming raw materials from one or more used products into a new product of lower quality.		Long-term consumer involvement: (lock-in)-an offer that encourages consumers to regularly use a specific product or service.
	Upcycling: transforming materials from one or more used products into a new product with higher value for the consumer.		Local loops: because production processes are relocated to countries where the company operates on its key markets, the local production loop becomes closer and provides benefits to industry clusters.
	Industrial symbiosis: sharing services, tools and by-products between industries to improve efficiency of resources.		Modularity: a design that divides a product into smaller parts that can be used and replaced independently.
	Collection services: providing a collection service for old or used products.		Personalization: a company creates data management opportunities that enable product personalization.

Source: [67].

In one of the concepts of circular business models, there are as many as 19 business models (IMSA: Circular Business Model Scan) grouped in six areas: short cycle, long cycle, cascade, full loops, services and product on demand. Here, the following model proposals are included: payment for use (one-time payment for using a product or service), repair (extension of product life through repair services), waste reduction (reducing waste in the production process), sharing platforms (products and services are shared for consumers), progressive purchases (interim payments, small amounts, pre-purchase), performance-based contracting (long-term contracts that share responsibility between the producer and the consumer), product return management (incentives to ensure the product returns to the manufacturer), new life of the product (ensuring a second life of the product by re-selling it), modernizing and selling (re-selling the product after its modifications), upcycling (reusing raw materials with increasing product value), recycling (waste management), collaborative production (cooperation in the product value chain resulting in closing material cycles), from cradle to cradle (redesign of the product to fully close the loops), circular sourcing (sourcing only circular products or materials), virtualization of physical products and rental, make-to-order production, 3D printing and customer voting (basing production-related decisions on consumer votes) [56].

Another proposal for systematizing circular business models has been developed by a team of scientists and practitioners as part of the international R2Pi project (Horizon 2020 program). It was developed to create a database of best practices in the area of circular economy business models and to provide entrepreneurs with helpful tools. R2Pi places models in the product life cycle. Different business models can be applied (sometimes simultaneously) at the production, use and end-of-life stages. In the first one, it is possible

to re-use worn-out parts/components of the product (re-make) to restore functionality while ensuring quality. This business model involves extending the life of a product by modifying it in such a way (repairing, refreshing or improving its aesthetics) that the product becomes as good as new or better than new and obtains a warranty extension. It is also possible to change some features by changing the appearance, repairing, changing the form of ownership (re-condition), etc. Another approach at this stage is to recover and use the by-products in a different process or value chain (co-product recovery). What is waste for one producer may be a valuable raw material for another. By creating entire ecosystems of businesses working together in this way, it is possible not only to reduce the amount of waste but also to significantly reduce the cost of acquiring raw materials. In this circular economy model, an entrepreneur cannot just focus on their product, but must consider it in the context of the ecosystem in which they operate. It is also necessary to exchange knowledge and information about the company's internal processes, and therefore establish far-reaching trust between entrepreneurs. It is also possible to obtain materials from recycling or renewable materials that can be returned to the technical or biological cycle (circular sourcing). The use of raw materials should be kept to a minimum. Optimizing their use is therefore an important part of this model. One radical example of optimization is virtualization, which is the replacement of a real product or service with a virtual one, available online. At the stage of use, a frequently applied model is ensuring access, where the end user has access to certain product features but the owner retains ownership. The classic application of this model is in lending libraries, from libraries to car rental companies. In the virtual version, they correspond to online platforms giving access to virtual products—such as e-book rentals or services streaming films and series. Another model also already known to users is the provision of a certain package combining product and service (product-as-a-service, performance). This model has benefits for both the customer and the manufacturer. The customer does not have to worry about purchasing and disposing of equipment, items or devices. He is not interested in servicing, repairing or replacing. He is guaranteed continued access to the service. Instead of selling the device one time, the manufacturer can offer the customer an ongoing subscription to deliver the service. This gives him a steady source of income and builds long-term relationships with consumers. An additional advantage of this model is that it is profitable to produce durable goods. Since the manufacturer remains the owner of the products, it is in his interest to ensure a long life of the products and to maximize the use of end-of-life waste. Performance is more important than quantity, and longevity is above disposability. At the end-of-life stage of a product, a model is used that allows for the recovery of raw materials or parts in such a way that they can be used in another product or in a different value chain, mainly through recycling but also through upcycling (resource recovery). In this way, the economic value of each item produced is maximized and, above all, the life cycle of the raw material is extended [41].

A review of the literature has shown that there are many suggestions for categorizing business models [69,70]. As Lewandowski rightly points out, most of them have similar assumptions and use the criterion of the source of value creation [43]. Few of the authors propose other criteria, such as design strategies for product life extension [71], cycle of product/component/material circulation in material loops [72] or mixed criteria [73]. The wide variety of concepts for building circular business models may cause difficulties in CE modelling through activities of individual business entities. This is why it seems reasonable to propose the use of an integrated business model, the so-called business model canvas for designing and implementing circular business models in practice [42]. It is a popular tool in business practice for building and redesigning business models [58]. It is composed of the following nine elements:

1. Customer segments;
2. Value proposition that aims to solve problems of customers and meet their needs;
3. Channels used by the enterprise to deliver, communicate and sell value propositions;

4. Customer relationships that the company builds and maintains with each customer segment;
5. Streams of revenues resulting from the value proposition to be offered to customers;
6. Key resources as assets needed to offer and deliver the above items;
7. Key activities that are performed to offer and deliver the above items;
8. Key partnerships constitute the company's network of suppliers and business partners execution by providing certain resources and performing certain activities;
9. Cost structure that includes all costs related to the company's operations.

The above-mentioned R2Pi project, which aims to organize the strategy of designing business models that meet the requirements of circular economy, also encourages the use of the business model canvas when developing circular business models [41]. Furthermore, a template (business model canvas, BMC) was created for each of the models, which is part of the free tool for implementing circular economy models. Due to the above, there is a ready tool for the implementation of the presented models. An important advantage of BMC is its versatility. It can be used by any organization, not only in the private but also in the public sector.

A literature review made it possible to identify various strategies of developing circular business models and numerous classifications of models. The few studies on the problem of adjusting the existing business model to circular economy are mostly based on case studies. They suggest specific business models with limited application possibilities in other organizations. There is also no empirical verification of the versatility of the use of circular business models and the maturity of enterprises in implementing activities consistent with the assumptions of circular economy. Hence, the following research questions arise:

- Q1. What is the level of companies' knowledge regarding the circular business models?
- Q2. What circular business models are used in business practice?
- Q3. Is the business canvas model a tool used in business practice, and can it be helpful in implementing circular business models?
- Q4. What is the level of achievements of enterprises when it comes to implementing the principles of circular economy?

3. Research Methodology

The objective of the study is to assess the organizational maturity of enterprises in terms of implementing the assumptions of circular economy. Maturity is understood as a state of achieving full development or a state of readiness of the enterprise to take specific actions [40]. The concept of capability maturity model integration (CMMI) was used, which enables incremental improvement of a selected area of processes [74], in this case the implementation of circular economy assumptions by enterprises. For the purposes of the study, five levels of organizational maturity were characterized, the basic assumptions of which are presented in Table 4.

Based on the CMMI model, the business model canvas and literature review regarding the classification of circular business models maturity index of the circular economy business model was created ($BMMI_{CE}$). Each of the 9 business model canvas elements (which include value proposition, key activities, key partners, key resources, customer segments, channels, customer relations, cost structure and revenue streams) was assigned to the assumptions of the circular economy models according to the R2Pi project (Table 5). Based on the general level of perception of the circular economy model maturity (Business Model Maturity Indicator, $BMMI_{CE}$) the enterprise was designated as the arithmetic mean of the results obtained in the nine areas of the canvas.

$$BMMI_{CE} = \frac{1}{n} \sum_{i=1}^n \left(\frac{1}{k_i} \sum_j^{k_i} x_{ij} \right) \quad (1)$$

where x —response value in each canvas element and to the question j , where $j = 1..k$ —the number of questions on the canvas element, and $n = 9$ canvas elements.

Table 4. Organizational maturity levels in the area of implementing CE principles.

L5. Optimizing	circular business model implemented
	improvement of the organization through process monitoring in terms of possible improvements
	formalized environmental management system
	raising awareness of the company's stakeholders when it comes to ecology
L4. Quantitatively managed	familiarity with the rules of circular economy; work on redesigning the business model towards circular economy formalized environmental management system
	process quality measures are built into the enterprise's decision-making system
	the causes of process deviations are eliminated
L3. Defined	awareness of the impact on the environment and awareness of the existence of circular economy
	environmental management system (formal or not) defined processes for the area of environmental activities
	pragmatic and altruistic reasons for limiting negative impact on the environment
	qualified employees for environmental protection
L2. Managed	low level of knowledge about circular economy and business models dedicated to it
	most of the processes regarding the area of environmental activities are identified and defined
	environmental impact awareness
	pragmatism in activities limiting negative impact on the environment
	monitoring environmental indicators
L1. Initial	lack of knowledge about the assumptions of circular economy and business models dedicated to it
	low environmental awareness
	failure to limit the negative impact on the environment
	environmental activities undertaken for pragmatic reasons

Source: own study based on the assumptions of the CMMI model [61].

Table 5. Classification of circular business models according to the Forum for the Future.

Business Model Canvas	Elements	Circular Business Model According to R2Pi
Value proposition	Extended product life through maintenance, repair, redistribution, upgrading resale.	Re-condition
	Product disassembly for parts/materials recycling or reuse	Re-condition; Re-make
	Extended warranty	Re-condition
	Reuse, regeneration, recycling or safe disposal	Re-condition; Re-make
	Virtual product	Re-make; Access

Table 5. Cont.

Business Model Canvas	Elements	Circular Business Model According to R2Pi
	Increasing customer awareness regarding sustainable consumption	Access
Key partners	Cooperative production based on a green supply chain	Circular sourcing
	Recycling of waste/parts by third parties	Circular sourcing; Co-product recovery
	Cooperation within the service network, collection and/or recovery programs for end-of-life products, product components after their end of use	Re-condition; Resource recovery
Key resources	Use of raw materials/resources originating from recycling/other forms of recovery	Circular sourcing; Co-product recovery
	The use of raw materials/materials with better technical parameters, less harmful to the environment, more efficient in use	Re-make; Re-condition
	Protection of natural capital (renewable energy use, land reclamation, water saving, energy saving, etc.)	Re-make
Key activities	Human capital	Circular sourcing;
	The product is characterized in terms of material composition, chemical composition	Circular sourcing; Resource recovery
	Looping production (using materials that make it easier to reuse or recycle a product, reduce material, energy and waste losses)	Circular sourcing; Resource recovery; Re-make
	Optimization (increasing product efficiency and performance, eliminating waste throughout the supply chain)	Circular sourcing; Resource recovery
	The use of recyclable materials in a product	Circular sourcing
	Product design with extended lifetime	Re-condition
	The value proposition includes maintenance, servicing, availability of spare parts availability and other services	Re-condition
	Logistics of returns	Resource recovery
Customer segments	Increasing efficiency (e.g., equipment modification, technological changes and improvement of management functions)	Re-make
	New customer segments	Re-make; Access
	A customer outside the primary value chain	Re-make; Access
Customer relations	Production upon order	Circular sourcing; Re-make
	Elimination of waste as a social marketing strategy	Circular sourcing; Re-make
	Long-term relationships	Access
Channels	Virtual communication with the customer	Access
	Product sales using virtual channels	Access; Performance
	Channel of return/collection and/or recovery of product and/or parts/materials	Resource recovery; Access
Cost structure	Cost structure analysis to improve business efficiency	Re-make
	Savings related to the implementation of circular economy rules	Re-make; Resource recovery
	Increase in costs resulting from the implementation of circular economy rules	Re-make; Resource recovery
	Innovative activity	Re-make

Table 5. Cont.

Business Model Canvas	Elements	Circular Business Model According to R2Pi
	Customer incentive program to return the product at the end of its life cycle	Resource recovery
	Payment form for the product: one-time, subscription	Access; Performance
	Product feature sale	Access
Revenue streams	Source of income from recovered parts/materials of the product and raw materials	Performance
	Use of activity waste streams as raw materials for other organizations	Co-product recovery

The presented empirical research included surveys that were carried out from November 2020 to February 2021 using the *interankiety.pl* platform among a group of 99 enterprises operating in the small and medium-sized enterprise sector. (The request to participate in the research was sent to 180 enterprises, and 121 entities completed the questionnaire. Due to the completeness of the information provided, 99 questionnaires were included in the study). For the purpose of achieving the goals and verifying research questions, two subgroups of enterprises were indicated according to the age: enterprises operating for less than 3 years and enterprises operating for more than 3 years. The survey questionnaire consisted of personal questions, and closed questions with a 5-point Likert scale for assessing individual elements of circular economy, circular business models and organizational maturity. Small and medium-sized enterprises were invited to the study due to their key importance in the economy. Moreover, it was assumed that these enterprises may have difficulty adjusting to the CE rules, due to limited organizational and financial possibilities. The primary variable in the selection of entities for the research sample was the location by region, i.e., the northern sub-region of the Śląskie Voivodeship, and cooperation with an academic center (Częstochowa University of Technology).

4. Results and Discussion

Ninety-nine enterprises participated in the survey, including 43.44% operating for no longer than 3 years. Among the remaining 56.56% of the respondents, 47 enterprises had been operating for over 3 but less than 10 years and 9 enterprises for over 10 years (Table 6).

Table 6. Characteristics of the research group.

Enterprises in General		<i>n</i> = 99	
Business Duration	Up to 3 years, <i>n</i> = 43 (43.44%)	Over 3 years, <i>n</i> = 56 (56.56%)	
		Over 3 to 10 years, <i>n</i> = 47 (47.47%)	Over 10 years, <i>n</i> = 9 (9.09%)
Type of Activity	Production, <i>n</i> = 78 (78.79%)	Services, <i>n</i> = 21 (21.21%)	
Enterprise Size by Number of Employees	Small, <i>n</i> = 76 (76.77%)	Average, <i>n</i> = 23 (23.23%)	

As indicated in the results of the study, altruistic and pragmatic motivations can be listed among the conditions for implementing solutions in the circular economy trend. The first ones result from the entrepreneur's belief in the rightness of the idea and satisfaction with the actions taken, and the awareness that these actions have a positive and long-term impact on the environment. They were indicated by only 11% of the respondents. Pragmatic motivations resulting from the issue of legal coercion or the desire to achieve business benefits are decisive when it comes to implementing solutions from the area

of circular economy (89%). The surveyed enterprises are aware of their impact on the environment. Regardless of the type of motivation, it is important to note that the majority of enterprises (91%) indicate that they undertake activities limiting negative impact on the environment, including 13% of respondents declaring the implementation of circular business models, and 9% do not take any measures to reduce the negative impact on the environment. The most important reasons for the above are the costs of implementing eco-friendly solutions (86%) and the lack of sufficient knowledge about technical and/or technological solutions limiting negative impact on the environment (12%).

The research results also indicate a competency gap in the area of circular business models. As it has already been mentioned, only 13% of the surveyed companies declare the use of a circular business model. Knowledge barrier results from the fact that shifting the business model to circular economy requires highly qualified staff (45%) and knowledge about what solutions can be implemented (53%). Deficiencies in this area effectively block the concept of circular economy both at the stage of initiation and implementation, and most of all, in the creation of new business models. Small enterprises have the greatest difficulty when it comes to adapting to trends due to the fact that this is associated with a proportionally greater effort in both financial and organizational terms (this was indicated by 76% of respondents from the group of small enterprises).

The circular business models declared by the surveyed companies include circular raw materials, raw material recovery, modification and repair. Out of the group of 13% of enterprises that apply a circular business model in practice, half declared that they started operating with a circular business model, and half of them modified their business model in line with the circular economy assumptions.

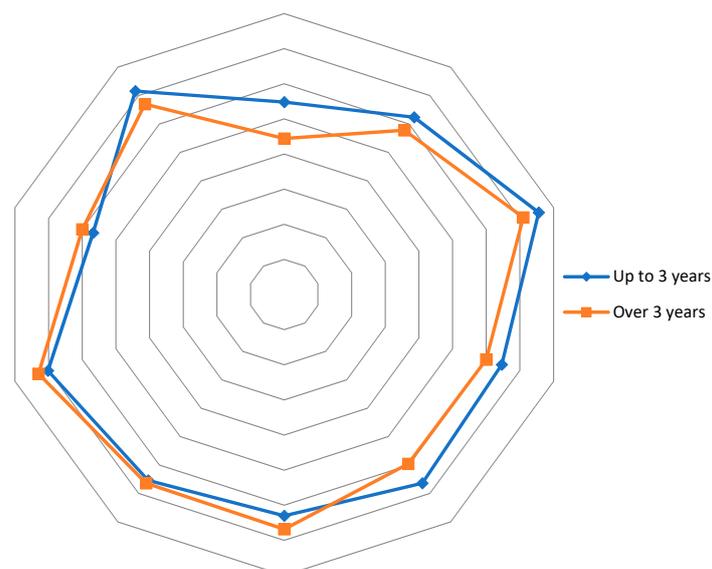
Most of the surveyed companies (84%) know the business model canvas, and 57% used this tool when developing a business idea as a template for a business plan. This was associated with applying for funds and resulted from institutional requirements. Twenty-seven percent of enterprises used the services of business incubators, among which the use of a business model canvas template is common. On the other hand, in the group of companies that declared that they use circular business models, i.e., in the group of 13 companies, 5 used the business model canvas to redesign their business model towards the circular model. This group unanimously expressed a positive opinion on the possibility of using the above tool in building business models in line with the assumptions of circular economy.

Despite the small group of enterprises that declared the use of a circular business model, it can be concluded that the surveyed enterprises undertake actions that constitute elements of business models in line with the circular economy trend. Table 7 presents the results of the $BMMI_{CE}$ index in total for all surveyed enterprises and for the selected subgroups in nine areas of the canvas. As predicted, with the age of the company, the mean and median of the business model maturity index increase, while the variance reflecting the variation in the sample decreases.

Comparison of $BMMI_{CE}$ values in nine areas of the canvas show higher mean $BMMI_{CE}$ values in every area, except for key resources for companies operating for more than 3 years than for companies operating for less than 3 years. The results obtained indicate that the importance of circular economy elements in the business model increases with the age of the enterprise. On the other hand, the differences in the area of key resources result from the advantage of young companies, primarily in the use of energy from renewable sources, energy-saving technologies, raw materials and/or materials with better technical parameters in terms of environmental impact. In the group of young companies, the importance of knowledge, team experience and flexibility is also more strongly emphasized in order to adjust the business model to the requirements of circular economy (Figure 1). This group of enterprises also indicated lower risk aversion in modifying the business model.

Table 7. Comparison of descriptive statistics of the BMMI_{CE} index.

		Min	Max	Mean	Median	Variance
BMMI_{CE}	Total	1.00	4.71	3.21	3.26	0.26
	Up to 3 years	1.84	4.00	3.12	3.21	0.37
	Over 3 years	2.61	4.00	3.29	3.28	0.15
Value Proposition	Total	1.00	4.55	2.91	3.43	0.81
	Up to 3 years	1.00	4.30	2.67	2.80	0.93
	Over 3 years	2.00	4.55	3.14	3.43	0.73
Key Partners	Total	1.60	4.80	2.99	2.90	0.77
	Up to 3 years	1.60	4.66	2.93	2.60	0.82
	Over 3 years	1.80	4.80	3.06	3.00	0.66
Key Resources	Total	2.00	5.00	4.03	3.82	0.71
	Up to 3 years	2.75	5.00	4.11	4.00	0.68
	Over 3 years	2.00	4.17	3.96	3.73	0.81
Key Activities	Total	1.87	4.75	3.82	3.98	0.89
	Up to 3 years	1.87	4.75	3.71	4.00	0.98
	Over 3 years	2.17	4.75	3.92	4.13	0.83
Customer Segments	Total	1.00	5.00	5.85	3.00	0.73
	Up to 3 years	1.00	4.00	2.69	3.00	0.85
	Over 3 years	1.75	5.00	3.16	3.00	0.65
Customer Relations	Total	1.66	4.66	3.45	3.76	0.61
	Up to 3 years	1.66	4.66	3.33	3.66	0.75
	Over 3 years	2.00	4.66	3.57	3.96	0.54
Channels	Total	3.00	5.00	4.36	4.24	0.49
	Up to 3 years	3.00	5.00	4.21	4.66	0.47
	Over 3 years	3.00	5.00	4.52	4.23	0.53
Cost Structure	Total	2.20	4.90	3.67	3.89	0.59
	Up to 3 years	2.20	4.80	3.39	3.60	0.72
	Over 3 years	2.70	4.90	3.95	3.99	0.46
Revenue Streams	Total	1.00	4.00	2.80	3.13	0.80
	Up to 3 years	1.00	3.75	2.57	3.00	0.92
	Over 3 years	2.00	4.00	3.04	3.13	0.68

**Figure 1.** The assumptions of circular economy that are the most important for the surveyed enterprises.

The following are of the highest importance for the surveyed companies: the use of recycled raw materials, the use of raw materials and materials with better technical and/or technological parameters, energy-saving production/provision of services, use of renewable energy sources, production looping, elimination of waste, extended product life, use of virtual channels in customer relations and knowledge and skills of employees (Figure 1). The above activities are characteristic of such circular business models as: circular sourcing, re-condition, re-make and resource recovery. Thus, they are related to the production process and the last stage of the product life cycle.

The least important in the daily activities of the surveyed companies are: sale of product features, virtual product and the related subscription fees, reuse of a part of the product, cooperation with partners under the collection and/or recovery program of end-of-life products, the implementation of individual orders and the use of waste from business as a resource for partners (Figure 2). These activities are characteristic of such business models as: access, resource recovery and co-product recovery. It should also be noted that the importance of the above elements of circular economy in the business model increases with the age of the enterprise.

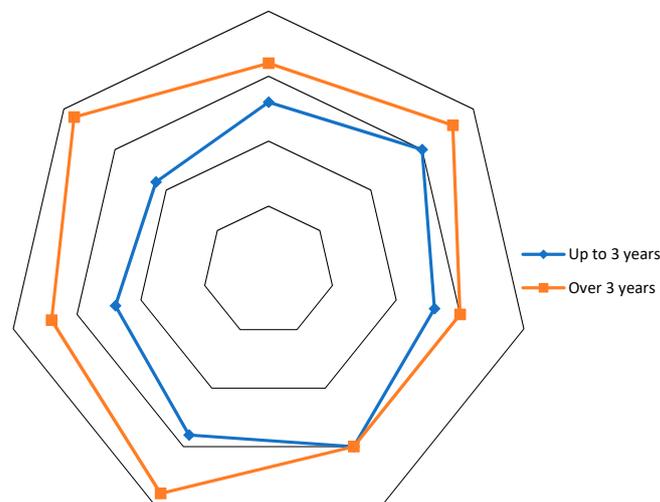


Figure 2. Elements of circular economy that are the least important for the surveyed companies.

The surveyed enterprises in terms of organizational maturity in the area of circular economy are mainly characterized by the level of L2, L3 and L4 (Table 8). The largest group is composed of enterprises that are familiar with the assumptions of circular economy, as evidenced by altruistic motives to reduce the negative impact on the environment. At this maturity level (L3. Defined), enterprises have qualified employees in the studied area at their disposal. Activities that are compliant with the principles of circular economy mainly relate to the production and cooperation with business partners regarding the green supply chain and waste recycling. Enterprises have implemented an environmental management system that, although informal, causes processes in the environmental aspect of operations to be identified and improved.

Table 8. Organizational maturity of enterprises in the area of implementing the assumptions of circular economy.

Maturity Level	Total	Age of the Enterprise	
		Less than 3 Years	More than 3 Years
L1. Initial	5%	3%	2%
L2. Managed	18%	11%	7%
L3. Defined	41%	18%	23%
L4. Quantitatively Managed	23%	9%	14%
L5. Optimizing	13%	5%	8%

At the level of L4. Quantitatively Managed, company managers do not have a business model developed according to the circular economy guidelines, but in their activities they commonly apply activities in such areas as: closed-loop supply chain, recovery and recycling, LCA concept and increasing product efficiency and performance. The activities undertaken in this area mainly include production, product life cycle and its use. Among the employees, there are qualified people responsible for the area of environmental management. This converts into implementation of the environmental management system. In most cases, it is informal, i.e., uncertified, but it proves that the environmental aspects of operations are included in the process management criteria. The next largest group is composed of enterprises at level L2. Managed. Most of the processes for the area of environmental activities are identified and defined. To a greater extent, these activities are understood in the category of reducing the negative impact of activities on the environment, as opposed to the category of circular economy. The level of knowledge in this area is low. The motivation to reduce the negative impact on the environment is mainly pragmatism, i.e., compliance with standards, legal regulations and avoiding environmental fines. Enterprises monitor the key environmental impact indicators, including in particular costs. The smallest number of surveyed enterprises can be characterized by the lowest level of maturity, i.e., L1. Initial. These enterprises often do not even take steps to reduce the negative impact on the environment, and if so, for pragmatic reasons, the processes in the studied area are neither identified nor measured. Lack of knowledge about the assumptions of circular economy and the business models dedicated to it are further characteristics. The highest level of maturity, L5. Optimizing, is presented by 13% of enterprises. These are enterprises with an implemented circular business model. They have a high level of knowledge about circular economy. This group includes enterprises that stand out from the rest by implementing reverse logistics, designing virtual products/services and selling product features. Enterprises are aware of their shortcomings, but they improve their activities continuously through processes monitoring in terms of possible improvements.

The results obtained allowed one to find answers to all research questions (Q1–Q4) and to formulate conclusions, which, unfortunately, are moderately optimistic. First of all, the use of circular business models is not a common practice. The reason for this is the unsatisfactory level of knowledge of enterprises about circular economy and its business models. When it comes to small enterprises, this is mainly due to limited organizational and financial possibilities. Knowledge also converts into environmental awareness, which can be divided into two levels: awareness of the impact on the environment and awareness of circular economy. The majority of the surveyed enterprises are aware of the negative impact on the environment and therefore take measures to reduce this impact. Nevertheless, it cannot be ignored that they do it chiefly for pragmatic reasons. What is very surprising in the face of contemporary global challenges is the disregard for environmental protection by some enterprises. The companies operating on a circular model in Europe have a number of advantages at the micro and macro levels. Shpak et al. point to the opportunity to influence the cost of production by reducing the cost of raw materials. As a result, both sales volume and productivity can increase. the shift to a circular production model will enable businesses to further reduce their tax burden, as tax rates are projected to increase for businesses that do not use resource- and energy-efficient methods [17].

The use of circular business models as a well-planned strategy of action is rarely practiced. Enterprises most often use selected activities characteristic of circular economy, e.g., elimination of waste from business activity and in the supply chain, production looping, energy-saving activities, use of raw materials or materials with better technical/technological parameters or recycling. Most enterprises that implemented circular business models used the classification proposed by R2Pi. This constitutes a confirmation of assumptions that the above classification of circular business models is most useful in business practice due to its simplicity. The circular business models declared by the surveyed companies include circular raw materials, recovery of raw materials, and modification and repair. It was also confirmed that the business model canvas is a tool popular

in business practice, both in the case of setting up a business and its redesign. The above justifies its use also for building circular business models. Its great advantage is versatility, which makes it possible to be used by any company or organization, regardless of the industry or size.

In summary, the implementation of circular business models is not widely practiced. This is mainly due to the competence gap in circular business models. The main barrier is the lack of knowledge and qualified staff. Shortages in this area effectively block the idea of CE both at the stage of initiation and implementation, and above all in the creation of new business models. Small businesses have the greatest difficulty in adapting to trends due to the fact that for them it involves proportionally more effort in both financial and organizational terms. Undertaking pro-environmental actions by companies is dictated mainly by pragmatic motivations. Assessment of the level of enterprises' achievements in implementing the principles of circular economy indicates the average level of maturity of the surveyed enterprises. First of all, the importance of circular economy components in the business model increases with the age of the enterprise. Key resources dominated by younger enterprises are an exception here. More often and to a greater extent, they utilize energy from renewable sources, apply energy-saving technologies and use raw materials and/or materials with better technical parameters in terms of environmental impact. In the group of young companies, the importance of knowledge, team experience and flexibility in action is also more strongly emphasized in order to adjust the business model to the requirements of circular economy. This group also exhibits a lower risk aversion in modifying the business model. Circular business models are used by companies at the highest level of maturity. The formulated conclusions are not optimistic. Adapting the activities of enterprises to the assumptions of circular economy becomes a must. Meanwhile, small businesses, which make up a decisive proportion of economic actors, are not coping well with this challenge. Therefore, it is important to provide and disseminate tools to assist them in implementing CE principles. An example of such a solution is the business model canvas. An example of such a solution is the business model canvas, which is also confirmed by research of Gomes et al. [75].

The results of the study are in line with some of the conclusions of other scholars dealing with the topic, like Frishammar and Parida [76], Czikkely et al. [77] and Nußholz [78]. In addition, one should also add that to some extent the results obtained are in line with the findings of Szczepańska-Woszczyna i Kurowska-Pysz [79], who state that the idea of sustainable business development in Polish SMEs is still in the development phase (it influences the implementation of CE principles), and of Diego and others, who researched the entrepreneurial approach to achieve societal and environmental goals [80]; some problems may still limit or discourage a CE approach, mainly companies being small [81,82], the analysis of the process and role of business model experimentation [83].

5. Future Direction of Research

This study is based on a literature review and a survey but it is not free from certain limitations. First of all, the literature related to the general definition of circular economy and the classification of circular business models was taken into account. To a lesser extent, the literature on the general issue of business models and individual concepts underlying circular economy was used. Reducing the research group to small and medium-sized enterprises constitutes another limitation. The study also did not consider the effects of implementing circular business models. Future research directions should also focus on comparisons with large enterprises. A question arises whether there are grounds to perceive large enterprises as coping better than smaller companies with the challenges of circular economy, due to the fact that they have organizational and financial resources. The reason for the unsatisfactory level of knowledge about circular economy among enterprises that cooperate with an academic centre also requires further research. Such cooperation is based on the distribution of knowledge and modern technical and/or technological solutions.

This study indicates interesting directions for continued research. One of them is the incentive for companies to implement CE principles. It can be expected that companies that are exposed to greater risk, either due to possible environmental impacts or potential image damage, tend to be more responsive and mature. The ecosystem in which enterprises operate and its impact on the implementation of business circularity are also interesting. The result of the research should be mainly proposals for tools helpful in business practice in the area of circular economy and suggestions for top-down initiatives of a social or political nature.

6. Conclusions

When it comes to designing circular business models, multiple concepts and classifications of models as well as guidance for business activities related to circular economy have been identified in literature. Most of these are case-based studies, and this translates into limited applicability in other companies. Nevertheless, there are very few universal concepts that would support practitioners in adjusting their activities the circular economy needs. One of them is the proposal to use a business model canvas to design circular business models [32]. There is a lack of elaborations that would show the scale of practical use of circular business models by enterprises. As it has already been mentioned, cases of individual enterprises are presented, but the level of organizational skills of enterprises to implement the circular economy principles is not specified. This provides grounds for conducting research on the above-mentioned issues, all the more so as the modification of business models towards the idea of circular economy is a necessity and will cause entrepreneurs to have new opportunities in place of some lost opportunities.

Implementing circular economy solutions is a multi-threaded issue. Among others, it is associated with the involvement of often significant technical and financial resources, change of business models or the need to develop competences (including personnel dealing with implementation). Due to the above, the processes of implementing solutions in the area of circular economy are subject to the impact of a number of conditions, both favorable and difficult, for their implementation. The study indicates significant barriers. One of the factors that makes it difficult is the high level of variation in classifying circular business models. Another barrier is the competency gap resulting from the low level of knowledge about circular economy. Consequently, this results in an average level of maturity of business models in the area of implementing the assumptions of this economy. Other challenges in the process of CE implementation cannot be ignored either. These are: the level of awareness not only of companies but also consumers and public administration; the pace of changes; legislation and system solutions (the need to create and properly implement appropriate legal regulations); economic conditions (the cost of new, innovative technologies, often of low profitability, and the possibility of optimizing the costs of sustainable solutions in business). Important barriers to the implementation of CE rules are the lack of mechanisms to promote and support good and quality products. Activities to introduce CE should be carried out in parallel-from education, through cooperation with business at different levels, to solve legislative/systemic problems. The motivation for which circular business models are implemented is very important. It largely determines how and whether a business deals with the mentioned obstacles.

This article contributes to the discussion regarding the implementation of circular economy and indicates the need to popularize tools to assist practitioners in the transition from linear to circular models, such as the business model canvas. It also draws attention to the need of continuous monitoring of trends in this respect, so that both, societies and the economy have time to adapt. One can hope, as shown by the situation related to the COVID-19 pandemic, that in a very short period, we will be able to radically change our habits and behaviors, find ourselves in the new reality and learn new methods of functioning. Perhaps circular economy solutions do not have to be completely new to enterprises, or they only need an impulse to be implemented.

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