

CONSUMER EDUCATION IN THE CIRCULAR ECONOMY: MARKETING STRATEGIES FOR EFFECTIVE COMMUNICATION

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Abstract

This paper explores the directions of effective marketing strategies in terms of consumer education to understand the effects of the circular economy on the purchase and consumption decision on the environment, analyzing those communication techniques that positively influence and impact the target audience.

The perspective on the concept of education is defined in the paper through the principles of the circular economy currently applied through marketing strategies adapted to the market, starting from the relationship of market understanding and adaptation to the market. Thus, the exploratory research aims at a scientific analysis that is limited by the interconnection of key elements in the present specialized literature, such as: circular economy, marketing, environmental economics, education, big data.

The main question of the paper: "How can marketing strategies contribute to consumer education regarding the benefits of the circular economy?" is highlighted by the structure of the addressed topics, marking a series of results and discussions carefully redirected to the present.

In a rapidly changing market, selected communication practices to convey educational and awareness messages on a global scale are becoming increasingly common and represent an effective marketing tool to support the circular economy in a strategic, transparent and credible way, with the possibility of reaching a larger and more targeted audience through the use of digital platforms and social networks.

Keywords: circular economy, marketing, environmental economics, education, big data

JEL Classification: I20, M00, M31, O33, Q01, Q55

1. Introduction

In the context of the current global economy and the global economic, social and environmental perspective in continuous dynamics, evolution and

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change, consumer education is becoming increasingly important in promoting the principles of the circular economy through marketing strategies [Velenturf, A.P. and Purnell, P., (2021)]. This marks not only the action of raising awareness of the effects on the environment, but also the adoption of responsible behavior, based on the principles of the circular economy, namely the reuse of products, recycling of materials and waste reduction. In essence, we are talking about educating consumers in the circular economy, through communication and marketing techniques, used as a strategy to reduce negative effects on the environment, both from the perspective of companies and from the perspective of consumers. Thus, in this context, marketing strategies gain major importance, playing an essential role and becoming a key tool for the efficient transmission of information and for influencing consumer behavior, and ultimately, of companies responding to market demand.

In contrast to the linear economy, which is defined by a traditional consumption system, the circular economy is marked by a circular system, continuing the normal cycle of extraction, production, consumption and disposal. In order to align consumer behavior with the trends of this world, promoting a system in which resources are maintained for as long as possible, are reused and recycled, denotes an educational action on a global scale. Thus, with the help of marketing and communication strategies, marketing is no longer limited to promoting products or services but represents an essential promoter of communication and education. Starting from the basic question of the article: "How can marketing strategies contribute to consumer education regarding the benefits of the circular economy?" the study aims to be an analysis of communication strategies that facilitate the adoption of responsible behavior by consumers, while also highlighting the techniques and tools through which educational messages can be transmitted efficiently and adapted to the current context of the global market.

In terms of structure, the paper is classified into several main sections, each of which has the role of clarifying essential aspects regarding consumer education in the circular economy and the impact of marketing strategies for effective communication. The first part of the paper is marked by both general perspectives on the topic and key and specialized terms, aiming at the interconnection between the latter, and by the analysis of theoretical concepts based on the exploration of specialized literature. Regarding the specialized literature, the extracted premises were also classified into three main categories, such as: perspectives on circular economy and nowadays education, consumer behavior in a circular economy, marketing strategies for effective communication. The second part of the paper addresses the marketing strategies used to promote sustainable marketing practices, as well as their impact from the perspective of the concept of education, through a section of results and discussions, also

structured into three main categories, namely: general perspectives, challenges related to the circular economy and digitalization, solutions to the challenges of digital integration. At the end of the paper, the results of the analysis performed are discussed, highlighting future directions and relevant conclusions for the development of effective consumer education strategies within the circular economy.

The present paper thus aims, both by analyzing the proposed subject and by presenting the ideas reflected in the specialized literature in strengthening the relationship between the terms circular economy, marketing, education, big data and environmental economics, to mark a scientific path that supports the concept of consumer education within the circular economy, in relation to the use of marketing strategies for efficient communication. Promoting sustainable practices thus represents an environmental action for a sustainable, innovative future with development perspectives on a global scale.

In the perspective of the specialized literature, the circular economy is often seen as a sustainable model of economic development, which requires not only changes at the industrial level, but also significant changes in both consumer and company behavior. Given the fact that there is a connection between market demand and the response to market demand, highlighted by the adaptation of companies to the market, the development of society becomes a fundamental aspect on the strategic agenda of organizations around the world. In this direction, many studies highlight the importance of consumer education as a determining factor in the adoption of sustainable practices, highlighting the strategic role of marketing techniques in the effective promotion of sustainability principles [Geissdoerfer, M. et al., (2017)]. It is especially noteworthy that by integrating circular economy principles into companies' marketing strategies, consumer behavior is gradually determined in a direction of rejection through education on the effects of consumption on the environment. Since the responsibility is not only environmental, but also social and economic, education is done in a way adapted to the needs and desires of the target audience, encompassing sustainable promotion through adapted messages and tools.

In this research, the specialized literature is structured along main directions to provide an in-depth understanding of how consumers perceive and adopt the principles of the circular economy, as well as the tools through which marketing can facilitate this transition of responsibility. It is also worth noting that the study aims to identify the most effective communication tools and techniques that can support consumer education by promoting sustainable behavior, in a circular economy and future perspectives in which consumer education is a key antecedent in consumer decision-making, and attitude and knowledge are the elements with the greatest influence in the consumer purchase decision-making process [Vidal-Ayuso, et al., (2023)], aspects that bring the consumer-circular economy relationship to the fore. There are thus a series of premises that underlie

the work, delimiting theoretical concepts from practical ones, through the novelty of the theme, the applicability of marketing strategies, and the innovativeness of the subject brought by the circular economy.

2. Literature review

2.1. Perspectives on circular economy and nowadays education

Currently, we say that the circular economy aims for a fundamental paradigm shift from the traditional economic model, namely the model based on the linear path of extraction, production, consumption and disposal, that is, a closed loop cycle, not a circular one. Of course, depending on the materials, the cycle can have a longer or shorter period of reuse, recycling and reduction. The basic idea, however, lies in the concept of promoting a system in which resources are kept in use as much as possible, and their consumption is reduced as much as possible, in order to support the environment with the help of consumer behavior. In this context, the perspectives on the circular economy in relation to today's education outline a topic of discussion with innovation prospects, the applicability of the present being determined by the marketing strategies put into practice through efficient techniques and tools, with an emphasis on the target audience. Thus, companies, in response to market demand, respect the relationship of market demand-adaptation to the market, promoting a sustainable and future model.

In the literature, education for the circular economy is seen as a continuous development process, which must be integrated both into formal education systems and into companies' marketing campaigns aimed at the general public, which practically marks a raising awareness of the circular economy through digital marketing [Ronkainen, L., (2022)]. Many studies suggest that currently, and especially for the younger generations, education initiatives supported by digital and interactive strategies contribute significantly to raising awareness and changing consumer behavior [Panyapatiphan, D., (2020)]. Thus, marketing tools such as storytelling, gamification and social influence promoted on social networks play an essential role in shaping perceptions and promoting the adoption of a sustainable lifestyle in the long term, with benefits for both society and the economy, as well as for the environment [Amirova, N., (2021)]. We thus have in mind the concept of responsibility, which, with the help of widely promoted education, takes shape and is implemented in consumer behavior, which, in turn, influences the production and offering behavior of companies.

2.2. Consumer behavior in a circular economy

Starting from the perspective of the specialized literature, such as that, in the circular economy, consumers are key actors in the production-consumption

cycle and have a direct impact on the success of economic models [Vidal-Ayuso, F., et al., (2023)], European Environment Agency considers that consumer behavior in a circular economy is influenced by a series of factors, such as: economic factors, desires and needs, level of education, social factors, as well as references and beliefs. All these factors together, form a system of values on which a consumer relies when making a purchase choice, so that in order to redirect consumption towards a sustainable model, we emphasize the education component, more precisely on empowerment through education. Thus, the marketing strategy appears, which, with the help of communication tools and techniques, can positively influence consumer behavior in a circular economy. We therefore argue that the adoption of sustainable behavior is influenced by the level of environmental education and the perception of the clarity of the concept of sustainability. For example, research on consumer behavior towards e-waste highlights the need for clear policies and marketing strategies that facilitate the recycling and reuse of technological products [Islam, M.T. et al., 2021].

The attitude, perspective and behavior of consumers towards the circular economy can vary, as we mentioned, especially depending on the level of education and consumer culture. Basically, while some consumers are receptive to information about sustainability, the environment and a sustainable future, others show resistance or indifference towards this type of content [Siminelli, C., (2017)]. Precisely for this reason, an adapted, creative and targeted marketing strategy is meant to bring the right message to the mind and eyes of the right customer, in order to determine them, through current, digital and ethical practices, to adopt a responsible consumption behavior that minimizes the negative effects on the environment. In this case, we are talking about marketing from the point of view of a promoter for education on the concept of sustainability, both in terms of notion and applicability in society. Embedding and transmitting messages adapted to a circular economy through efficient communication techniques carefully targeted towards consumers' needs and desires is practically an approach with future prospects for any responsible company.

2.3. Marketing strategies for effective communication

Based on the perspectives on the circular economy in relation to the current concept of education, as well as on the research on consumer behavior highlighted in a circular economy, the current context of analysis is directed towards a sustainability perspective, which is based on the concept of education brought into the main image of consumers through the marketing practices of companies inclined towards responsibility. Thus, the emphasis is placed on facilitating the transition of the linear economy model to a circular model, which is promoted through green marketing, more precisely a type of modern marketing that emphasizes ecological practices and brings with it the promotion of them for

the public. However, in order to reach a target audience, the marketing direction needs to involve both a market-targeted strategy through an adapted message, as well as efficient and currently applicable communication channels, such as digital communication channels. Thus, we are considering combining ecological marketing with digital marketing, in order to maximize the transmission of the message of awareness on the circular economy to a wider audience. By integrating educational messages into companies' marketing campaigns, messages that are part of current environmental practices, brands can make a significant contribution to the initiative and the effort to educate consumers in a circular economy [Kotler, P., (2022)].

Currently, one of the most effective communication strategies is the use of digital platforms, respectively social networks, to transmit interactive and personalized educational messages. Campaigns based on this type of tool are considered adapted to the current market trend and are seen as successful and future-oriented promotional tools, especially when we consider the concept of education or empowerment. In terms of characteristics for the most efficient communication and intended for the widest possible audience, characteristics such as authenticity, transparency and clarity in communication can determine the adoption of responsible behavior towards the environment. Since communication is based on simple language, the message must be both easy to understand and attractive to look at, which means that the message must be personalized, both in terms of text and visuals. Currently, video content has increased considerably in terms of impact for users, with more and more social platforms adapting their content type to this dynamic form of promotion. In this way, the degree of understanding of the concept of circular economy and awareness increases directly proportionally to the degree of consumer involvement. In this sense, studies show that messages that highlight the economic benefits of the circular economy have a greater impact on purchasing decisions than those that focus exclusively on ecological aspects [Gleim, M.R. et al., (2013)].

Another fundamental element of effective communication is the ability to adapt marketing strategies to market dynamics and trends in relation to consumer preferences, which more precisely mark the relationship between supply and demand [Abbati, M. and Abbati, M., (2019)]. In this sense, the use of big data, artificial intelligence and IoT for transmitting messages can significantly improve the efficiency of marketing campaigns both now and in the future. Digital marketing is also placed in this direct line, which, with the help of effective communication features, incorporates the marketing strategy in a complex, personalized and adapted way, as social networks and digital platforms are increasingly used on a global scale. In this case, we are talking about a type of interactive marketing campaigns, which by interconnecting Social Media (SoMe), Pay per Click (PPC), Public Relations (PR), Search Engine Optimization (SEO) and User Experience (UX) services in terms of websites, creates a complex

strategic ecosystem, which can stimulate public engagement while educating the end consumer by strengthening trust in brands and sustainable actions, within a circular economy.

In terms of digital communication channels, social media platforms have the greatest impact, being the most efficient to use, both from a consumer and a company perspective [Pereira, G.M. et al., (2024)]. Basically, when we talk about Facebook, Instagram, LinkedIn and TikTok, we think of attractive visual content, which can be both educational and entertaining. When we talk about educational content, we can mainly refer to social media campaigns to stimulate engagement, but also to collaboration with influencers who can surround the adoption of sustainable behavior towards the environment. From an optimization point of view, SEO plays an extremely important role in transmitting key messages and highlighting them in the online environment through search engines [Barčić, A.P.]. Optimizing keywords in this sense, such as circular economy or education for sustainability, can reach through this strategy a broad and targeted publication, improving the visibility of the educational concept organically. Also, in terms of improving visibility, PPC campaigns, i.e. Pay Per Click campaigns organized on advertising platforms, such as Google Ads, Meta Ads (Facebook & Instagram), LinkedIn Ads or YouTube Ads, allow for clear and precise targeting of users and direct campaigns according to the objective [de Souza Costa et al., (2021)]. In terms of image, the most suitable are Public Relations campaigns, which are essential to increase the notoriety of a concept, a brand or an idea [Romero-Luis, J. et al., (2022)]. In terms of positive impact, collaborations with journalists, the transmission of articles or press releases. as well as specialized publications or storytelling, can be widely used to support the concept of educating consumers in a circular economy. The experience of consumers and respectively the user, is given in any of the situations by the visual side, whether it is dynamic or static, because graphic design plays an essential and increasingly important role in the efficient transmission of messages, especially educational ones [Lin, K.Y., (2018)]. Thus, by embedding educational messages to support the circular economy within digital platforms suitable for the target audience, marketing strategies will not only be informative, but will also be inspirational, educational and effective [Augustínová, N. and Bednárik, J., (2020)].

In addition to highlighting the potential impact of digital marketing in promoting the concept of sustainability, the study also examines the need for collaboration between businesses, policymakers and educational institutions to create a coherent and comprehensive approach to consumer education in the circular economy [Holst, J., (2023)]. By integrating these findings into marketing strategies, companies can not only improve their brand reputation and consumer loyalty but also contribute to a more sustainable future [Carbonell-Alcocer, A. et al., (2025)]. The importance of transparency, credibility and engagement in marketing communications by using effective strategies based on digital

platforms and social networks to reach a wider audience and by creating educational content that is both informative and engaging.

Therefore, by supporting research ideas with the help of specialized literature, this research provides valuable insights into the development of marketing strategies that effectively communicate the principles of the circular economy according to strategies that play a crucial role in advancing the transition to a more sustainable and circular economic model through their influence on consumer behavior and decision-making processes.

3. Research methodology

The paper "Consumer Education in the Circular Economy: Marketing Strategies for Effective Communication" represents an exploratory research and aims to deepen the proposed subject by reviewing and interpreting the specialized literature from several scientific perspectives. From a methodological point of view, a series of scientific premises were analyzed based on the keywords of the theme, such as: circular economy, marketing, environmental economics, education and big data, marking a structured path around the question: "How can marketing strategies contribute to consumer education regarding the benefits of the circular economy?"

The research is also outlined by both the general perspectives given by the literature review and the results and discussion section, which represents an open direction for new ideas and topics to be explored. From this point of view, the research gap identified based on the analysis performed is highlighted by the limitations of current research regarding the interconnection of the terms of education, circular economy and marketing strategies. However, the present work aims to bring added value and novelty in this segment. The review of the specialized literature was carried out through detailed research of specialized sources in circular economy and marketing strategies, targeting books, academic journals, industry reports and specialized premises, the resulting ideas being classified into three directions, respectively: perspectives on circular economy and nowadays education, consumer behavior in a circular economy, marketing strategies for effective communication.

The general perspective on the research methodology nuances the exploratory desk research nature of the topic and marks the analysis carried out on the specialized literature to identify the marketing strategies used in the circular economy, with an emphasis on the concept of education. Thus, the present study aims to bring to the forefront the interconnection between the terms marketing, education and circular economy, offering a scientific overview of effective communication techniques and strategies, the analysis being supported for the accuracy of the information, on studies, examples and specialized ideas that

illustrate how educational messages can influence the consumer's perspective and behavior towards responsible consumption.

4. Results and discussion

4.1. General perspectives

The path towards a circular economy calls for an integrative approach where consumer education would play a major role in developing sustainable consumption behaviors. This is mainly because the principles of reduce, reuse, and recycle under the circular economy model have come to promise resource efficiency, a most urgent need in the fight against environmental degradation [Stahel, (1982)]. In this informative consumer education, people are made aware of the effects of their actions on the environment, thereby arming them with the knowledge to make informed decisions [Velenturf & Purnell, (2021)]. This must be supported by implementing the principles of circular economy through effective marketing communications that can create an impression on consumers about its benefits for sustainability [Gomes et al., (2024)].

Marketing strategies are realigned with circular economy objectives, wherein digital tools and social media are used in consumer engagement. Since consumers currently rely more on online media for product information and sustainability choices, the circulation of information practices leverages digital media significantly [Barčić, et al., (2024)]. Companies adopt digital marketing as a tool to facilitate realignment, wherein the long-term benefits of circular consumption are cost savings and a reduced environmental footprint. However, the study also proved that consumer behavior towards sustainable products is influenced by barriers like sensitivity to price, distrust of green claims, and insufficient knowledge regarding the circular economy [Gleim et al., (2013)].

Behavioral insights should be incorporated into consumer education efforts to counteract the possible resistance toward embracing sustainable consumption patterns. Social marketing campaigns, focusing on collective responsibility, and ethical consumerism may have important implications on consumer attitudes and buying behaviors. Effective communication will focus primarily on behavioral change with the psychological barrier being given attention, following clarity and visibility for the stakeholders through the participatory approach. Therefore, not only informative, educational strategies are to motivate and empower the consumer to take an active interest in the circular economy. If we refer to consumer demand, we will notice that it practically redefines existing marketing practices and, to some extent, influences the transition of brands toward the adoption of innovative and sustainable solutions.

Therefore, in this context, the circular economy becomes, compared to the traditional economy, a central element, intended to offer much more than a simple alternative to the traditional models that the consumer of goods and services is

already accustomed to; the circular economy brings as a new element a strategic opportunity in support of companies so that they can reposition their promoted values so that they align with the dynamics of the market.

By adopting a circular economy model by companies, we will be able to notice multiple benefits for both producer and consumer, because, on the one hand, we will witness an optimization of the use of resources, a reduction of waste resulting in the minimization of the ecological impact and, at the same time, the extension of the life cycle of products.

By approaching such a circular economy model, both companies and consumers will have multiple benefits because, on the one hand, the resources used will be optimized in the production process, and on the other hand, this aspect will certainly lead to the extension of the product life cycle and, automatically, to the minimization of the ecological impact. This upgrade from the traditional economy to the circular economy must be perceived by both companies and consumers as a necessity for the future of business and society, and not at all as a transient trend of the moment.

The integration of sustainability into all operational aspects, starting with the minimalist design of products and ending with the completion of the supply chain – recycling and reuse, will certainly create long-term value for both organizations and consumers. An efficient circular economy model will stand out for the major contribution it will bring to the environment by protecting it but also for stimulating innovation, and economic efficiency, which will also attract consumer loyalty. Because sustainability is currently no longer viewed as just a simple competitive advantage but represents an essential advantage for ensuring the medium and long-term success of any business, all companies that integrate the principles of the circular economy into their marketing strategies will meet market demands and make an essential contribution actively and beneficially, strengthening a balanced, ethical, and sustainable economic ecosystem. With such an approach, companies will be able to create a continuous cycle of improvement and innovation, thus strengthening consumer trust, which is translated into strengthening a more responsible future. In a context in which sustainability is becoming a global priority, marketing strategies must adapt to transparently reflect the principles of the circular economy. Repositioning them towards the circular economy in a positive way to the expectations of conscious consumers will create medium and long-term value for brands on the market, thus reducing their impact on the environment and strengthening customer loyalty towards them.

To strengthen the marketing strategies used in the circular economy, companies should consider following some healthy and predictable concepts, such as:

1. Design focused on sustainability and education

Brand communication policy must be carried out in a clear manner related to their commitment to the circular economy and highlight the use of recyclable

materials, waste reduction and product life cycle optimization. Marketing campaigns can include transparent labeling, ecological certifications and authentic stories about the sustainable processes implemented.

2. Collaborative economy and extending the life of products

Through the marketing strategies used by companies, they can encourage models based on reuse, repair, and recycling, promoting initiatives such as:

- Buy-back and recycling programs – in which customers are encouraged to return used products in exchange for benefits;
- Repair and upgrade services – by creating partnerships that allow the life of products to be extended.

Sharing and leasing platforms – through which companies can meet consumer needs with subscriptions or rentals at the expense of traditional purchases.

3. Responsible production and a transparent supply chain

Sustainable marketing policy must actively encourage initiatives to reduce the carbon footprint and the efficient use of resources, through various methods such as: entering into partnerships with suppliers who are certified eco-friendly, optimizing the logistics side of businesses to reduce carbon emissions, and creating modular products that are easy to disassemble and recycle.

4. Organizing awareness campaigns and active consumer involvement

Supporting consumers towards active involvement in the transition to the circular economy must be done actively and transparently, to encourage healthily and beneficially educational marketing, gamification, and awarding rewards to stimulate sustainable behaviors through prizes and discounts for recycling, as well as to build a community by involving consumers in ecological initiatives through events, challenges, and social networks.

5. Digitalization and innovation to reduce waste

Another important aspect is represented by encouraging the use of digital technologies that allow the optimization of production and delivery to minimize waste.

Therefore, data-based marketing can realistically support brands to personalize the offers they bring to consumers, thus avoiding overproduction and, implicitly, reducing unused stocks; thus, virtual experiences (augmented reality, sustainable e-commerce) can reduce the need for physical materials and unnecessary transportation.

4.2. Challenges related to the circular economy and digitalization

Although the importance of circular economy is increasing, many widespread adoption of circular practices challenges. The most important barrier to 100% adoption is the immaturity lack of awareness and immobility of consumer awareness and engagement. Research indicates that most of the consumers are

not exposed to the concept of circular economy, or do not have a complete perception of what productivity means over the long term [Monteiro Gomes et al., (2024)]. Such a lack of knowledge leads to a lack of willingness to embrace circular consumption behaviors.

The benefits that digitalization brings in terms of consumer education are unarguable. However, digitalization brings with it the problems of misinformation, access to information, and the gap between those who have access to digital tools and those who do not. All marketing strategies in the digital environment will be effective if the subjects trust the sources and are capable of differentiating between information and misleading content [Carbonell-Alcocer et al., (2022)]. Unequal levels of knowledge due to differences in reading the news online and the availability of technology limit the spread of circular economy education initiatives.

One more key issue is the pushback from sectors that have usually worked in a straightforward money model. Companies might be reluctant to change to round business models because of money risks, supply chain limits, and the ask for infrastructure spending [Jamwal et al., (2021)]. Sustainability trade-offs are also clear in business operations, where money efficiency often battles with environmental goals, making it hard for businesses to take on circular strategies without outside incentives or rule support [Leseure, (2023)].

We can notice that the transition from the traditional economy to a circular economy model, combined with the acceleration of the digitalization process, brings significant benefits but, at the same time, a series of ongoing challenges that companies playing in the consumer market must manage more strategically. These difficulties and challenges range from technological barriers to high costs and changing consumer conservative mindsets and strict regulations.

The challenges most frequently encountered in implementing the circular economy are:

a) High initial costs and low short-term profitability, which can be discouraging for companies

Adopting such a circular model requires significant investments in recycling technologies, product redesign, and, to the same extent, the development of sustainable supply chains. Although these changes can bring long-term benefits, many companies in the market are still hesitant to make the transition due to high initial costs corroborated with the uncertainty regarding the recovery of the investment within a reasonable period.

b) Infrastructure that is still inadequate for recycling and reusing products

In many regions, we observe that the systems for collecting and processing recyclable materials are underdeveloped, which makes it difficult to implement the circular economy in a foreseeable period; in this context, the lack of an

efficient infrastructure leads to a rather cumbersome and difficult process of recovering and reintegrating materials into the economic circuit.

c) The current difficulty in changing the perception of the circular economy and consumer behavior

Many consumers still prefer cheap and disposable products to durable and recyclable ones for financial reasons. We can also observe that there is a lack of education on the benefits of the circular economy, which leads to an extremely slow adaptation of this model than it could be otherwise.

d) Complex and inconsistent regulations

We note that the legislation on the circular economy varies considerably from one country to another: the lack of a uniform custom in the field leads to the creation of difficulties for companies operating internationally. Circular economy regulations are still strict in some countries or, on the contrary, insufficiently developed, which affects the implementation of effective circular practices.

Regarding challenges in digitalization and sustainability, we can consider:

a) The ecological footprint of technology – Even though the digitalization process encourages resource efficiency and, implicitly, the reduction of physical waste, it comes with a significant environmental cost.

To digitize this process, massive production of electronic devices is needed, which represents major challenges for digital sustainability, along with the energy consumption of data centers and the generation of e-waste.

b) High risks related to data security and privacy

As companies move into the process of digitizing their processes and try to adopt solutions such as blockchain or artificial intelligence to optimize the circular economy, cybersecurity risks inevitably arise; therefore, we can see that, currently, the protection of consumer data and the prevention of cyber-attacks are considered critical aspects in this transition process.

c) The need for investments in digital infrastructure

Last but not least, and not to be neglected, is the fact that all important elements that converge towards the adoption of digital technologies directly require considerable financial resources, which will be reflected in the final price of products sold to consumers.

Companies are forced, in this process of transition directly from the traditional economy to the circular economy, to implement advanced monitoring systems for both the supply chain and to identify traceability solutions for products and sustainable e-commerce platforms, which can represent a real challenge, especially for SMEs.

d) Difficulties in integrating digitalization into the circular economy

For digitalization to truly support the circular economy, solutions must be developed that facilitate the reuse and recycling of consumer goods. For

example, online platforms can be used to manage second-hand products or to optimize the exchange of resources between companies; currently, we note that a significant number of entities do not yet have the experience or technological capacity required to implement such solutions.

Ways to overcome these challenges:

- ✓ Strategic investments and partnerships – Companies should pay increased attention to active collaboration with innovative startups, governments, and NGOs to identify opportunities to develop scalable and efficient solutions for the circular economy and digitalization.
- ✓ Education and mindset change – Companies should pay increased attention to awareness and education campaigns, as these are essential to encourage consumers to adopt responsible consumption habits.
- ✓ Clear government policies and incentives – Well-structured regulations and subsidies for investments in the circular economy can accelerate the transition and reduce financial risks for companies.
- ✓ Green technologies and innovative solutions – Investing primarily in the development of sustainable digital technologies, such as AI to optimize a range of resources or blockchain for traceability, can help companies overcome current barriers.

4.3. Solutions to the challenges of digital integration

To address the challenges of consumer education in the circular economy, a multi-faceted approach with technological advancement and policy frameworks is desirable. An approach that could be used is through the application of digital marketing strategies, which could be perpetuated by AI and big data analytics, that respond to messages of sustainability in a more personalized manner. In that respect, AI platforms would assess and intuit the kind of pedagogical content that would best increase both engagement and retention of knowledge by learners.

Partnerships among firms, governments, and schools play a key role in promoting digital equality. Free online classes, sustainable workshops, and literacy programs help close the info gap and raise involvement of consumers in the circular economy. In addition, regulations that ensure clear and accurate digital ad messages can help lower fake news and establish trust with buyers.

Games and interactive learning tools are another effective way of increasing consumer engagement. According to research, digital incentives are very well accepted by consumers; an example is a loyalty program that rewards sustainable behavior (Barčić, Kralj, & Ćurić, 2024). Companies would thus educate through gaming strategies and simultaneously motivate consumers to make choices in favor of environmental sustainability, facilitating long-term behavioral change.

Besides, the schools must put sustainability ideas in their courses, supporting a full-institution way of learning about sustainability (Holst, 2023). By putting

circular economy rules in schools and out-of-school activities, learners and buyers can gain the skills needed to take part in green habits. Digitalization is undoubtedly an essential process for accelerating the transition to a circular economy, but the effective integration of digital technologies certainly also entails a series of challenges, and to manage them effectively, companies and organizations must carry out the necessary due diligence to prepare for the adoption at the organizational level of a series of innovative, sustainable and scalable solutions, of which we mention, in our opinion, some relevant ones:

- 1. Reducing the ecological footprint of technology** – to optimize the energy efficiency of data centers by using renewable energy sources to power servers.

This measure involves the implementation of advanced passive cooling technologies and the reuse of waste heat; to the same extent, the possibility of developing energy-efficient cloud algorithms and infrastructures must be analyzed, as well as promoting modular design for electronic devices. Reducing the ecological footprint also considers the creation of gadgets that can be easily repaired, updated, and reused. Thus, companies will encourage the promotion of "right to repair" policies to extend the lifespan of digital products and the use of recyclable and biodegradable materials in hardware production, as well as the development of sustainable software solutions. All these measures will lead to the optimization of code to reduce resource and processing consumption and will also encourage the use of artificial intelligence to minimize the energy consumption of applications and devices.

- 2. Increasing data security and transparency** – for implementing blockchain for traceability.

Blockchain technology can be used to track materials and products in the circular supply chain, in this way, a fair and transparent process will be ensured and the risks of fraud will be significantly reduced; in this forecast, Consumers can have access to detailed information about the provenance and recyclability of the products they purchase, which will instill in them a high degree of trust and will lead to the adoption of a system that uses advanced cybersecurity solutions; all these measures to encourage increased data security and transparency will lead to the adoption of advanced encryption standards to protect user data and the integration of AI and machine learning to detect and prevent cyber-attacks on companies' digital infrastructures.

- 3. Developing digital infrastructure for the circular economy** – which will lead to investments in digital platforms for reuse and recycling to create online marketplaces for second-hand, refurbished, and recyclable products.

The development of digital infrastructure will actively encourage the development of mobile applications that will effectively connect consumers

with collection and recycling centers by integrating artificial intelligence into resource management. We conclude that with the help of AI, we can optimize supply chains, and this process will certainly facilitate the substantial reduction of waste and maximize the use of recycled materials. Encouraging the use of predictive technologies in current activity will help companies estimate the demand for sustainable products, which will reduce overproduction. Another branch of the development of digital infrastructure for the migration of the traditional economy to the circular economy is the use of IoT (Internet of Things) for monitoring environmental impact. Therefore, IoT devices can be used to monitor the actual consumption of resources and at the same time to optimize industrialization processes. The benefit of using smart sensors is that they can detect and report in real-time data on recycling, pollution, and energy efficiency.

4. Creating clear policies and regulations – through incentives for sustainable digitalization.

These policies can encourage the granting of subsidies to companies that implement green digital technologies and through tax breaks for businesses that implement circular economy models based on digitalization. An important aspect that deserves due attention is that of clear legislative regulations for the reduction of e-waste; currently, it is necessary to define a more applied legislative framework through which to grant bonuses for the recycling of electronic components and limit the use of non-recyclable materials. We must be aware of the fact that standardizing recycling procedures at a global level will help us all in facilitating the efficient management of digital waste.

5. Education and changing mentality – imply professional training in digitalization and sustainability by encouraging the adoption of active measures for the development of digital education programs for entrepreneurs and employees and by creating courses on the circular economy in the academic and corporate environment.

Consumer awareness through technology can be addressed by creating mobile applications that can provide information about the ecological impact of products and by supporting interactive campaigns that promote recycling through digital rewards.

Thus, we can conclude that the integration of digitalization into the circular economy is essential to creating a sustainable future, but it is obvious that it comes at the cost of significant challenges that we must learn to manage.

The solutions identified can range from optimizing technological efficiency and at the same time increasing data security, to developing a digital infrastructure in conjunction with consumer education. By adopting such measures, we will manage to reduce the negative impact on the environment, but we will also be able to offer economic opportunities for companies that want to innovate processes but at the same time remain competitive in the long term.

5. Conclusions

Consumer education would play a very essential role in promoting the principles of the circular economy. The marketing strategies would have to be reoriented so that there is a smooth transition into this new system. Information accessibility and the possibility of putting everybody on board make digitization an opportunity, though issues of misinformation, digital divide and industrial resistance must be addressed. The integration of personalization based on AI and regulatory measures, as well as educational tools that operate on an interactive basis, would strengthen the effectiveness of communication strategies about the circular economy.

For business sustainability, companies along with governments and education providers need to come together. This will make digital tools more accessible, create clear marketing communications, and steer the adoption of innovative engagement practices all leading to a circular economy. As consumer knowledge and involvement rise, it becomes more workable to change to a circular and greener economic model that is good for the world. For business sustainability, companies together with governments and education providers must come together. This will make digital tools more accessible, create clear marketing communications and drive the adoption of innovative engagement practices, all leading to a circular economy. As consumer knowledge and engagement increase, it becomes more practical to move to a more circular and greener economic model that is good for the world.

The influence of the circular economy on the application of marketing strategy and consumer behavior is becoming increasingly evident, as brands recognize the need to adapt to the ever-changing expectations of consumers as well as environmental imperatives. Political economy, psychology, sociology, and anthropology are also considered to have laid the theoretical foundations of the current understanding of consumer behavior. Due to the complexity and varied nature of the acts and processes that define consumer behavior, people's reactions in economic terms cannot be reduced to simple repetitive actions; they reflect an accumulated life experience. In this sense, simply observing and quantifying consumer actions is not sufficient and relevant. It is also necessary to explore the psychophysiological processes that underlie these actions and to explain the interdependencies between them.

The transition to the circular economy and digitalization is an extremely complex process, but one that is essential for the sustainable future of both business and society in general. Even though, at the moment there are multiple challenges, these can be overcome through concrete processes of innovation, collaboration, and at the same time a strategic adaptation to real needs.

Thus, the integration of digital technologies into the circular economy can transform the industry and create a much more efficient, fair, and environmentally friendly economic ecosystem. The analysis of how consumer demand transforms

marketing practices reveals a shift towards innovation, the adoption of circular economy principles, and a strong focus on market adaptation. By integrating these elements, brands can create effective marketing strategies that resonate with consumers, drive loyalty, and contribute to a more sustainable future.

The essential objective of the circular economy must be kept constantly in the focus of organizations, not only for their success but also for the positive impact on the environment as a whole. The transition to a circular model brings major benefits, both for protecting natural resources and reducing pollution, and for the well-being of organizations, society, and the economy.

In this context, a fundamental aspect to remember is that sustainable business practices, both at a large and small level, are no longer just an opportunity, but a pressing necessity for the healthy future of our environment. Thus, the adoption of the circular economy becomes an essential condition for ensuring a sustainable future, in which resources are used efficiently and responsibly.

Abbreviations

CE: Circular Economy

SoMe: Social Media

SEO: Search Engine Optimization

PPC: Pay per Click

PR: Public Relations

UX: User Experience

IoT: Internet of Things

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