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Circular Economy Role in Industry and Environmental Sustainability: Qualitative Content Analysis Approach

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ABSTRACT

This study aims to investigate the system and principles of a circular economy. Our research uses a qualitative research approach, and the results of our study are hypotheses. We identified four main topics in our initial research to understand the potential future benefits of circular economies: Forests, Industrial and Environmental Sustainability, Circular Economy, and pollution. We found that forests play a role as a supporter and indicator of the success of sustainable economic development. Industrial and environmental sustainability are at the core of the circular economy concept. Circular financing plays an important role in addressing ecological improvements. Pollution resulting from industrial activities is a threat to the environment and must be recycled or minimized.

Keywords: Economic Circular, Forest, Industry, Environmental Sustainability, Pollution.

INTRODUCTION

Forests are harmed by the world's fast population growth and industrialization, which severely strains resources Naturelles and precludes the prospect of attaining a circular economy. Forests may be seen as a critical resource for sustaining communities, satisfying the requirements of the next generations, and promoting the circular economy (Stevic, Karamas, Demir, & Korucuk, 2021). The circular economy is positioned as a strategy for economic growth compatible with ecological sustainability. However, some recent work has emphasized the concept's inadequacies in terms of environmental sustainability (Giudice, Alice Mazzucchelli, & Fiano, 2020).

The forestry industry has been critical in Slovakia's transformation of the economy into a circular one, providing considerable efficiency possibilities gains and wood substitution in the case of non-renewable resources. Additionally, there is an increasing opportunity for ecosystem management and restoration. However, expanding biomass uses may trump other considerations, such as biodiversity. Ultimately, the continuation of these services is contingent upon a sound government (Beckmann, Sivarajah, & Irani, 2021). The concept describes the difficulties and opportunities of sustainability, and several Businesses take advantage of this concept in their sustainable and development strategies (Marrucci, Daddi, & Iraldo, 2021). The existing level of theoretical knowledge is not suitable for management strategy. Still, one practical objective is to determine how information systems may be improved and used to strengthen these ideas and, more generally, sustainable management (Jones & Wynn, 2018).

Industry 4.0 and the two of the business industry's latest phrases are circular economies and circular economy. Primary focus areas nowadays. However, global acceptance, Industry 4.0 implementation, and Circular economies continue to exist in their infancy (Sahu, Agrawal, & Kumar, 2021). The most crucial actors in integrating Industry 4.0 are senior executives, and they are also ensuring Circular Economy sustainability. Additionally, sophisticated Internet of Things (IoT) and malware technologies are essential Industry 4.0 initiatives that improve CE performance metrics (Chauhan, Sharma, & Singh, 2019). Manufacturing enterprises' operating operations continually wreak havoc on the environment. Adopting a circular economy approach may assist enterprises in optimizing their resource use and minimizing waste generation. The digital revolution has presented industrial organizations with several difficulties and possibilities. The influence of Industry 4.0 deployment On resource efficiency, insufficient emphasis has been paid (Stevic, Karamas, Demir, & Korucuk, 2021; Lim, Lim, Lim, Lim, & Oktaviandra, 2022)

Industry 4.0's growing technology may be combined with Circular Economy (CE) principles to develop business models that maximize pollution reuse and recycling resources such as scrap metal or electronic waste. The study findings include a circular model proposal for reusing and integrating old electronic equipment. In addition, web-based platforms, reverse supply, and rapid prototyping will be used to boost CE Practice. The results demonstrate the beneficial impact of growing company sustainability by reintroducing trash into the store to invent stuff on demand (Nascimento et al., 2018; Prabowo, Sulisnaningrum, & Harnani, 2021).

LITERATURE REVIEW

The circular economy is a growing trend that many businesses proactively consider addressing sustainable development objectives. As shown by the literature, collaborative interactions between supply chain partners support circular economy techniques. Unfortunately, research in the lower parts is lacking. They demonstrated the particular problems businesses face when implementing circular economy concepts and how these challenges might be solved.

In contrast, data analysis capability functions as a moderating element in the section. It was discovered that cooperation capabilities and advanced information analytics substantially influence distribution network flexibility's sustainability, while industry dynamism has a negligible effect. Finally, Flexible supply chains have a significant and favorable impact on accomplishing circular economy goals and enhancing resilience (Bag & Rahman, 2021).

Manufacturing enterprises' operating operations continually wreak havoc on the environment. Adopting a circular economy approach may assist firms in optimizing their resource allocation and minimizing waste generation (Badhotiya, Avikal, Soni, & Sengar, 2021; Sasongko, Widarni, & Bawono, 2021). The clever approach is founded on creating a circular economy with ecological finance to bolster the system's structural soundness (Xiaofei, 2021). Circular economy approaches such as supply chain planning, procurement relationship building, and circular economy human capital management all significantly contribute to an organization's resource efficiency performance improvement. Big data supply chains function as mediating factors among human capital managers and company performance in sustainability-oriented supply networks (Beckmann, Sivarajah, & Irani, 2021).

Throughout all, 19 circular economy methods were evaluated in such a local network of small enterprises and independent entrepreneurs linked by shared products and by-product flows. Internal factors administration, ecosystem protection, and investment recovery were identified as these activities. This strategy is most often used in product design. On the other hand, the implementation was often late and lacked indications of continuous and appropriate activity, stressing the European Commission's (EC) nascent beginnings in the visual system. The management category's approaches are less practical, implying that environmental considerations are not considered while establishing strategic business strategies (Silva, Shibao, Kruglianskas, & Barbieri, 2018).

Within the context of a circular economy and a smart tourist industry. This study reveals how smart travel and the circular economy may be used in tandem to navigate complexity and move tourist firms and destinations toward healthy and intelligent real-worth processes (del Vecchio & Secundo, 2021). There are practical implications for tourist activities and policymakers regarding tourism innovation and the transition towards circular business models. This study has social consequences because it contributes to the dispersion of a tourism development organizational structure and the active role of local stockholders in the growth of tourist areas (del Vecchio, Malandugno, Passiante, & Sakka, 2021). As Krabi tourism stakeholders have done by cooperating to establish a green action and tradition in which the business model Collaboration among stakeholders is crucial

for advancing the circular economy (Pongsakornrungsilp & Pongsakornrungsilp, 2021).

The evaluation of particular resource efficiency (CE) metrics in aspects of able to use that knowledge, metric scope but also breadth, and technology levels shows the lack of incorporation of information measurements and the importance of various aspects, a shortage of hands in the more significant part of narratives, and intensity of metrics at the component level. Therefore, reliability and validity criteria for assessments, along with methodologies and recommendations for future CE investigation, are recommended (Kuzma, Sehnem, & Jabbour, 2021).

By assessing areas for future research inside the circular economic helix (CE) and sustainable business performance (SBP) within the scope of digitalization, it is feasible to make a substantial contribution to the creation of circular products that seem durable (Ye, Deng, Yang, & Liang, 2021). Additionally, user interaction is necessary to develop novel circular goods that are sustainable via digitalization. A shift to a product-service structure is recommended to expedite the transition to CE and digitalization (Agrawal, Wankhede, Kumar, Upadhyay, & Arturo Garza-Reyes, 2021).

To analyze the overlap, complementarity, and divergence between the writings on circular economic systems (CE) and related books on quasi-power generation frameworks and models. For example, CE, reverse supply, sealed, manufacturing symbiosis, and green innovation prove the high convergence in the observations and the gaps and weaknesses in this literature. The adverse environmental, economic, and operational consequences are not recognized, and there is a shortage of studies showing empirically shown benefits of approaches. The corporate and societal justification for non-linear manufacturing remains based on conceptual investigations, modeling, and case studies. Despite the normative orientation, management theory is seldom used (Simone, Brust, & Pereira, 2019).

Pollution avoidance strategies may be a critical motivator for firms to advance toward a circular economy practice. It demonstrates how ecological modernization ideas might aid in creating a circular economy (Bag & Pretorius, 2020). This knowledge may help design processes that promote circular and sustainable operations and the value of social benefits. EMT concepts, such as the construction of an institutional climate conducive to proactive corporate behavior, may facilitate the implementation of circular economy techniques across various industries (Sehnem, Sousa Jabbour, Conceiço, Weber, & Julkovski, 2021).

The Paris climate accord, for example, refocused attention on the issues of carbon reduction, the circular economy, green environments, and the fundamental necessity to allow the construction of a sustainable business environment. Numerous SMEs have complied with waste disposal regulations since 2006 and remain impervious to innovation. Adherence to guidelines is expected to positively impact advancement (Lopes, Farinha, & Silva, 2021).

RESEARCH METHOD

We want to validate a notion developed in prior research addressing circular economy deployment across various industries. We gather scientific papers from emeralds, google academics, and books authored by specialists in regional, environmental, and circular economy economics via a thorough examination of the literature. We methodically gather scientific publications, from selection to analysis, using a systematic literature research approach. We employed the content analysis approach to analyze our research journal. Our research employs the qualitative research approach, and the outcome of our investigation is a hypothesis based on the findings of prior studies. We conducted a study starting from the influence of forests on various sectors and their interrelationships. We will investigate the forest research system and the notion of a circular economy. Naturally, forests and circular economies are inextricably linked to industry expansion and other environmental issues such as pollution. We identified four main topics in our initial research to understand the circular economy's potential for future ecology, namely:

1. Forests
2. Industry and Environmental Sustainability
3. Circular economics
4. Pollution

Each subject is developable based on our study of thousands of research articles discovered using direct scientific search, emerald, and Google Scholar. The theme analysis that we conducted was an attempt to analyze the relationship between the variables we identified and potential changes in the circular economy's sustainability and industrial sustainability in the future. Therefore, we explored not only the themes but also the relationships between them to develop a conceptual picture of the circular economy, corporate efficiency, and the ecosystem.

RESULTS

The analysis revealed the relationship between the topics: forests, industry and environment sustainability, circular economics, and pollution. The results of content analysis based on our theme are presented in Table 1.

Table 1. Content Analysis

Theme	Content Analysis
Forest	Of the articles we searched for related to forest and circular economy, only three pieces were close to the study. The three articles indicate that forests play a role as a supporter and an indicator of the success of sustainable economic development in industrial revolution 4 and circular economics.
Industry and Environmental Sustainability	Of the articles we searched for related to Industry and Environmental Sustainability, only seven pieces were close to the study. The seven articles indicate that industry and environmental sustainability are at the center of the concept of circular economics.
Circular Economic	Of the total articles we searched for related to circular economics, only fifteen articles were close to the study.

	The fifteen articles indicate that circular economic play a significant role in addressing environmental improvements.
Pollution	Of the total articles we searched for related to Pollution, only two pieces were close to the study. The two articles indicate that pollution results from industrial activities that threaten the environment and must be recycled or minimized.

There are 4 main themes that we found in our study and we found the results by doing various triangulation and developing the results and we present them in the table. Circular economics is an economic concept based on a green economy. Where pollution can be converted into monetary value, such as plastic waste that can be recycled, industrial activities cause pollution. However, it is necessary to pay attention to sustainability in industrial activities where the forest supports economic stability and sustainability.

While forests are critical to maintaining a healthy atmosphere, they are being affected by the world's fast population increase and industrialization, which place a significant demand on natural resources and jeopardize possibilities for attaining a circular economy. Forests may be seen as a critical resource for community sustainability, supporting future generations' needs and encouraging a circular economy. However, a recent study has shown us the format's shortcomings in environmental protection.

Industry 4.0 and also the circular economy are now the two key focuses. Industry 4.0 and indeed the circular economy, on the other hand, are still in their infancy in terms of worldwide acceptance and implementation. Senior executives are the most crucial actors in integrating Industry 4.0 and ensuring the circular economy's stability. Connections are critical parts of Industry 4.0 efforts since they contribute to developing the circular economy's evaluation criteria. If we examine industrial activities attentively, we will see that they continually inflict havoc on the environment. Adopting a circular economy strategy may assist businesses in optimizing resource utilization and minimizing waste output.

Industrial 4.0 technology may be used in conjunction with circular economy (CE) concepts to develop business models that reuse and recycle waste materials such as scrap metal or electronic trash. The conclusions of the study include a suggestion for a circular model for recycling outdated electronic equipment and integrating online reverse logistics, technology, and additive manufacturing to encourage environmental stewardship practices. In this respect, a favorable effect on the long-term viability of the business has been discovered via the reuse of trash in the supply chain to make items on demand.

The circular economy is a developing trend, and many firms are investigating proactive approaches to achieving sustainable development objectives. As the research demonstrates, the participants' collaborative interactions support the circular economy method. However, a shortage of study in lower-middle-income countries presents the particular hurdles businesses face when applying the circular economy idea and how these impediments could be overcome. The relationships between alliance capability and involvement, with data analysis skills serving as a moderating factor, the interaction between partnerships and technical analysis, and corporate sustainability flexibility, with industry volatility serving as a

moderating factor. The association between supply chain agility and environmentalism and accuracy on circular economy targets demonstrated that alliance ability is favorably and substantially influenced by engagement capacity.

On the other hand, data processing capacity is a somewhat mediating element. Second, it was shown that data analytics capabilities drastically affect the economy of adaptability of the distribution network, Although dynamism in the business has a minor influence. Finally, flexibility in the distribution chain is crucial for establishing a circular economy that promotes sustainability.

Manufacturing processes are wreaking havoc on the environment regularly. Adopting a circular economy strategy may assist businesses in optimizing resource allocation and reducing waste output. The intelligent model provides a supply chain and green financing to reinforce the system's structure. Circular economy techniques such as production chain planning, customer engagement, and management of human resources contribute significantly to a firm's circular economy performance. In circular economy supply chains, Supply chains powered by big data serve as a mediator of the link between human resource management and organizational effectiveness.

In all, 19 circular economy materials were prepared within a local network of small businesses and independent entrepreneurs linked by goods and by-product streams. Microenvironment management, environmental design, and investment recovery are three strategies. This strategy is most often used in product design. However, executions are often delayed and lack indications of prolonged and adequate activity, highlighting the embryonic line of the European Commission (EC) in the tissues studied. The category management technique is less practical, implying that environmental conditions are not considered when the company's strategic plan is developed.

To evaluate the areas of overlap, interrelatedness, and disagreements here between literary works on circular economic models (CE) and relevant literature on models and structures for quasi-manufacturing, include circular economy, reverse supply, shuttered production, manufacturing synergy, and green innovation, to demonstrate the elevated convergence in the findings, as well as the gaps and weaknesses in this literature. Adverse environmental, economic, and operational effects are not explored, and approaches for identifying research with empirically shown benefits are lacking.

Pollution prevention techniques may be a significant inducement for businesses to adopt circular economy principles. This indicates how ecological modernization may aid in creating either a circular economy. This data may assist in developing systems that promote circular and sustainability operations and prioritize social benefits. EMT themes, such as fostering an institutional environment supportive of proactive business behavior, may promote the implementation of circular economy strategies across various sectors.

DISCUSSION

Forests are harmed due to the world's fast population growth and industrialization, creating a high demand for environmental assets and obstructing a circular economy. On the other hand, forests may be seen as a critical resource for community sustainability, ensuring future generations' needs are met and promoting a circular economy (Stevic, Karamas, Demir, & Korucuk, 2021). The circular economy is touted as an ecologically friendly mode of growth. On the other hand, new research has revealed the concept's inadequacies in environmental protection (Giudice, Alice Mazzucchelli, & Fiano, 2020).

The forestry sector has been essential in Slovakia's transition to a circular economy, providing considerable opportunities for efficiency improvements and wood substitution for non-renewable resources. Additionally, the possibility of referring to environment management and rehabilitation is growing. On the other hand, expanding biomass applications may overcome other factors, such as biodiversity. These services' sustainability depends on a stable administration (Beckmann, Sivarajah, & Irani, 2021).

Numerous businesses include this concept in their promotion of sustainable development strategies to demonstrate the challenges and opportunities associated with sustainability (Marrucci, Daddi, & Iraldo, 2021). The managerial process cannot be formed based on already available theoretical knowledge. However, one practical approach is to examine how knowledge management might be used to support these concepts and sustainable management as a result (Jones & Wynn, 2018).

There are two significant areas of focus in manufacturing today: The circular economy and Industry 4.0. On the other hand, they are still in their early infancy regarding worldwide recognition and implementation (Sahu, Agrawal, & Kumar, 2021). The most crucial players in the integration of Industry 4.0 are those in leadership positions who can ensure CE's long-term viability. Advanced Industry 4.0's most critical components are innovations like the Internet of Things and computer crime systems that improve CE performance metrics (Chauhan, Sharma, & Singh, 2019). The environmental impact of industrial companies' daily operations cannot be overstated. Circular economies can reduce waste while increasing industry resource efficiency. Due to the digital transformation, manufacturing firms face a slew of new issues and possibilities. There hasn't been much research on how the introduction of Industry 4.0 technology affects green production (Stevic, Karamas, Demir, & Korucuk, 2021).

Circular Economy (CE) methods may be used in conjunction with Industry 4.0 technology to conceptualize business concepts that reuse and recycle waste resources like scrap metal and electronic trash. Reusing old electronic equipment, logistics, web innovations, and Additive Manufacturing (AM) is the outcome of this research. The findings suggest that returning trash entering the supply chain to produce things on demand has a beneficial effect on boosting corporate sustainability (Nascimento et al., 2018).

Many companies are beginning to look at the circular economy to take a proactive approach to achieve sustainable development goals. The literature shows that interactions between parties in the supply chain promote circular economy

strategies. A lack of research in lower-middle-income countries shows that firms encounter unique hurdles when applying circular economy principles and overcoming these issues. The researchers have asked for this study on the relationship between involvement and alliance abilities, data analytics skills, and the flexibility of sustainable supply chains, regarding the link between the distribution network management adaptability and circular economic objective accomplishment. According to dynamic capability theory, engagement capacity significantly impacts alliance capability.

On the other hand, analyzing data has a partial mediating role. While sector dynamism has little effect on supply chain flexibility, alliance capabilities, and data analysis skills substantially impact circular economy analysis results. As a final point, sustainable supply chain flexibility is critical to achieving circular economy goals and enhancing long-term viability (Bag & Rahman, 2021). In both rich and developing nations, efforts to implement a Circular Economy (CE) are now in progress (Hazen, Russo, Confente, & Pellathy, 2020). The environmental impact of industrial companies' daily operations cannot be overstated. It is possible to reduce waste generation and increase resource efficiency in enterprises by implementing a circular economy (Badhotiya, Avikal, Soni, & Sengar, 2021). Action mechanisms for a circular economy and green financing are included in the intelligent model to enhance system structure (Xiaofei, 2021). Circular economy practices in three domains, namely Distribution network design for the circular economy, procurement human capital management, and circular economy human resource management, all contribute significantly to boosting business performance from a circular economy perspective. Within the circular economy supply chains framework, distribution networks enabled by big data function as mediators of management and organizational performance (Beckmann, Sivarajah, & Irani, 2021).

Nineteen circular economy strategies were assessed in a geographical network of small companies and self-employed business people related to the usual commodities and output flows in the study area. These strategies include microenvironment management, environmental design, and green procurement. Product design is the most common use of this technique. As a result, the European Commission (EC) embryonic contours were visible in the observed network's implementation. As a result, the management category's approaches are less practical, suggesting that environmental concerns are not considered while establishing strategic firm plans (Silva, Shibao, Kruglianskas, & Barbieri, 2018).

According to this study, the importance of intelligent tourists and the circular economy cannot be overstated perspectives for navigating difficulty and guiding tourism businesses and locations toward a lasting, efficient entrepreneurial process (del Vecchio & Secundo, 2021). Tourism management innovation and the circularization of business models have practical implications for destination managers and creators. The latest findings are believed to help the development of a mindset of touristic governance. The engagement of local stakeholders in the growth of tourist destinations, as Krabi tourism stakeholders have done in establishing a green attitude and lifestyle wherein the value chain between participants is crucial for circulation (Pongsakornrungsilp & Pongsakornrungsilp, 2021).

Analytical elements, width and breadth of measures, and degrees of innovation suggest that social dimensions and environmental indicators are not fully integrated. There is a lack of hands-on involvement in most tales, and measurements are concentrated at the product level. Standards for measuring studies and methodologies and suggestions for future CE research are recommended here (Kuzma, Sehnem, & Jabbour, 2021). By examining potential research avenues in the circular economy nexus (CE) and sustainable business performance (SBP), digitization may significantly contribute to the creation of circular commodities that are sustainable (Ye, Deng, Yang, & Liang, 2021). Additionally, customers must develop innovative and sustainable digital circular products. To hasten the shift to CE and digitalization, it is advised that a product-service system is implemented (Agrawal, Wankhede, Kumar, Upadhyay, & Garza-Reyes, 2021).

According to Ünal, Urbinati, and Chiaroni (2018), the relevance of patent-related corporate innovation skills is highlighted to assist decision-making toward a circular economy (CE). Cooperation, perseverance in patents, or collaboration with research institutions drive patent waste rates to increase firm economic performance.

To illustrate the high level of integration in the literature on semi-product theories and approaches (including non-linear production models and frameworks such as industrial symbiosis and industrial ecology) and to identify the gaps in this literature. Research identifying strategies with experimentally proven benefits lacks environmental, economic, and operational ramifications are not examined. Non-linear manufacturing's business and social justifications are still based on theoretical research, modeling, and case studies. There is a lack of utilization of management theory despite its normative emphasis (Simone, Brust, & Pereira, 2019).

Policies to prevent pollution may be a powerful motivator for companies to adopt a circular economy approach. According to this article, a circular economy may benefit from the concepts of ecological modernization (Bag & Pretorius, 2020). With this knowledge, circular and sustainable processes and social commodities with the ineffective value might be designed. The ideas of EMT, such as the building of an institutional structure conducive to a proactive corporate environment, may support circular economy operations (Sehnem, Sousa Jabbour, Conceiço, Weber, & Julkovski, 2021). Because of the Paris climate accord, issues including cutting carbon emissions, green ecosystems, circular economies, and ensuring the formation of a long-term entrepreneurial environment have gained renewed traction. Several micros, small, and intermediate firms Since 2006, (SMEs) have adhered to waste quality management and are not receptive to innovative ideas. Organizations that adhere to waste management guidelines are expected to have a beneficial impact on the number of patents and intellectual assets they create, with significant and positive improvements (Lopes, Farinha, & Silva, 2021).

CONCLUSIONS

Forests play a role as a supporter and an indicator of the success of sustainable economic development in industrial revolution 4 and circular economics. Industry and environmental sustainability are at the center of the concept of circular economics. Circular financials play a significant role in addressing ecological improvements—pollution results from industrial activities that threaten the environment and must be recycled or minimized.

As a paradigm for economic growth that is both environmentally friendly, the circular economy is being pushed to go forward. The concept's shortcomings in environmental sustainability have been highlighted through research. Industry and circular economy 4.0 are now the two key focus areas. As a critical resource for community sustainability, forests can help meet the demands of future generations and promote a circular economy. Major statistics supply chains help control the relationship between circular economy and circular economy—management of human resources and circular economy performance of the supply chain.

Environmental management on an organizational stage, sustainable architecture, and green procurement are a few circular economy concepts often used in product development. Green finance and establishing an eco-system-friendly economy are the cornerstones of the European Commission's (EC) concept. Focused attention was brought back towards carbon reduction, green landscapes, the circular economy, and supporting sustainable business practices. Using the notion of ecological modernization shows how a circular economy might be developed. The adoption of circular economy methods across many industries may facilitate EMT themes such as promoting an institutional framework that supports proactive corporate conduct.

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