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Impact of innovation on the implementation of circular economy practices: evidence from firms in the Western Balkans

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The circular economy (CE) is becoming increasingly important to scholars and practitioners. To implement circular economy practices, businesses are using other strategies to nudge adoption of the CE model. Investing in innovation is one of them. Innovation is considered a driving force for implementing circular economy practices in business operations. This article aims to empirically investigate the impact of innovation on the implementation of circular economy practices in the Western Balkans. The results of the binary logistic regression show that innovation is a driving force of these circular economy practices, including using renewable energy, saving materials, minimizing waste, supply of greener materials, recycling by using materials or waste within the company, and designing products that are easier to maintain, use, or repair. However, innovation does not emerge as a significant predictor of selling residues and waste to another company.

Keywords: circular economy, innovation, logistic regression, Western Balkans

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Introduction

There is growing scholarly interest in the circular economy (CE), a transformative model that shifts away from the traditional *take-make-dispose* approach to one that emphasizes waste minimization and resource efficiency (Stahel 2016). The CE model is complex, requiring holistic collaboration among governments, businesses, and citizens to achieve its objectives (Kirchherr et al. 2023). Businesses occupy a central role in this triad, serving as critical actors in implementing strategies and initiatives that drive the transition to circularity. The relationship between the circular economy and business performance has been widely studied in developed countries, with research examining its potential to improve operational efficiency, environmental sustainability, and long-term profitability (Cauyan 2026, Liu et al. 2023, Magdalena et al. 2025). Scholars have also investigated the challenges and incentives that influence businesses to adopt

circular practices, highlighting barriers such as regulatory constraints, resource scarcity, and a lack of technical knowledge, alongside enablers such as supportive policies and innovation-driven strategies (Ignjatović et al. 2024). Among these enablers, innovation is a pivotal driver of the transition to circular business models. Innovations in technology, product design, and business processes can significantly enhance resource efficiency, reduce waste, and foster sustainability. To date, no empirical studies appear to have investigated the impact of innovation on CE practices in the Western Balkans, a region characterized by diverse economic landscapes and developmental challenges. Existing research in this region predominantly focuses on barriers to becoming circular (Kosta 2022). To address this gap, this research aims to empirically evaluate the impact of innovation in driving circular economy practices among businesses in the Western Balkans. Using a dataset of 1,200 firms from six Western Balkan economies, this study employs a binary logistic regression model to examine the extent to which innovation influences the adoption of key CE practices.

Based on the dynamic capabilities approach and the resource-based perspective, the study argues that the stronger a firm's innovation capabilities are, the better it can reallocate resources, integrate new technologies, and direct its operations toward sustainable goals. The theoretical approaches underline the contribution of intangible assets, such as technical know-how, collaborative networks, and knowledge, as drivers of the successful implementation of circular economy principles. With a focus on the Western Balkan region and its unique socio-economic environments, the study examines how innovation can bridge the institutional and infrastructural gaps that typically inhibit the adoption of circular strategies in emerging economies. This study contributes to the existing literature by examining various dimensions of circular economy practices and evaluating how innovation drives each practice. The literature previously tended to focus either on developed economies or on single sectors, whereas this study focuses on the six Western Balkan economies. The findings thus provide detailed insights into the differentiated link between circular economy practices. The study not only contributes to the theoretical debate surrounding innovation-led transitions towards sustainability but also provides practice-based knowledge for policymakers and managers looking to drive circularity into new environments.

The article is structured as follows. We provide a comprehensive review of relevant literature on CE practices and the role of innovation, and describe the research methodology. We present the empirical findings and conclude the article with managerial and policy implications, as well as recommendations for future research.

Literature Review

Circular Economy Practices

The Circular Economy is a modern economic approach that emphasizes resource efficiency, waste minimization, and the creation of closed material loops. Unlike the traditional *take-make-dispose* model, the Circular Economy demonstrates how economic growth can align with environmental sustainability (Sehnem et al. 2019). Its implementation takes diverse forms within business operations, referred to as Circular Economy practices. A key practice is adopting renewable energy sources such as solar, wind, and biomass, replacing fossil fuels with cleaner alternatives. This transition reduces carbon emissions and supports sustainable energy shifts (Korhonen et al. 2018). Further, renewable energy contributes to a critical principle of the Circular Economy: decoupling economic growth from environmental degradation (Dung et al. 2023). Another significant practice focuses on material conservation and waste reduction. By optimizing processes to reduce raw material use and eliminate waste, industries can save substantial resources. Practices like lean manufacturing and precision engineering enable these savings without compromising production standards (Stahel 2016). Additionally, prioritizing greener materials reduces reliance on virgin resources, supports biodiversity, and decreases harmful emissions (Geissdoerfer et al. 2018, Jayasiri & Wickramaarachchi 2024). To further embed circular principles, businesses often adopt industrial symbiosis, where one company's waste becomes another's resource. This collaboration

enhances resource efficiency and minimizes environmental impact by repurposing residues and waste into valuable inputs (Kimuli et al. 2023). Recycling is another critical practice at the organizational level. It allows companies to recover materials from waste streams through various strategies, decreasing reliance on virgin raw materials and reducing energy-intensive production processes (Mandpe et al. 2023). Finally, product design that facilitates maintenance, usage, and repair plays a vital role in circularity. Designing for extended product lifespans reduces resource consumption while making post-sale support and repairs more accessible (Bocken et al. 2016). This approach helps businesses minimize resource use while enhancing product utility and longevity (Moreno et al. 2016).

Impact of Innovation on the Adoption of Circular Economy Practices

Innovation is believed to be the driving force enabling firms to advance toward circular economy practices. Advancements in technology, operational strategies, and business model innovation help firms better prepare to address challenges such as resource efficiency, waste reduction, and sustainable product design. This literature review explores how innovation influences the adoption of CE practices while identifying the challenges and enabling factors of this transition. The first part of this section provides a general overview of the impact of innovation on the implementation of circular economy practices, and the second part discusses the current evidence of the relationship between certain circular economy practices and innovation.

Innovation lies at the core of CE transitions, providing firms with essential tools and frameworks to adopt sustainable practices. Technological advancements are crucial for CE adoption. Xiao et al. (2024) explain how leveraging renewable resources, supported by innovations in regional institutional structures, enhances CE implementation by reducing carbon emissions and promoting resource circularity. Additionally, integrating lean principles with green and digital technologies has proven effective in optimizing resource use and minimizing waste in biobased manufacturing processes. These cases illustrate how innovation serves as the foundation for reimagining production systems in line with circularity principles.

Shqairat et al. (2025) emphasize the importance of operational sustainability, research and development, and collaborative dynamics in achieving CE goals. Their study underscores that innovation not only enhances internal processes but also facilitates external partnerships, paving the way for systemic approaches to CE practices. Collaborative innovation ecosystems play a crucial role in addressing interdependent challenges like resource sharing and waste valorization. Business model innovation is closely tied to the successful implementation of CE practices. Bocken et al. (2016) propose strategies such as redesigning products for durability, repairability, and resource efficiency, which are critical to fostering circularity. These strategies align with CE objectives by slowing and closing resource cycles, reducing material inputs, and extending product lifespans. Konietzko et al. (2020) extend this perspective by highlighting the role of innovation ecosystems in circular business models. They identify three key principles: collaboration, which fosters co-creation with stakeholders; experimentation, which encourages trial-and-error approaches to enhance circularity; and platform development, which facilitates resource-sharing and supply chain optimization.

Chizaryfard et al. (2023) address the challenges of closed-loop supply chain configurations, emphasizing the need for collaborative development of technologies, product designs, and infrastructure. Their findings highlight the importance of long-term partnerships among supply chain actors to tackle complexities and build resilience. While innovation is widely acknowledged as a driver of CE practices, research in this field remains fragmented. Konietzko et al. (2020) argue that existing studies often focus on isolated aspects, such as technological or business model innovations, without considering their interdependencies. Conversely, Halim-Lim et al. (2024) advocate a holistic approach integrating lean, green, and digital technologies to foster a comprehensive transition to circular practices.

Theory

This study is grounded in the Resource-Based View (RBV) of the firm, which emphasizes that a company's ability to achieve competitive advantage lies in the strategic management of its internal resources (Barney 1991). According to RBV, resources that are valuable, rare, inimitable, and non-substitutable are central to sustaining firm performance. Innovation is considered one such strategic resource, enabling firms to develop unique capabilities that improve operational efficiency, product quality, and environmental performance. In the context of the circular economy, firms with stronger innovation capabilities are more likely to identify opportunities for resource efficiency and to invest in solutions that align with circular principles. RBV suggests that such firms are better positioned to integrate circular economy practices not simply as environmental compliance measures, but as a means to build long-term strategic advantage through differentiation, cost savings, and sustainability-oriented value creation.

Based on the literature review, Figure 1 depicts the conceptual framework used in this study for the hypotheses development.

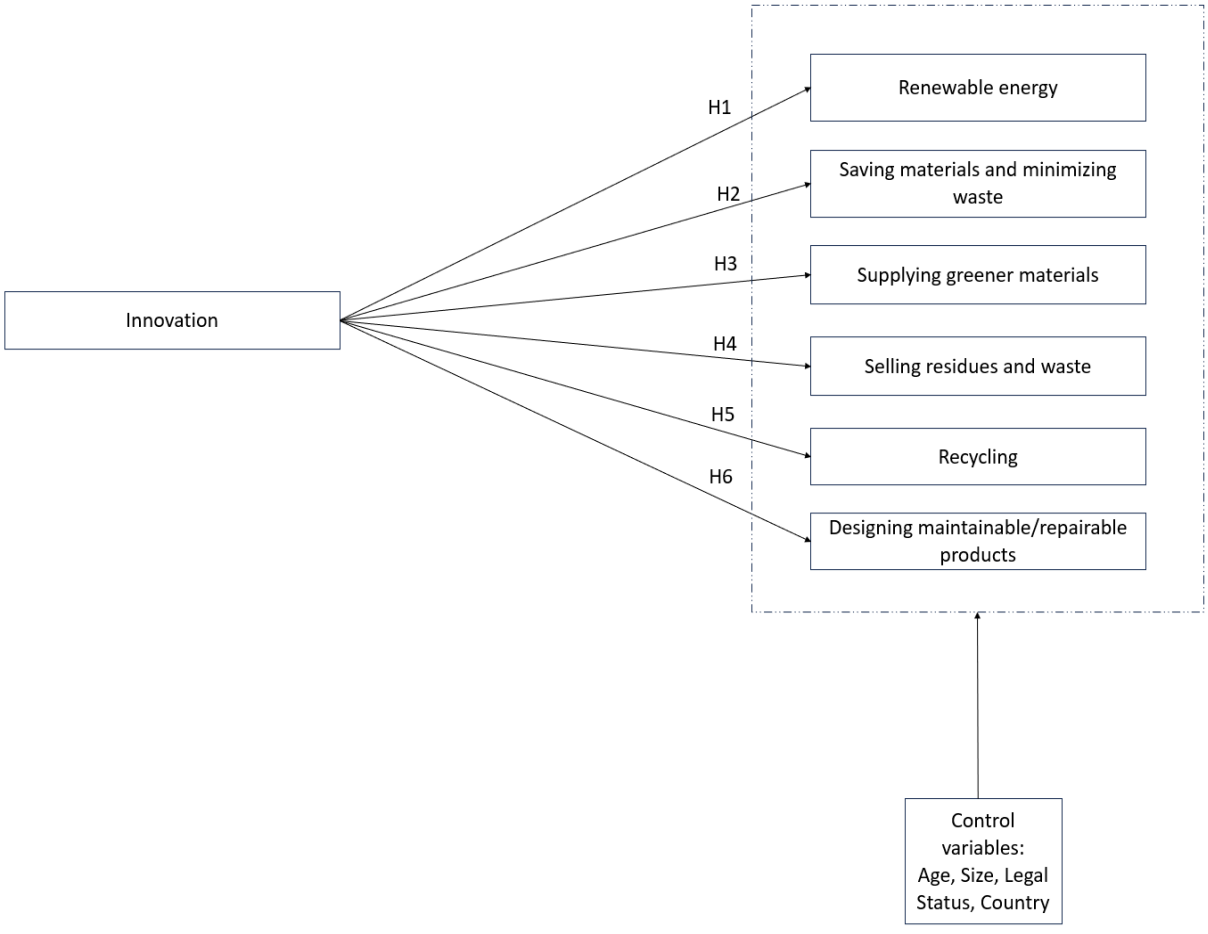

Figure 1: Conceptual Framework
Source: the authors

Hypotheses Development

Firms that engage in innovation activities are typically characterized by organizational flexibility and technological foresight, enabling them to invest in renewable energy systems (Khan et al. 2022). Through investment in research and development, they can explore sophisticated energy solutions, reduce dependence on fossil fuels, and embrace new processes or equipment (Palage et al. 2019). A systematic literature review of 27 studies found that firm-level innovation is a key driver of renewable energy adoption, alongside governance and regulation (Capozza et al. 2021). Another study that used the PMG-ARDL method found that a 1% increase in technological innovation leads to a .33% increase in long-term renewable energy use and a .17% increase in short-term renewable energy use, confirming a strong positive link between innovation and renewable energy adoption (Han et al. 2025). Therefore, the following hypothesis is developed.

H1. Firms that engage in innovation activities are more likely to use renewable energy sources in their operations predominantly.

Firms that prioritize innovation frequently possess both the resources and the mindset to explore new, more efficient production processes and material flows (Bataineh et al. 2024). This innovation-oriented approach enables them to identify and implement cutting-edge technologies, lean manufacturing techniques, and advanced process improvements that reduce or repurpose waste. From a resource-based view, innovation strengthens a firm's strategic capabilities, enabling it to differentiate through sustainable cost savings and improved environmental performance competitively (Martin-Rios et al. 2018). This capacity for constant adaptation and reinvention drives a stronger commitment to waste minimization and material savings (Ar 2012). Studies confirm that technological innovations aimed at reducing environmental impact are significantly negatively associated with total waste generation, including both hazardous and non-hazardous waste. Importantly, higher eco-innovation levels were linked to both lower waste output and increased recycling practices (Ameer et al. 2025). Based on that, the following hypothesis is developed.

H2. Firms that engage in innovation activities are more likely to implement measures to conserve materials and minimize waste.

Firms that actively engage in innovation initiatives generally demonstrate a greater capacity to explore and adopt novel materials and production methods (Habib et al. 2021). These organizations often discover alternative inputs that are both eco-friendly and technically feasible, thus enabling them to reduce their environmental impact. This innovation-driven mindset fosters collaborative networks and knowledge sharing with suppliers, thereby expanding the firm's access to emerging material solutions. A study of eco-friendly firms in the US finds that companies developing green products often adopt greener production technologies and materials to meet regulatory standards and align with evolving market expectations (Fusillo et al. 2025). In addition, a Brazilian agribusiness study demonstrates that organizational and resource capabilities, fostered by eco-innovation, enable firms to explore alternative, eco-friendly inputs, supporting greener material sourcing (Barriga Medina et al. 2022). Based on that, the following hypothesis is developed.

H3. Firms that engage in innovation activities are more likely to source greener materials for production.

Firms that prioritize innovation often develop new capabilities and collaborative networks, making them more adept at identifying and capitalizing on waste streams (Albitar et al. 2024). Consequently, they become more aware of the potential market value of residues and by-products, as well as the technological pathways for repurposing them. From a resource-based perspective, the ability to transform what might be considered waste into a salable input reflects a firm's strategic adaptability and capacity to reconfigure its operations (Liu et al. 2025). Hence, innovative enterprises are better positioned to explore partnerships or market platforms to sell residues and waste to other companies. A systematic literature review reveals that firms implementing technological innovations and smart solutions in waste handling can transform residues into marketable resources (Farooq et al. 2022). Based on that, the following hypothesis is developed.

H4. Firms that engage in innovation activities are more likely to sell residues and waste to other companies.

Firms that engage in innovative activities frequently develop the requisite capabilities and technological know-how to identify and exploit opportunities for internal recycling systematically (Galanou & Farrag 2025, Li et al. 2022). This innovation-driven approach can involve cross-functional collaboration, such as between R&D, production, and supply chain teams, to integrate updated processes that reduce reliance on virgin materials and shrink environmental footprints. A sample-based study of G7 companies finds that higher levels of eco-innovation are strongly associated with increased internal waste reuse and recycling, as well as reduced total waste generation (Albitar et al. 2024). Based on that, the following hypothesis is developed.

H5. Firms that engage in innovation activities are more likely to recycle by reusing materials or waste within the company.

Business organizations that invest in R&D have the motivation and resources to develop enhancements to their products, making them usable, maintainable, and fixable (Castro-Lopez et al. 2025, Zikopoulos 2022). Investment in research and development exposes them to new technologies, design procedures, and consumer opinions, helping them identify pain points in product use and eliminate them through iterative refinements (Schreier et al. 2012). Moreover, innovative organizations tend to have cultures of ongoing experimentation and learning, which help improve the testing of new ideas and product designs. Therefore, their products are not only more technologically advanced but also more use-oriented in design, with usability and ease of maintenance in mind. A study conducted in the smartphone industry found that modular eco-design significantly enhances users' ability to repair and maintain products independently. It showed that when firms adopt service-driven, sustainable design principles, the resulting products are both maintenance-friendly and user-oriented (Amend et al. 2022). From that, the following hypothesis is derived.

H6. Firms that engage in innovation activities are more likely to design products that are easier to maintain, use, or repair.

Methodology

This article relies on data collected from the 2024 Business Opinion Balkan Barometer survey, conducted between March and April 2024 in Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia, with financial backing from the Regional Cooperation Council (RCC). The RCC initially drafted the questionnaire in English, which was then translated into the respective local languages. A team of experienced interviewers surveyed all six Western Balkan economies. Using the Computer-

Assisted Personal Interviewing (CAPI) methodology, the questionnaires were digitized and uploaded to laptops or tablets for interviewers. To achieve a representative sample across the Western Balkans, the selection of companies was carefully planned. Firms were randomly chosen and stratified by region, sector, firm size, and ownership type to ensure proper representation of the various business sectors. The sampling frame for these surveys relied on official lists from statistical offices in each Western Balkan economy, which were regarded as the most reliable sources for the random sample. In total, 1,200 businesses were interviewed, with 200 surveys conducted in each economy. To ensure the validity of the findings, the RCC considered potential non-response bias during the survey's design and implementation. Despite the randomized and stratified sampling approach, non-response bias remains a potential limitation if the characteristics of non-responding firms differ systematically from those of participating firms. The structured sampling strategy, stratified by region, sector, firm size, and ownership type, was intended to mitigate such bias by ensuring diversity and balance across key business demographics.

Analyses

Dependent variables: This study employs binary logistic regression models to examine the impact of innovation on circular economy practices. The dependent variable is a binary (dummy) variable, assigned a value of 1 if the company has adopted any of the following circular economy principles in response to the question, "What steps has your business taken over the last 12 months to reduce its environmental impact?": (i) predominantly using renewable energy, (ii) saving materials and minimizing waste, (iii) sourcing greener materials, (iv) selling residues and waste to other companies, (v) recycling by reusing materials or waste within the company, and (vi) designing products that are easier to maintain, use, or repair. If the company has not undertaken the specific practice, the variable takes the value 0.

Independent variables: Innovation is defined as a dichotomous variable, determined by the question: "Did your company introduce any new or improved products/services during the last year?" If the response was yes, it was coded as 1; otherwise, it was coded as 0.

Control variables: Firm Age: The number of years the firm has been operating in the market. It serves as a continuous measure of the company's experience, which may influence its adoption of circular economy practices. Due to the lack of normal distribution, a logarithmic transformation of this variable was applied. Older firms often possess well-established operational routines, a loyal customer base, and entrenched organizational structures. Even though older companies might have greater financial resources, their ingrained systems and practices can slow the pace of circular transformation (Kanda et al. 2024).

Company Size: A categorical variable representing the company size based on the number of employees, coded as follows: 1=Micro company (up to 9 employees), 2=Small company (10–49 employees), 3=Medium-sized company (50–249 employees), and 4=Large company (more than 250 employees). Firm size is an important determinant in the adoption of circular economy activities. Larger firms generally possess greater financial, technological, and human resources, which can be allocated toward R&D, product redesign, and specialized equipment, key components for transitioning to more circular processes. By contrast, smaller firms may lack sufficient capital and technical expertise, making it challenging to invest in advanced environmental management systems or collaborative initiatives. Consequently, research consistently indicates that larger firms are more likely to adopt circular economy principles than their smaller counterparts (Takacs et al. 2022).

Country of Operation: This categorical variable identifies the country where the company is based. The coding is: 1=Albania, 2=Bosnia and Herzegovina, 3=Kosovo, 4=Montenegro, 5=North Macedonia, and 6=Serbia.

Legal Form: A categorical variable representing the company's legal structure, which may affect its decision-making processes and flexibility in adopting circular economy practices. The coding is: 1=Sole

proprietorship, 2=Limited liability company, and 3=Joint stock company. Companies registered as joint-stock or limited-liability entities typically have more formal governance structures and greater access to capital, enabling them to invest in technologies and processes that support circular practices.

Results

The results from the six binary logistic regression models (1–3, 5, 6) in Table 1 confirm that innovation significantly increases the likelihood of adopting most circular economy practices across firms in the Western Balkans. Innovation shows a strong and statistically significant effect on the use of renewable energy (*B*=.63, *p*=.00, Model 1), saving materials and minimizing waste (*B*=.36, *p*=.00, Model 2), sourcing greener materials (*B*=.75, *p*=.00, Model 3), internal recycling (*B*=.62, *p*=.00, Model 5), and designing maintainable products (*B*=.53, *p*=.02, Model 6), However, it is not a significant predictor (*B*=.22, *p*=.23, Model 4) of selling residues and waste to other companies.

Table 1. Results of Binary Logistic Regression

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
	B	*B*	*B*	*B*	*B*	*B*
Innovation	.63***	.36***	.75***	.22	.62***	.53**
Age (log)	.25*	.12	-.23*	.13	.02	-.34**
Size (RC: Large)						
Micro (2-9 employees)	-.64	-.08	.19	-.60	-.82*	.29
Small (10-49 employees)	-.26	.01	.54	-.06	-.88**	.52
Medium (50-249 employees)	.04	.22	.38	.12	-.52	.59
Legal status (RC: Joint stock)						
Physical person	-.59	-.31	.10	-1.44**	-.14	-.15
Limited liability	-.63*	.14	.19	-.79**	.30	.04
Country (RC: Serbia)						
Albania	.70**	.88***	1.29***	-.18	-.48*	.26
BiH	-.19	.43*	1.04***	.03	-.94***	.08
Kosovo	.75**	.61***	1.67***	-.56*	-.22	-.40
Montenegro	1.0***	-.62**	-.61	-1.26***	-.90***	.84**
North Macedonia	.25	.52**	-.03	-.56*	-.42	.82*
Constant	-2.24***	-1.62***	-2.71***	-.86	-1.14*	-2.72**
N	1200	1200	1200	1200	1200	1200
The Nagelkerke R^2	.09	.07	.18	.08	.06	.05

Standard errors in parentheses: ***p< 0.01, **p<0.05, *p<0.1

Authors' calculations from the Balkan Barometer 2024 Business Opinion

Country-level differences are notable. Albanian firms are significantly (*B*=.7, *p*=.02, Model 1; *B*=.88, *p*=.00, Model 2; *B*=1.29, *p*=.00, Model 3) more likely than Serbian firms to adopt three out of the six practices, while firms in Montenegro (*B*=-.61, *p*=.01, model 2; *B*=-1.26, *p*=.00, Model 4; *B*=-.90, *p*=.00, Model 5) are negatively associated with the likelihood to implement saving materials and minimizing waste, selling residues and waste to another company and recycling by using materials or waste from within the company. Likewise, firms in Kosovo (*B*=-.56, *p*=.05, Model 4) are negatively associated with the likelihood of implementing the practice of selling residues and waste to another company. Firm age has mixed effects. Older firms are more likely to use renewable energy (*B*=.25, *p*=.06, Model 1). However, older firms

are negatively associated with the likelihood of supplying greener materials (*B*=-.23; *p*=.05, Model 3) and with designing products that are easier to maintain, use, or repair (*B*=-.34, *p*=.02, Model 6).

Smaller firms, especially micro and small enterprises, are less likely to engage in internal recycling. The models explain between 5% and 18% of the variance in the adoption of CE practices, with the strongest (Nagelkerke R^2=.18, Model 3) explanatory power observed for greener material sourcing.

Table 2 Summary of Results

	Hypotheses	*Model*	*B/p*	*Status*
H1	Firms that engage in innovation activities are more likely to use renewable energy sources in their operations predominantly.	1	.63/.00	Accepted
H2	Firms that engage in innovation activities are more likely to implement measures to conserve materials and minimize waste.	2	.36/.00	Accepted
H3	*Firms that engage in innovation activities are more likely to source greener materials for production*.	3	.75/.00	Accepted
H4	Firms that engage in innovation activities are more likely to sell residues and waste to other companies.	4	.22/.23	Rejected
H5	*Firms that engage in innovation activities are more likely to recycle by reusing materials or waste within the company*.	5	.62/.00	Accepted
H6	Firms that engage in innovation activities are more likely to design products that are easier to maintain, use, or repair.	6	.53/.02	Accepted

Discussion

This research aimed to explore the influence of innovation on the likelihood that businesses in the Western Balkans implement circular economy practices, using data from firms and binary logistic regression. The results of this study in Table 2 reveal a clear and consistent relationship between innovation and the adoption of several key circular economy practices among firms in the Western Balkans. Specifically, innovation is positively associated with practices such as integrating renewable energy, improving resource efficiency, incorporating sustainable materials into production, recycling within business operations, and designing products that are easier to repair and maintain. These findings suggest that firms that invest in innovation, whether technological, process-based, or organizational, are better positioned to transition from linear to circular business models.

However, not all circular practices appear to benefit equally from innovation. The lack of a strong correlation between innovation and the practice of selling residues or waste to other firms may indicate structural or market-based barriers. This activity may be more dependent on external logistics, infrastructure availability, or existing networks for waste exchange rather than internal innovation capacity. It may also point to a lack of mature secondary markets in the region for industrial by-products or residual materials.

Conclusion

This study examined how innovation influences the adoption of circular economy practices among firms in the Western Balkans, using binary logistic regression analysis. The findings reveal that innovation significantly increases the likelihood of implementing practices such as renewable energy use, waste minimization, sustainable material adoption, internal recycling, and product design for reparability. However, innovation had a limited impact on inter-firm resource exchange, such as the sale of residues or waste. These insights highlight the critical role of innovation in advancing sustainability and suggest that

both firms and policymakers should prioritize innovation-driven strategies to accelerate circular transitions across the region.

Policy and Managerial Implications

This research has some important managerial and policy implications. Regarding policy implications, policymakers can make an important contribution by providing incentives and financing for sustainable businesses, such as grants, tax credits, or low-interest loans, to reduce the upfront cost of CE investments. This is particularly important for small businesses that lack sufficient resources to undertake large-scale sustainability initiatives. Further, encouraging collaborative networks through innovation clusters, industrial symbiosis, or knowledge-sharing platforms can facilitate the sharing of best practices and market-based transactions in recycled or reused materials. Finally, harmonized regulations and standards across regions can minimize uncertainty and administrative hurdles, thereby facilitating greater participation in CE activities. Standardized regulatory frameworks not only encourage cross-border collaboration but also position the region better to attract greener investment inflows.

Regarding managerial implications, businesses that wish to augment their circular economy efforts must invest in strategic innovation, budget for research and development, renew technologies, and train personnel. Supporting an experimental culture will lead to process or product innovations better aligned with environmental sustainability. Managers also have to adapt to the size and age of the companies they manage. Larger firms can leverage economies of scale to adopt end-to-end CE strategies, whereas younger or smaller firms can leverage agility, lean operations, and flexibility to transition to sustainable practices.

Limitations and Future Research

This research, although providing valuable insights, has some limitations. The cross-sectional nature constrains the ability to make causal inferences about changes in CE adoption over time. Furthermore, regional data aggregation across six Western Balkan economies could neglect specific country-level circumstances; for example, various policy settings or cultural particularities. Another drawback is the potential self-reporting bias, as firm representatives may involuntarily overestimate their environmental behavior. Lastly, sectoral heterogeneity would mean that drivers and obstacles to adoption can differ significantly across industries, yet the data were analyzed in aggregate. Based on these findings, future studies can incorporate longitudinal designs to examine how circular firm practices evolve and adapt over time in response to evolving regulations or technological advances. Nation-specific studies would provide greater depth of knowledge about local policy, culture, and industry structure to inform targeted recommendations. Researchers might also review sector-specific research, highlighting the particular challenges and opportunities for manufacturing, services, and other industries. Finally, broadening the conceptualization of innovation to include process, organizational, and marketing innovation would capture a fuller picture of how firms facilitate CE adoption.

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