Contemporary Management Research
Pages 99-125, Vol. 21, No. 2, 2025
doi: 10.7903/cmr.24033

Transformative Paths to Economic Growth Through Circular Supply Chain Enablers and Environmental Initiatives - A Structural Equation Modeling Perspective

Fatima Zahra Fatih
Universitas Islam Internasional Indonesia
E-Mail: fatima.zahra@uiii.ac.id

Sadia Abbassy
Universitas Islam Internasional Indonesia
E-Mail: sadia.abbassy@uiii.ac.id

Fajar B. Hirawan
Universitas Islam Internasional Indonesia
E-Mail: fajar.hirawan@uiii.ac.id

ABSTRACT

This paper develops a model to explore the relationships between Circular Supply Chain Enablers, Environmental Sustainability Initiatives, and Economic Growth. We theoretically justified certain observed variables from previous literature for each latent factor consideration in our model. This study, which utilized data collected from 194 firms in Morocco’s textile industry, employed structural equation modeling (SEM) to test the model developed in SmartPLS. The findings suggest that companies adopting circular supply chain enablers and environmental sustainability initiatives experience real benefits in terms of economic growth within their organizations. The findings from the SEM analysis provide a solid foundation for academics and practitioners, offering valuable contextualization that highlights how the strategic integration of enablers for the circular supply chain and environmental sustainability initiatives can help companies meet their environmental responsibilities and achieve sustained economic success. This opens up opportunities for the reinvention of corporate strategies that integrate the relationships between circular economy practices, ecological sustainability, and financial performance into a business model as a key objective.

Keywords: Circular supply chain, Economic growth, Sustainability initiatives, Textile industry, Structural equation modelling

INTRODUCTION

Circular Economy and Supply Chain Management: Concepts and Practices

Rapid economic development is often accompanied by increased material/energy consumption, as well as environmental pollution. Therefore, with growing awareness of ecological problems, scholars have begun to consider decoupling economic development from both consumption and pollution by promoting a circular economy (Chen et al., 2020).

The circular economy is a restorative and regenerative system (Charonis, 2021). It focuses on applying three pillars: the first one is the recovery of any waste throughout the value chain before it goes to landfill or other waste disposal method; the second one is efficiency to optimize energy and materials and thus maximize production output while minimizing inputs and pollutant discharge to the environment, third one is the valorization of waste to be re-economized for further social benefit (Wang et al., 2018).

As environmental concerns intensify, there is a common understanding that current supply chain models are unsustainable (Fatih & Hirawan, 2024). Therefore, the circular economy has garnered increasing attention from businesses, policymakers, and academics in recent years to enhance supply chain efficiency (Dev et al., 2019; Stewart & Niero, 2018). The integration of the circular economy and supply chain management is known as circular supply chain management (CSCM), which provides a transformational solution to the complex interplay between market demand and consumer behavior (Zhang et al., 2021).

The circular supply chain framework functions through the coordination of a networked chain with interdependent activities, players, and resources (González-Sánchez et al., 2020). Its main objective is to create value by strategically implementing recycling, reuse, and regeneration processes throughout the life cycle (Nag et al., 2021). CSCM enables enterprises to act proactively in achieving their sustainability goals. Therefore, this strategy allows organizations to simultaneously reduce environmental impact, minimize waste, emissions, and resource consumption throughout the supply chain design, while also contributing to a more sustainable future (V. K. Jain et al., 2025; Montag, 2022). This integrated strategy promotes a more resource- and environmentally conscious supply chain by aligning perfectly with the tenets of the circular economy.

Circular Supply Chain Enablers (CSCEs) are essential elements due to their assistance and enabling effect on implementing the principles of the circular economy (CE) in supply chain activities. Circular practices remain a significant challenge for most organizations (Lieder & Rashid, 2015). Nevertheless, its successful application can also be contingent on the availability of specific enabling drivers, which can collectively ensure the transition to circularity (Sharma & Bhat, 2016). Such enablers are crucial in circumventing these impediments and making circularity strategies an integral part of the entire supply chain.

Environmental Sustainability: Principles and Approaches

Sustainability is generally considered a development that meets the needs of current generations without limiting the ability of future generations to satisfy their own needs (Keeble, 1988). This idea emphasizes the importance of giving equal consideration to economic, social, and environmental concerns in development processes. Sustainable development builds upon this notion, making it a process of ongoing societal development that occurs responsibly, combining economic activity with social justice and environmental safeguards (Glavič & Lukman, 2007). In this large context, environmental sustainability focuses more on maintaining the health and resilience of natural ecosystems. According to Goodland (1995), the definition of environmental sustainability can be understood as the use of natural resources and assimilation of waste materials in a manner that allows economic activities to remain within the Earth's regenerative capacity. Accordingly, environmental sustainability can be considered one of the pillars of sustainable development, which is necessary to ensure the sustainability of ecosystem services related to the well-being of current and future generations (Morelli, 2011).

The circular economy focuses on environmental sustainability, providing instruments to redesign consumption and production processes that exclude linear patterns. Nonetheless, being a micro-level, bottom-up strategy, it is much narrower and operational in nature (Sauvé et al., 2015). Although it can have positive environmental impacts, it does not necessarily align with the broader ecological vision and goals of environmental sustainability (Bartelmus, 2013). Additionally, the connection between the two is conceptually ambiguous, with environmental sustainability being strategic in setting its aims but vague in outlining the specific implementation mechanisms, and the circular economy being specific in providing strategies to act but indistinct in its goal. Hence, our study's framework needs to incorporate environmental sustainability initiatives with circular supply chain enablers to effectively establish an overall framework that maintains a connection between practical actions informed by overarching goals of eco-friendly activities.

Environmental sustainability initiatives, in this context, are tangible undertakings practiced in all operations of a supply chain to curb ecological degradation and preserve the regeneration capacity of natural systems. The measures related to such initiatives are generally aimed at reducing gas emissions (Setiawan & Iswati, 2019), minimizing waste (Esposito et al., 2015), decreasing the use of virgin input materials (Patricio et al., 2018), and reducing the use of hazardous/toxic materials (Parvin et al., 2020). Although the circular supply chain enablers, like cleaner production (Sousa-Zomer et al., 2017), reverse logistics infrastructure (Scavarda et al., 2018), and circular supply chain design (Ripanti & Tjahjono, 2019), develop the structural and functional settings of circularity, environmental sustainability initiatives are required to ensure that the approach directly addresses and tracks ecological effects. They establish specific measures that strengthen environmental responsibility and facilitate conformity with the environmental standards of performance. Incorporating these initiatives into the framework also allows one to avoid the situation where ecological priorities are considered secondary outcomes, but rather as direct goals being pursued alongside the circular initiatives.

Economic Growth: Foundations and Indicators

Economic growth has emerged as the ultimate objective of governments worldwide, considered an indicator of good progress and stability. It is generally measured through the growth of the Gross Domestic Product (GDP), which is the increase each year in the total value of goods and services produced in a Country. The focus on economic growth as a central goal of policymaking gained widespread use in the mid-20th century, particularly after World War II, when countries began to systematize the means of measuring and maximizing economic performance (Goodwin et al., 2014).

Economic growth is also a crucial undertaking in industrial development and labor markets. A prolonged period of GDP growth can lead to structural changes in economic affairs, including industrialization, expansion of the job market, and infrastructure improvement. In areas with high unemployment rates, economic expansion can help reduce unemployment rates by increasing labor demand in industries (Horbach & Rammer, 2019). Although the evolutions in labor productivity during economic expansions in the past have occasionally produced uneven employment patterns, some of these shifts have led to a broad-based improvement in the national and local employment situations.

Economic growth at the business level fosters an environment that attracts firms to research, innovation, and increased productivity. These investments enable companies to be more competitive in responding to emerging market conditions (Flachenecker & Kornejew, 2018). Although large companies can cover the expenses associated with innovation, small and medium-sized businesses often struggle due to their limited financial resources (Antonioli et al., 2022). However, good economic conditions often lead to higher investor confidence, which motivates equity holders to invest in companies with effective resource management and business turnarounds (Demirel & Danisman, 2019; Horbach & Rammer, 2019).

Finally, consumer behavior is influenced by economic growth, which increases demand and, consequently, income levels. This diversion promotes the efficiency of firms in maximizing their production processes to reach further markets and sustain a competitive advantage (Esposito et al., 2015). In this sense, economic growth is seen as a driver of both large-scale transformation and individual company strategic decisions that lead to economic development.

From Circularity and Environmental Sustainability Initiatives to Economic Growth

The circular economy (CE), which has been proposed as a model for sustainable industrial development, is widely accepted globally (Bakker et al., 2014). It has been recognized as a solution to balancing the goals of economic development with environmental sustainability by addressing the shortcomings of the linear economy, characterized by the 'take, make, use, then dispose' approach (Lieder & Rashid, 2015). As a supporter of CE, the restorative economy model (Blomsma & Brennan, 2017) emphasizes the importance of restoring natural capital and ecosystems, while promoting environmental sustainability through economic activities (Stahel, 2016). Also, Natural Capital Accounting (NCA) incorporates the cost of natural resources and ecosystem services into economic considerations. It helps businesses understand the actual costs of depleted resources and waste, which is likely to lead to the circular practice of product lifetime extension and material recovery (James et al., 2018; Kosoy & Corbera, 2009; Spash, 2013).

A combination of these approaches can help achieve the harmony between economic growth and environmental health, creating a long-term level of resilience. Despite the existing problems associated with the implementation of restorative practices and their evaluation to measure the impact (Korhonen et al., 2017), the given approach is essential as economic development has traditionally promoted produced and intangible capital at the expense of natural capital, which has been depleted and has impacted the environment adversely (Jorgenson & Dietz, 2014). Therefore, initiatives related to advancing circularity and restoring natural resources are crucial to achieving sustainable economic growth.

Recent theoretical studies have explored the correlation between economic development and environmental sustainability within the framework of the circular economy, suggesting that economic development may conflict with the enhancement or conservation of environmental quality. However, Donaghy (2021) demonstrates how, by considering circular and cumulative causation (CCC) processes, a circular market economy can be created to achieve both economic and environmental objectives.

Theoretical discussions and analyses conducted across countries and economies have supported the idea that circular economy and environmental sustainability solutions can have the capacity to balance economic growth. However, empirical research on such methodologies is limited to either macroeconomic or regional effects. Indicatively, Propensity Score Matching and Difference-in-Differences methods were employed to examine the impact of implementing circular economy policies on the local economic development of pilot cities in China (Chen et al., 2020). Similarly, papers on sustainable supply chains highlight limitations to implementing a circular model (Fatih & Hirawan, 2024), and studies on the indicators of a circular economy in the European Union reveal strong correlations between the scope of circularity and GDP growth (Radivojević et al., 2024). Nevertheless, these studies do not pay much attention to the microeconomic level, more specifically, the use of Circular supply chain enablers and environmental sustainability initiatives at the industry level. Additionally, there is an evident lack of comprehension of how these factors translate on the local level of a country, as seen in the case of Morocco and its textile industry, where the implementation of circular supply chains presents both individual challenges and opportunities.

To fill this gap, the present study employs structural equation modeling (SEM) to investigate the relationship between circular supply chain enablers and environmental sustainability initiatives, as latent constructs measured through various indicators, and economic growth in the Moroccan textile industry. Structural equation modeling is suitable for the present analysis due to its ability to model complex relationships by evaluating the relationships between indicators and latent constructs, while also providing estimates of directional effects among constructs. To establish a comprehensive conceptual framework, Table 1 presents all three key latent variables and their corresponding observable indicators. The paper contributes to a better understanding of the factors influencing the economic growth of the textile industry in Morocco through this rigorous methodological approach, providing valuable insights at both theoretical and policy levels.

Table 1 *Latent and Observable Variables Extracted from the Literature Review.*

Latent variables	Conceptual meaning in the study	Observable variables		Sources
Circular Supply Chain Enablers (CSCE)	The organizational capabilities, processes, and resources that can help firms implement the circular economy within their supply chain	CSCE 1	Circular supply chain design	(Bassi & Dias, 2020; Brown & Bajada, 2018; Pagoropoulos et al., 2017; Ripanti & Tjahjono, 2019;)
		CSCE 2	Cleaner production	(Ghisellini et al., 2015; Sousa-Zomer et al., 2017; Veleva et al., 2017)
		CSCE 3	Reverse logistics infrastructure	(Dhakal et al., 2016; S. Jain et al., 2018; Scavarda et al., 2018)
		CSCE 4	Circular Economy Relationship Management	(Genovese et al., 2015; Ripanti & Tjahjono, 2019)
		CSCE 5	Circular economy Human resources management	(Duff, 2018; Jabbour et al., 2017; Nejati et al., 2017)
		CSCE 6	Technological sustainability integration	(Abideen et al., 2021; De Giovanni, 2018; Prencipe et al., 2021)
Environmental Sustainability Initiatives(ESI)	The company's efforts and activities aimed at reducing environmental impact and adopting a sustainable mode of resource utilization	ESI 1	Reducing gas emissions	(Rahman et al., 2017; Setiawan & Iswati, 2019)
		ESI 2	Minimizing waste	(Esposito et al., 2015)
		ESI 3	Minimizing the use of virgin input material	(Patricio et al., 2018)
		ESI 4	Reducing the use of hazardous/toxic materials	(Parvin et al., 2020; Shaw et al., 2010)
Economic Growth (EG)	A multidimensional representation of the textile industry's economic advancement, shaped by key sectoral improvements that indicate enhanced performance, competitiveness, and contribution to the national economy	EG 1	Employment	(Mitchell & James, 2015)
		EG 2	Research and development	(Flachenecker & Kornejew, 2018)
		EG 3	Sales growth	(Horbach & Rammer, 2019)
		EG 4	Market expansion	(Mitchell & James, 2015)
		EG 5	GDP	(Hickel & Kallis, 2019)

Source: Collected from a comprehensive review of the literature conducted by the authors.

RESEARCH METHODOLOGY

Based on SEM analysis, the tenets of Circular Supply Chain Enablers (CSCE), Environmental Sustainability Initiatives (ESI), and Economic Growth (EG) were developed for the Moroccan textile industry. This study aims to fill the existing gap in the literature by investigating CSCE and ESI within Morocco’s textile industry, which is relatively unexplored and features a dynamic and changing circularity state, as well as unique environmental conditions. Therefore, by focusing on these factors, this research aims to address a gap in the existing literature that seeks to explain the extent to which circular supply chain enablers and environmental sustainability initiatives impact economic growth in Morocco’s textile industry. SEM enables the inclusion of indices for observable variables, which correspond to latent constructs, making it possible to assess hypotheses based on empirical facts within a coherent framework of how different variables may be related.

Structural Equation Modelling

SEM is one of the most potent and advanced statistical tools researchers have today. It provides them with a whole apparatus for testing, adjusting, or rejecting theoretical models (Anderson & Gerbing, 1988). It merges the confirmatory factor analysis with multiple regression (simultaneous equations models) in a single modeling architecture (Ko & Stewart, 2002). In addition to many endogenous and exogenous variables, SEM can provide latent (unobservable) variables as linear combinations (weighted averages) of the observed ones. SEM is an ex-ante method that can be used to test the validity of a set of hypotheses (J. F. Hair et al., 2017). SEM is a very flexible statistical modeling tool. Statistically speaking, SEM is a generalization and extension of so-called linear modeling procedures such as analysis of variance (ANOVA) or multiple regression models (Byrne, 2013). SEM is a confirmatory (or hypothesis-testing) theory that relates the multivariate analysis of the structural model to its variables.

Over the past several decades, structural equation modeling has gained increasing acceptance. The scientific world has made significant advancements in supply chains, logistics systems, and social sciences, encompassing economics, operations research, management studies, and the natural sciences (Anderson & Gerbing, 1988). The SEM has proven its effectiveness in capturing purchasing intention (Behjati et al., 2012), supply chain flexibility (Kennedy, 2011), and market research (Bacon, 1997); it also explains how to elevate the quality of supply chain management and improve organizational performance (George et al., 2015).

Based on the previous literature, no study has applied SEM to analyze the Circular Supply Chain Enablers, Environmental Sustainability Initiatives, and Economic Growth in the Moroccan textile industry. Prior works analyzing circular supply chain practices have been done at the macroeconomic or regional levels (Aguilar-Hernandez et al., 2020; Chen et al., 2020; Radivojević et al., 2024). However, they overlook sectoral factors and fail to account for the specific role of the observable variable in explaining these constructs. As a result of using SEM, this work can fill these gaps and provide a more detailed understanding of both the latent and observable variables. This approach enables the analysis of how specific sector factors affect economic growth, making it suitable for identifying patterns in emergent markets, such as Morocco.

Circular Supply Chain Enablers (CSCE) are assessed by indicators such as cleaner production, reverse logistics infrastructure, and Circular economy relationship management, which prior research has identified as affecting economic performance (Bilitewski, 2011; Dhakal et al., 2016; Ripanti & Tjahjono, 2019). Similarly, Environmental Sustainability Initiatives, such as reducing gas emissions, minimizing waste, and minimizing the use of virgin input materials, are associated with economic growth in various settings (Parvin et al., 2020; Patricio et al., 2018; Setiawan & Iswati, 2019). These insights informed the formulation of the following hypotheses:

H_1: It can be postulated that Circular Supply Chain Enablers (CSCE) have a significant positive impact on Economic Growth (EG).

H_2: Environmental Sustainability Initiatives (ESI) have a positive impact on Economic Growth (EG).

Although the hypotheses are grounded in existing literature, their applicability and relevance to the Moroccan textile industry have not been thoroughly tested. This paper fills this gap by operationalizing the latent constructs using observable variables and examining the hypotheses through a structural equation model, utilizing SmartPLS software. The measurement model employs a formative specification of Circular Supply Chain Enablers (CSCE), Environmental Sustainability Initiatives (ESI), and Economic Growth (EG), as these are built on distinct and non-substitutable elements. CSCE and ESI comprise a variety of enablers and environmental initiatives, respectively, each contributing uniquely to the construct. In a similar context, EG encompasses several economic indicators that collectively determine sectoral economic growth effectively. The validity of measurement is made by using the assessment of the outer weights, analysis of multicollinearity based on the variance inflation factors (VIF), and testing of significance levels based on bootstrapping, as per the accepted standards of the methodological points of view of formative constructs (Cenfetelli & Bassellier, 2009; J. F. Hair et al., 2021). This modeling method achieves methodological rigor and provides nuanced insights into the determinants of economic growth in the Moroccan textile industry.

Questionnaire Development and Data Collection

This paper tested our research hypotheses using the primary survey data collected from Moroccan textile firms. Based on this literature review, the observable variables were operationalized into measurement items for the survey, which were used to derive the questions for this study and are provided in Appendix 1. Each of these items is supported by previous research. As cited in the literature, the recognized sources of variables were employed to ensure that the questions were created from established scales.

Consequently, a stratified random sampling technique was employed to select 287 textile firms from the 1078 textile firms in Morocco. The sample size was estimated using the Krejcie and Morgan sample size table, which is based on the target population size (Krejcie & Morgan, 1970). The survey was designed as an online questionnaire with response options in a multiple-choice format for each question, using a Likert scale ranging from 1 to 5. The participants were determined by the use of professional platforms and Textile industry directories in Morocco. The Web-based survey was sent via email; together with the invitation, participants were provided with a brief description of the study's relevance and purpose. It was mentioned that the selected company representatives should complete the questionnaire if they had more than four years of working experience in environmental management. These participants are recognized as professionals within the Textile industry, and their experience was appreciable in the area of investigation in the study.

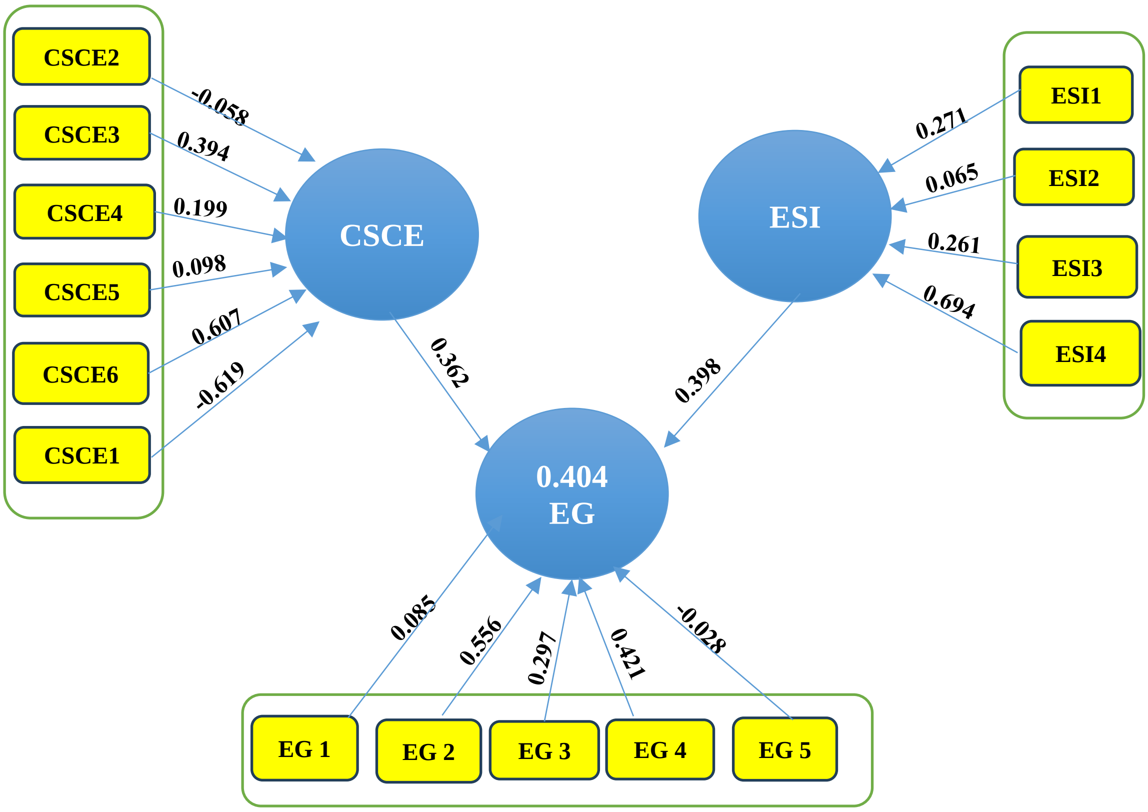
In total, 194 valid responses were collected, with one response from each company during the survey period from October 2023 to January 2024, resulting in a response rate of 67.60%. The response rate generated through this study is sufficiently high to merit being adequate for the kind of analysis proposed by several scholars, as a response rate of 20% is standard (Malhotra & Grover, 1998; Shashi et al., 2019).

RESULTS AND ANALYSIS

Results with the PLS-SEM Algorithm

With the aid of SmartPLS 4, our PLS-SEM analysis yields path coefficients that reveal the interdependencies between all variables, resulting in a structure that clarifies our model. The arrows in the model represent the relationships between the latent constructs and between indicators related to these constructs. The outer weights and path coefficients are defined by the values shown above the arrows. Visual clarity is enhanced by indicators in yellow and constructs in blue.

Figure 1 *Values of the Path Coefficients Obtained after Running the PLS-SEM algorithm using the SmartPLS 4® software.*



Source. Generated by the authors using SmartPLS ® software

Note. CSCE = Circular Supply Chain Enablers; ESI = Environmental Sustainability Initiatives; EG = Economic Growth. All constructs are measured using formative scales.

Hypotheses Checking

Table 2 summarizes the findings from hypothesis testing regarding the interaction between latent constructs as predicted by our structural equation model. Specifically,

Table 2 *Path Coefficients and Levels of Significance for Hypothesis Testing.*

	Path Coefficient	P-value	Decision
CSCE -> EG	0.362	0.0950	Supported
ESI -> EG	0.398	0.0000	Supported

Source. Generated by the authors using SmartPLS ® software

H$_1$**:** All the identified Circular Supply Chain Enablers (CSCE) have a significant positive impact on Economic growth (EG).

The path coefficient between CSCE and EG is 0.362, with a p-value of 0.095. At a 0.1 significance level, these values suggest that CSCE has a positive effect on EG.

H_2: Environmental Sustainability Initiatives (ESI) have a positive impact on Economic Growth (EG).

On the other hand, the path coefficient between ESI and EG is 0.398, which is a highly significant p-value of 0.000. These findings provide statistically strong and robust evidence, reinforcing the claim that ESI has a powerful and positive relationship with economic growth (EG).

The Equation Represents the Structural Model

In our analytical framework, the endogenous construct representing the broadest measure of overall performance, Economic Growth (EG), is clarified using a structured equation, as outlined in Equation 1. This equation reflects the interplay of exogenous constructs, primarily Circular Supply Chain Enablers (CSCE) and Environmental Sustainability Initiatives (ESI), which have a differential impact on the ultimate volume model performance. These relationships, quantified by the path coefficients shown in Figure 1 at 0.362 and 0.398, respectively, underpin the formulation of our structural model. Additionally, ζ, the error term integrated into the equation, represents the latent variables underlying the subtle intricacies of the GE, overturning it and increasing the accuracy of our performance analysis.

$$\mathrm{EG} = 0.362\ \mathrm{CSCE} + 0.398\ \mathrm{ESI} + \zeta \tag{1}$$

The Coefficient of Determination R^2

The values of R^2 for our SEM are 0.404 for the standard R^2 and 0.398 for the adjusted R^2. These indices represent the variance explained by the endogenous variable in the model. The R^2-value of 0.404 indicates that approximately 40.4% of the variability in the endogenous construct is explained by the exogenous variables in the proposed model. The adjusted R^2 of 0.398 is based on the number of predictors in the model. Thus, it leads to a slightly more conservative estimate. The values presented here would imply a moderate level of explanatory validity for our SEM and demonstrate that the employed variables help explain the variance of the endogenous construct.

Collinearity Statistics

In the formative measurement model, indicators are not necessarily interchangeable and do not require high correlations between indicators. The high correlations between two formative items are referred to as collinearity (J. F. Hair Jr. et al., 2014). The variance inflation factor (VIF) provides an indicator of collinearity. The higher the VIF values, the greater the collinearity. The VIF values of five or higher indicate collinearity problems (J.F. Hair et al., 2011).

On the other hand, a VIF between three and five indicates a potential collinearity problem (Diamantopoulos & Siguaw, 2006). While a VIF below three can be interpreted as indicating a non-problematic issue of collinearity. The VIF results for our SEM formative model, presented in Table 3, which includes CSCE1 to CSCE6, ESI1 to ESI4, and EG1 to EG5, indicate that all indicators have a VIF value below 3. This implies that the multicollinearity of the indicators is low, consistent with expectations for formative models in SEM. These findings strengthen the validity of our model, as they imply that the estimated coefficients are reliable.

Statistical Significance and Relevance of the Indicator Weight

The indicator weights are derived from the regression of each formatively measured construct on its indicators. As such, they denote the indicator's contribution to forming the construct. The significance testing of the indicator weights depends on the bootstrapping procedure, which allows for deriving standard errors from the data without making any distributional assumptions (J. F. Hair et al., 2014). In bootstrapping, many samples are drawn from the original sample with replacement (Davison & Hinkley, 1997). The number of bootstrap samples should be significant, but it must be at least equal to the number of valid observations in the dataset. Regarding our case, we estimated 5,000 structural models using PLS-SEM. Besides the number of samples, all conditions are set to default, including a "one-tailed" test type and a significance level of 0.10.

For the latent construct of circular supply chain enablers (CSCE), indicators CSCE1 and CSCE6 have outer weights of -0.6190 and 0.6070, respectively, with associated p-values of 0.0990 and 0.0770. These results suggest that CSCE1 and CSCE6 are statistically significant at a 0.1 significance level, supporting their contribution to the latent construct CSCE. Similarly, the indicators EG2, EG3, and EG4 exhibit significant positive relationships with the latent construct Economic growth (EG), as indicated by reasonably positive outer weights of 0.5560, 0.2970, and 0.4210, with p-values of 0.0000, 0.0360, and 0.0010, respectively. Regarding the latent construct of Environmental Sustainability Initiatives (ESI), the test for the significance levels of ESI1, ESI3, and ESI4 yields p-values of less than 0.1, indicating highly significant positive relationships.

Since some indicators demonstrated outer weights that were not statistically significant, their outer loadings and p-values were also assessed to verify whether they retained a meaningful contribution to the relevant latent construct, in line with the recommendations of formative measurement models suggested by Cenfetelli and Bassellier (2009) and J. Hair & Alamer (2022). Accordingly, CSCE4, EG1, EG5, and ESI2 indicators are considered significant, as they have an outer loading below 0.5 and p-values lower than 0.1, while CSCE2, CSCE3, and CSCE5 are therefore non-significant.

Table 3 *Outer weights, outer loadings, and related statistics found via bootstrapping.*

Indicators	Outer weights	T statistics (|O/STDEV|)	P values of outer weights	outer loadings	P values of outer loadings	VIF	Significance
CSCE1->CSCE	-0.6190	1.2870	0.0990	-0.5880	0.0920	1.8820	Significant
CSCE2->CSCE	-0.0580	0.3620	0.3590	-0.4190	0.1040	1.8900	Non-significant
CSCE3->CSCE	0.3940	1.1610	0.1230	0.2190	0.1680	1.1920	Non-significant
CSCE4->CSCE	0.1990	1.1210	0.1310	0.3530	0.0720	1.0940	Significant
CSCE5->CSCE	0.0980	0.6850	0.2470	0.2720	0.1030	1.2320	Non-significant
CSCE6->CSCE	0.6070	1.4250	0.0770	0.7060	0.0680	1.2000	Significant
EG1 -> EG	0.0850	0.8210	0.2060	0.3130	0.0060	1.0880	Significant
EG2 -> EG	0.5560	4.2880	0.0000	0.8620	0.0000	1.3870	Significant
EG3 -> EG	0.2970	1.7940	0.0360	0.6060	0.0000	1.3210	Significant
EG4 -> EG	0.4210	3.0290	0.0010	0.7770	0.0000	1.6610	Significant
EG5 -> EG	-0.0280	0.1840	0.4270	0.4940	0.0000	1.5350	Significant
ESI1 -> ESI	0.2710	1.9670	0.0250	0.5130	0.0000	1.2530	Significant
ESI2 -> ESI	0.0650	0.3930	0.3470	0.4520	0.0020	1.3060	Significant
ESI3 -> ESI	0.2610	1.7210	0.0430	0.7440	0.0000	1.5470	Significant
ESI4 -> ESI	0.6940	4.9750	0.0000	0.9190	0.0000	1.5100	Significant

Source. Generated by the authors using SmartPLS ® software

DISCUSSION

The outcome of the current study demonstrates the diverse impact that circular supply chain enablers and environmental sustainability initiatives have on the economic growth of Moroccan textile companies. According to the research results based on Structural Equation Modeling (SEM), certain observed variables have a positive and significant effect, while others have no effect.

The results herein suggest that Circular supply chain design (CSCE1) is valuable for promoting economic growth. The shift to a circular supply chain necessitates a restorative and regenerative redesign of supply chain networks (Bassi & Dias, 2020; Brown & Bajada, 2018; Pagoropoulos et al., 2017), ensuring sustainability, increasing profitability, and creating potential for various products through the efficient use of resources within the chain. Thus, Circular supply chain design has to be placed at the heart of organizational strategies to improve efficiency, control costs, and generate genuine value.

Circular supply chain relationship management (CSCE4) is also pivotal in economic growth. The aspect that companies choose suppliers who are ready to work with them to meet the strategic goals of sustainable value within a circular economy increases the partners' economic sustainability. As pointed out by Genovese et al. (2015), such relationships enable firms to coordinate sustainability efforts, minimize resource use, and regain investors' confidence, ultimately reducing wastage. In addition, properly managing the relations between the various parties engaged in the circular supply chain guarantees the entailed economic benefits and enhances economic stability. Ripanti and Tjahjono (2019) emphasize that a coordinated pattern of managing relationships facilitates the flow of information, knowledge, and resources; thus, increasing coordinative efficiency and productivity is a primary factor in transforming the economy.

AI, blockchain, machine learning, and IoT are instrumental in enhancing product recycling, minimizing waste, and improving the reverse logistics function (Romagnoli et al., 2023). Therefore, their integration in the circular supply chain enables cost savings, process improvements, and tangible economic benefits (Chanchaichujit et al., 2020; Pagoropoulos et al., 2017). Hence, Technological Sustainability Integration (CSCE6) plays a significant role in economic growth.

Although cleaner production (CSCE2), reverse logistics infrastructure (CSCE3), and human resources management (CSCE5) represent general aspects of circular economy success and performance, they have not proved to have a considerable impact on the textile industry in Morocco.

Cleaner production is recognized for saving costs and minimizing environmental impacts (Bilitewski, 2011; Ghisellini et al., 2015; Veleva et al., 2017), but this element did not have an impact on economic growth in this analysis. This could be because the diffusion of cleaner production techniques is relatively new in Morocco's textile industry. Increasingly, the application of cleaner production involves capital investments in new equipment, techniques, or processes, which may not yield quick returns in the short term, particularly in an industry driven mainly by efforts to reduce operating expenses.

The literature highlights that reverse logistics is a strategy to achieve a closed-loop flow and support the emergence of circular economies (Govindan & Soleimani, 2016; S. Jain et al., 2018; Scavarda et al., 2018). Nonetheless, given that Morocco lacks a well-established reverse logistics system, the role of such a system in promoting economic growth in the country's textile industry might be negligible due to the higher infrastructure costs associated with reverse logistics systems.

Human resources management is a key business function that helps organizations, both strategically and operationally, achieve their organizational objectives, such as sustainability strategies (Duff, 2018; Jabbour et al., 2017; Teixeira et al., 2015). Nonetheless, the absence of a positive impact on economic growth in our analysis may be explained by factors unique to the Moroccan textile industry. Since circular concepts are in the initial phase of being introduced in the country, specific HRM strategies designed to support the implementation of a circular economy are not yet sufficiently advanced to positively impact the economy's growth at this point.

This paper also demonstrates that Environmental sustainability initiatives, comprising reducing greenhouse gas emissions, minimizing waste, reducing the use of virgin input materials, and minimizing the use of hazardous/toxic materials, significantly impact economic growth, affirming the propositions of the circular economy practice for both environmental and economic benefits.

Reducing gas emissions, particularly carbon dioxide, is one of the most significant global issues (Rahman et al., 2017). This challenge is part of the circular economy strategy, whose key approach is to minimize emissions by increasing the efficiency of processes and utilizing cleaner technologies. This paper demonstrates that environmental initiatives, which have led to a decrease in gas emissions in Morocco's textile industry, have contributed to economic growth.

Minimizing waste is another area that connects environmental sustainability initiatives to economic growth. Implementing circular economy concepts, such as recycling and reusing materials, can increase the effectiveness of resource utilization, reduce waste, and decrease industries' costs, thereby promoting economic growth (Esposito et al., 2015). Another factor contributing to the Moroccan textile industry's economic growth is its efforts to reduce the use of virgin input materials. By switching from primary or virgin materials to secondary or recycled resources, the overall production cost can be reduced, and the impact of raw material price volatility can be mitigated. This practice enhances material efficiency for long-term sustainable development.

Ultimately, reducing the use of hazardous and toxic materials is crucial for both public health and economic reasons. According to Shaw et al. (2010), industries with fewer hazardous materials systems are more likely to address sustainability objectives, decrease pollution, and preserve human wellness. In the case of Moroccan textile organizations, switching to less hazardous materials is a way to control the impact of hazards, protect employees, and improve the organizational image, all of which contribute to economic growth.

CONCLUSION

Key Findings

A structural equation model was employed to investigate the influence of Circular Supply Chain Enablers (CSCE) and Environmental Sustainability Initiatives (ESI) on Economic Growth (EG), utilizing data from 194 textile companies in Morocco. The analysis of the results confirmed the positive significance of Circular Supply Chain Enablers and Environmental Sustainability Initiatives on economic growth. The formative measurement model validated the distinct contributions of each indicator by focusing on the variance inflation factor (VIF), outer weights, outer loadings, and p-values. Twelve of the fifteen indicators meet the significance thresholds, while cleaner production (CSCE 2), Reverse logistics infrastructure (CSCE 3), and Circular economy Human resources management (CSCE 5) do not. These insights offer a foundation for targeted actions to promote economic growth in the textile industry.

Theoretical Implications

The results provide significant theoretical contributions to complementing the conceptualization of Economic Growth (EG) as a construct that is influenced by strategic enablers and sustainability efforts from the perspective of circular supply chains. Modelling Circular Supply Chain Enablers (CSCE) and Environmental Sustainability Initiatives (ESI) as formative constructs, this paper makes progress toward the theoretical conceptualization of circularity as a multidimensional business force influencing microeconomic results. It emphasizes that economic growth cannot be generated solely by the conventions of economic inputs, but by correlating strategic capabilities and environmental operations. This understanding helps to inform the growing body of literature that has associated circular supply chain strategy with broader economic development models.

Practical Implications

The research has important practical implications for both managers and policymakers working in the textile industry who want to promote firm-level economic growth by engaging in sustainable activities. The findings highlight the importance of investing in circular supply chain enablers, such as circular design and relationship management, to support the implementation of a circular supply chain. Additionally, focusing on environmental initiatives such as reducing gas emissions and minimizing waste can yield economic returns, which can be quantified. Such results stimulate companies to consider sustainability not only as an expense, but also as a value-creating action plan that enhances long-term competitiveness and durability in dynamic markets.

Future Research Directions

Future studies could further explore the dynamic connections between circular supply chain enablers and environmental sustainability initiatives, as well as their impact on economic growth in various industrial sectors and geographical locations. It is also possible that longitudinal studies are conducted to gather more observations of how these relationships evolve. Longitudinal studies can also help elucidate the evolutionary aspects of these relationships over time. Moreover, by using qualitative methods, such as case studies or interviews with experts, it is possible to gain deeper insight into locally specific aspects and implementation difficulties. The possibility of mediating or moderating variables to reveal underlying mechanisms affecting the efficacy of circular strategies could also be explored in future work.

Conflict of Interests

None

REFERENCE

Abideen, A. Z., Pyeman, J., Sundram, V. P. K., Tseng, M.-L., & Sorooshian, S. (2021). Leveraging capabilities of technology into a circular supply chain to build circular business models: A state-of-the-art systematic review. *Sustainability, 13(16),* 8997. https://doi.org/10.3390/su13168997

Aguilar-Hernandez, G. A., Rodrigues, J. F. D., & Tukker, A. (2020). Macroeconomic, social, and environmental impacts of a circular economy up to 2050: A meta-analysis of prospective studies. *Journal of Cleaner Production, 278,* 123421. https://doi.org/10.1016/j.jclepro.2020.123421

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103(3),* 411–423. https://doi.org/10.1037/0033-2909.103.3.411

Antonioli, D., Ghisetti, C., Mazzanti, M., & Nicolli, F. (2022). Sustainable production: The economic returns of circular economy practices. *Business Strategy and the Environment, 31(5),* 2603–2617. https://doi.org/10.1002/bse.3046

Bacon, L. D. (1997, January). Using Amos for structural equation modeling in market research (white paper). Lynd Bacon & Associates, Ltd.; SPSS Inc. Retrieved from ResearchGate

Bakker, C. A., den Hollander, M. C., van Hinte, E., & Zijlstra, Y. (2014). Products that last: Product design for circular business models. Delft University of Technology.

Bartelmus, P. (2013). The future we want: Green growth or sustainable development? *Environmental Development, 7,* 165–170. https://doi.org/10.1016/j.envdev.2013.04.001

Bassi, F., & Dias, J. G. (2020). Sustainable development of small- and medium-sized enterprises in the European Union: A taxonomy of circular economy practices. *Business Strategy and the Environment, 29(6),* 2528–2541. https://doi.org/10.1002/bse.2518

Behjati, S., Pandya, S., & Kumar, M. D. (2012). Application of structural equation modeling (SEM) to explain online purchasing intention – An extension of Theory of Planed Behaviour (TPB). *Industrial Engineering Letters, 2(6),* 33–41. https://iiste.org/Journals/index.php/IEL/article/download/2240/2253

Bilitewski, B. (2011). The Circular Economy and its Risks. *Waste Management, 32(1),* 1–2. https://doi.org/10.1016/j.wasman.2011.10.004

Blomsma, F., & Brennan, G. (2017). The emergence of circular economy: A new framing around prolonging resource productivity. *Journal of Industrial Ecology, 21(3),* 603–614. https://doi.org/10.1111/jiec.12603

Brown, P. J., & Bajada, C. (2018). An economic model of circular supply network dynamics: Toward an understanding of performance measurement in the context of multiple stakeholders. *Business Strategy and the Environment, 27(5),* 643–655. https://doi.org/10.1002/bse.2069

Byrne, B. M. (2013). Structural Equation Modeling with Mplus. In *Routledge eBooks.* https://doi.org/10.4324/9780203807644

Cenfetelli, N., & Bassellier, N. (2009). Interpretation of formative measurement in information systems research. *MIS Quarterly, 33(4),* 689. https://doi.org/10.2307/20650323

Chanchaichujit, J., Balasubramanian, S., & Charmaine, N. S. M. (2020). A systematic literature review on the benefit-drivers of RFID implementation in supply chains and its impact on organizational competitive advantage. *Cogent Business & Management, 7(1),* 1818408. https://doi.org/10.1080/23311975.2020.1818408

Charonis, G. (2021). Degrowth, steady state and circular economies: Alternative discourses to economic growth. *Society Register, 5(3),* 75–94. https://doi.org/10.14746/sr.2021.5.3.05

Chen, Z., Chen, S., Liu, C., Nguyen, L. T., & Hasan, A. (2020). The effects of circular economy on economic growth: A quasi-natural experiment in China. *Journal of Cleaner Production, 271,* 122558. https://doi.org/10.1016/j.jclepro.2020.122558

Davison, A. C., & Hinkley, D. V. (1997). Bootstrap methods and their application. https://doi.org/10.1017/cbo9780511802843

De Giovanni, P. (2018). A feature fatigue supply chain game with cooperative programs and ad-hoc facilitators. *International Journal of Production Research, 57(13),* 4166–4186. https://doi.org/10.1080/00207543.2018.1519264

Demirel, P., & Danisman, G. O. (2019). Eco-innovation and firm growth in the circular economy: Evidence from European small- and medium-sized enterprises. *Business Strategy and the Environment, 28(8),* 1608–1618. https://doi.org/10.1002/bse.2336

Dev, N. K., Shankar, R., & Qaiser, F. H. (2019). Industry 4.0 and circular economy: Operational excellence for sustainable reverse supply chain performance. *Resources Conservation and Recycling, 153,* 104583. https://doi.org/10.1016/j.resconrec.2019.104583

Dhakal, M., Smith, M. H., & Newbery, R. (2016). Secondary market: A significant aspect in reverse logistics and sustainability. *The International Journal of Social Sustainability in Economic Social and Cultural Context, 12(1),* 25–35. https://doi.org/10.18848/2325-1115/cgp/v12i01/25-35

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and Empirical illustration. *British Journal of Management, 17(4),* 263–282. https://doi.org/10.1111/j.1467-8551.2006.00500.x

Donaghy, K. P. (2021). Getting to a circular growth economy by harnessing circular and cumulative causation. In *Edward Elgar Publishing eBooks.* https://doi.org/10.4337/9781839100598.00026

Duff, A. (2018). Intellectual capital disclosure: Evidence from UK accounting firms. *Journal of Intellectual Capital, 19(4),* 768–786. https://doi.org/10.1108/jic-06-2017-0079

Esposito, M., Tse, T., & Soufani, K. (2015). Is the circular economy a new fast-expanding market? *Thunderbird International Business Review, 59(1),* 9–14. https://doi.org/10.1002/tie.21764

Fatih, F. Z., & Hirawan, F. B. (2024). Towards a closed-loop future: A systematic examination of circular supply chain literature. *International Journal of Business Performance and Supply Chain Modelling, 15(1),* 47–62. https://doi.org/10.1504/ijbpscm.2024.140034

Flachenecker, F., & Kornejew, M. (2018). The causal impact of material productivity on microeconomic competitiveness and environmental performance in the European Union. *Environmental Economics and Policy Studies, 21(1),* 87–122. https://doi.org/10.1007/s10018-018-0223-z

Genovese, A., Acquaye, A. A., Figueroa, A., & Koh, S. L. (2015). Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. *Omega, 66,* 344–357. https://doi.org/10.1016/j.omega.2015.05.015

George, D. A., Lin, B. C., & Chen, Y. (2015). A circular economy model of economic growth. *Environmental Modelling & Software, 73,* 60–63. https://doi.org/10.1016/j.envsoft.2015.06.014

Ghisellini, P., Cialani, C., & Ulgiati, S. (2015). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production, 114,* 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

Glavič, P., & Lukman, R. (2007). Review of sustainability terms and their definitions. *Journal of Cleaner Production, 15(18),* 1875–1885. https://doi.org/10.1016/j.jclepro.2006.12.006

González-Sánchez, R., Settembre-Blundo, D., Ferrari, A. M., & García-Muiña, F. E. (2020). Main dimensions in the building of the circular Supply Chain: A literature review. *Sustainability, 12(6),* 2459. https://doi.org/10.3390/su12062459

Goodland, R. (1995). The concept of environmental sustainability. *Annual Review of Ecology and Systematics, 26(1),* 1–24. https://doi.org/10.1146/annurev.es.26.110195.000245

Goodwin, N. R., Harris, J. M., Nelson, J. A., Ackerman, F., & Weisskopf, T. E. (2014). Microeconomics in Context (3rd ed.). M.E. Sharpe. https://doi.org/10.13140/2.1.4786.528

Govindan, K., & Soleimani, H. (2016). A review of reverse logistics and closed-loop supply chains: A journal of cleaner production focus. *Journal of Cleaner Production, 142,* 371–384. https://doi.org/10.1016/j.jclepro.2016.03.126

Hair, J. F., Babin, B. J., & Krey, N. (2017). Covariance-based structural equation modeling in the *journal of advertising*: Review and recommendations. *Journal of Advertising, 46(1),* 163–177.

https://doi.org/10.1080/00913367.2017.1281777

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Evaluation of formative measurement models. In *Classroom companion: business (pp. 91–113).* https://doi.org/10.1007/978-3-030-80519-7_5

Hair, J. F., Jr., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM). *European Business Review, 26(2),* 106–121. https://doi.org/10.1108/ebr-10-2013-0128

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *The Journal of Marketing Theory and Practice, 19(2),* 139–152. https://doi.org/10.2753/mtp1069-6679190202

Hair, J., & Alamer, A. (2022). Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. *Research Methods in Applied Linguistics, 1(3),* 100027. https://doi.org/10.1016/j.rmal.2022.100027

Hickel, J., & Kallis, G. (2019). Is green growth possible? *New Political Economy, 25(4),* 469–486. https://doi.org/10.1080/13563467.2019.1598964

Horbach, J., & Rammer, C. (2019). Circular economy innovations, growth and employment at the firm level: Empirical evidence from Germany. *Journal of Industrial Ecology, 24(3),* 615–625. https://doi.org/10.1111/jiec.12977

Jabbour, C. J. C., De Sousa Jabbour, A. B. L., Sarkis, J., & Filho, M. G. (2017). Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda. *Technological Forecasting and Social Change, 144,* 546–552. https://doi.org/10.1016/j.techfore.2017.09.010

Jain, S., Jain, N. K., & Metri, B. (2018). Strategic framework towards measuring a circular supply chain management. *Benchmarking an International Journal, 25(8),* 3238–3252. https://doi.org/10.1108/bij-11-2017-0304

Jain, V. K., Singh, S., & Sharma, P. (2025). Circular economy: Developing framework for circular supply chain implementation for energy efficient solution in industry 4.0. *Circular Economy and Sustainability.* https://doi.org/10.1007/s43615-025-00511-9

James, K. L., Randall, N. P., & Haddaway, N. R. (2018). Towards a better understanding of circular economy practices: A literature review. *Sustainability, 10(6),* 2143.

Jorgenson, A. K., & Dietz, T. (2014). Economic growth does not reduce the ecological intensity of human well-being. *Sustainability Science, 10(1),* 149–156. https://doi.org/10.1007/s11625-014-0264-6

Keeble, B. R. (1988). The Brundtland report: 'Our common future.' *Medicine and War, 4(1),* 17–25. https://doi.org/10.1080/07488008808408783

Kennedy, O. R. (2011). Supply chain flexibility: Structural equation Modeling approach. *iBusiness, 03(04),* 390–399. https://doi.org/10.4236/ib.2011.34052

Ko, D., & Stewart, W. P. (2002). A structural equation model of residents' attitudes for tourism development. *Tourism Management, 23(5),* 521–530. https://doi.org/10.1016/s0261-5177(02)00006-7

Korhonen, J., Honkasalo, A., & Seppälä, J. (2017). Circular economy: The concept and its limitations. *Ecological Economics, 143,* 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041

Kosoy, N., & Corbera, E. (2009). Payments for ecosystem services as commodity fetishism. *Ecological Economics, 69(6),* 1228–1236. https://doi.org/10.1016/j.ecolecon.2009.11.002

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30(3),* 607–610. https://doi.org/10.1177/001316447003000308

Lei, P., & Wu, Q. (2007). Introduction to Structural equation modeling: Issues and practical considerations. *Educational Measurement Issues and Practice, 26(3),* 33–43. https://doi.org/10.1111/j.1745-3992.2007.00099.x

Lieder, M., & Rashid, A. (2015). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. *Journal of Cleaner Production, 115,* 36–51. https://doi.org/10.1016/j.jclepro.2015.12.042

Malhotra, M. K., & Grover, V. (1998). An assessment of survey research in POM: from constructs to theory. *Journal of Operations Management, 16(4),* 407–425. https://doi.org/10.1016/s0272-6963(98)00021-7

Mitchell, P., & James, K. (2015). Economic growth potential of more circular economies [Conference paper, ISWA World Congress, Antwerp, 7–9 September 2015]. https://doi.org/10.13140/RG.2.1.3516.8725

Montag, L. (2022). Circular economy and supply chains: Definitions, conceptualizations, and research agenda of the circular supply chain framework. *Circular Economy and Sustainability, 3(1),* 35–75. https://doi.org/10.1007/s43615-022-00172-y

Morelli, J. (2011). Environmental sustainability: A definition for environmental professionals. *Journal of Environmental Sustainability, 1(1),* 1–10. https://doi.org/10.14448/jes.01.0002

Nag, U., Sharma, S. K., & Govindan, K. (2021). Investigating drivers of circular supply chain with product-service system in automotive firms of an emerging economy. *Journal of Cleaner Production, 319,* 128629. https://doi.org/10.1016/j.jclepro.2021.128629

Nejati, M., Rabiei, S., & Jabbour, C. J. C. (2017). Envisioning the invisible: Understanding the synergy between green human resource management and green supply chain management in manufacturing firms in Iran in light of the moderating effect of employees' resistance to change. *Journal of Cleaner Production, 168,* 163–172. https://doi.org/10.1016/j.jclepro.2017.08.213

Pagoropoulos, A., Pigosso, D. C., & McAloone, T. C. (2017). The emergent role of digital technologies in the circular economy: A review. *Procedia CIRP, 64,* 19–24. https://doi.org/10.1016/j.procir.2017.02.047

Parvin, F., Islam, S., Akm, S. I., Urmy, Z., & Ahmed, S. (2020). A study on the solutions of environment pollutions and worker's health problems caused by textile Rahman, F. A., Aziz, M. M. A., Saidur, R., Bakar, W. A. W. A., Hainin, M. R., & Hassan, N. A. (2017).

Patricio, J., Axelsson, L., Blomé, S., & Rosado, L. (2018). Enabling industrial symbiosis collaborations between SMEs from a regional perspective. *Journal of Cleaner Production, 202,* 1120–1130. https://doi.org/10.1016/j.jclepro.2018.07.230

Prencipe, M. P., Vishkaei, B. M., & De Giovanni, P. (2021). Blockchain adoption in the winery industry. In *Advances in data mining and database management book series (pp. 43–72).* https://doi.org/10.4018/978-1-7998-8014-1.ch003

Radivojević, V., Rađenović, T., & Dimovski, J. (2024). The role of circular economy in driving economic growth: Evidence from EU countries. *SAGE Open, 14(4).* https://doi.org/10.1177/21582440241240624

Rahman, F. A., Aziz, M. M. A., Saidur, R., Bakar, W. A. W. A., Hainin, M. R., & Hassan, N. A. (2017). Pollution to solution: Capture and sequestration of carbon dioxide (CO_2) and its utilization as a renewable energy source for a sustainable future. Renewable and Sustainable Energy Reviews, 71, 112–126. https://doi.org/10.1016/j.rser.2017.01.011

Ripanti, E. F., & Tjahjono, B. (2019). Unveiling the potentials of circular economy values in logistics and supply chain management. *The International Journal of Logistics Management, 30(3),* 723–742. https://doi.org/10.1108/ijlm-04-2018-0109

Romagnoli, S., Tarabu, C., Vishkaei, B. M., & De Giovanni, P. (2023). The impact of digital technologies and sustainable practices on circular supply chain management. *Logistics, 7(1),* 1. https://doi.org/10.3390/logistics7010001

Sauvé, S., Bernard, S., & Sloan, P. (2015). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. *Environmental Development, 17,* 48–56. https://doi.org/10.1016/j.envdev.2015.09.002

Scavarda, A., Daú, G. L., Scavarda, L. F., & Korzenowski, A. L. (2018). A proposed healthcare supply chain management framework in the emerging economies with the sustainable lenses: The theory, the practice, and the policy. *Resources Conservation and Recycling, 141,* 418–430. https://doi.org/10.1016/j.resconrec.2018.10.027

Setiawan, P., & Iswati, S. (2019). Carbon emissions disclosure, Environmental management system, and environmental performance: Evidence from the plantation industries in Indonesia. *Indonesian Journal of Sustainability Accounting and Management, 3(2),* 215. https://doi.org/10.28992/ijsam.v3i2.99

Sharma, S. K., & Bhat, A. (2016). Risk mitigation in automotive supply chain: An Empirical Exploration of enablers to implement supply chain risk management.fff *Global Business Review, 17(4),* 790–805. https://doi.org/10.1177/0972150916645678

Shashi, N., Centobelli, P., Cerchione, R., & Singh, R. (2019). The impact of leanness and innovativeness on environmental and financial performance: Insights from Indian SMEs. *International Journal of Production Economics, 212,* 111–124. https://doi.org/10.1016/j.ijpe.2019.02.011

Shaw, S., Grant, D. B., & Mangan, J. (2010). Developing environmental supply chain performance measures. *Benchmarking an International Journal, 17(3),* 320–339. https://doi.org/10.1108/14635771011049326

Sousa-Zomer, T. T., Magalhães, L., Zancul, E., & Cauchick-Miguel, P. A. (2017). Exploring the challenges for circular business implementation in manufacturing companies: An empirical investigation of a pay-per-use service provider. *Resources Conservation and Recycling, 135,* 3–13. https://doi.org/10.1016/j.resconrec.2017.10.033

Spash, C. L. (2013). The shallow or the deep ecological economics movement? *Ecological Economics, 93,* 351–362. https://doi.org/10.1016/j.ecolecon.2013.05.016

Stahel, W. R. (2016). The circular economy. *Nature, 531(7595),* 435–438. https://doi.org/10.1038/531435a

Stewart, R., & Niero, M. (2018). Circular economy in corporate sustainability strategies: A review of corporate sustainability reports in the fast-moving consumer goods sector. *Business Strategy and the Environment, 27(7),* 1005–1022. https://doi.org/10.1002/bse.2048

Teixeira, A. A., Jabbour, C. J. C., De Sousa Jabbour, A. B. L., Latan, H., & De Oliveira, J. H. C. (2015). Green training and green supply chain management: evidence from Brazilian firms. *Journal of Cleaner Production, 116,* 170–176. https://doi.org/10.1016/j.jclepro.2015.12.061

Veleva, V., Bodkin, G., & Todorova, S. (2017). The need for better measurement and employee engagement to advance a circular economy: Lessons from Biogen's "zero waste" journey. *Journal of Cleaner Production, 154,* 517–529. https://doi.org/10.1016/j.jclepro.2017.03.177

Wang, N., Lee, J. C. K., Zhang, J., Chen, H., & Li, H. (2018). Evaluation of Urban circular economy development: An empirical research of 40 cities in China. *Journal of Cleaner Production, 180,* 876–887. https://doi.org/10.1016/j.jclepro.2018.01.089

Zhang, A., Wang, J. X., Farooque, M., Wang, Y., & Choi, T. (2021). Multi-dimensional circular supply chain management: A comparative review of the state-of-the-art practices and research. *Transportation Research Part E Logistics and Transportation Review, 155,* 102509. https://doi.org/10.1016/j.tre.2021.102509

Ms. Fatima Zahra Fatih (Corresponding author) is a PhD scholar in economics whose research focuses on economic analysis, supply chain management, and sustainable development, particularly green and circular economy practices. She holds an MBA from Beijing Technology and Business University, where she received the Best Master's Thesis Award, and a bachelor's degree in organization management. Her work integrates multi-criteria decision analysis, statistical modeling, and system dynamics to study the drivers of sustainability and circular supply chain transitions. She has earned multiple academic scholarships, presented at international conferences, and published research in Web of Science and Scopus-indexed journals.

Ms. Sadia Abbassy is an economist specializing in cross-border trade, regional integration, and women's economic empowerment across Asia. She holds a Master of Arts in Economics from Universitas Islam International Indonesia, where her research focused on economic diplomacy and regional trade among ASEAN, China, and India. Her work spans policy analysis, international cooperation, and sustainable development, with publications and conference contributions in economic integration and socioeconomic policy. She has professional experience in research, education policy projects, and senior leadership roles in Afghanistan's private sector.

Dr. Fajar Bambang Hirawan is an Assistant Professor at the Faculty of Economics and Business, Universitas Islam Internasional Indonesia (UIII) since May 2021. He offers courses in microeconomics, mathematical economics, and development economics. Before joining UIII, he spent over 15 years (2006-2023) at the Centre for Strategic and International Studies (CSIS), serving as Head of the Economics Department (2022-2023). His research focuses on food security, international trade, the digital economy, SMEs, poverty, and broader development issues. He holds a Bachelor's degree in Economics from the University of Indonesia, a Master's in Development Studies from the University of Rome "La Sapienza," and a Ph.D. in Economics from the University of Sydney.

APPENDIX 1: QUESTIONNAIRE ITEMS

Circular Supply Chain Enablers (CSCE) Please provide your rate from (1) strongly disagree to (5) strongly agree.	
CSCE 1	To what extent does your company implement circular supply chain design?
CSCE 2	How effectively does your company integrate cleaner production practices into its manufacturing processes?
CSCE 3	To what extent is the reverse logistics infrastructure in your company geared towards supporting circularity?
CSCE 4	To what extent does your company manage relationships with stakeholders in alignment with circular economy principles?
CSCE 5	How well does your company integrate circular economy principles into its human resources management practices?
CSCE 6	How actively does your company integrate technological sustainability into its operations?
Environmental Sustainability Initiatives (ESI) Please provide your rate from (1) strongly disagree to (5) strongly agree.	
ESI 1	How actively does your company work towards reducing gas emissions?
ESI 2	To what extent does your company minimize waste generation in its processes?
ESI 3	How committed is your company to minimizing the use of virgin input materials in its operations?
ESI 4	To what extent does your company actively work towards reducing the usage of hazardous/toxic materials in its processes?
Economic Growth (EG) Please provide your rate from (1) strongly disagree to (5) strongly agree.	
EG 1	To what extent does your company contribute to employment growth?
EG 2	How significantly does your company invest in research and development?
EG 3	To what extent does your company experience consistent sales growth?

EG 4	How actively does your company pursue market expansion opportunities?
EG 5	To what extent does your company believe its activities positively contribute to the growth and development of the textile industry and by extension, the national economy?