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Zero Waste Management: Investigation of Green Technology, the Green Supply Chain, and the Moderating Role of CSR Intentions

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Abstract: The conservation of natural resources, reduction in waste, and minimization of energy consumption are now the primary focuses of zero waste management. Thus, this study examined the direct impact of green technology on zero waste management. We also explored the significant mediation role of the green supply chain (GSC) in links between green technology and zero waste management. Moreover, we investigated how corporate social responsibility (CSR) intentions moderate the relationship between green technology and zero waste management. For the data collection, a quantitative method and random sampling technique were used. The data were collected from 450 questionnaires conducted in the energy sector. The results demonstrate that green technology has a valuable role in the accomplishment of zero waste management in enterprises. Our findings also show that the green supply chain mediates, and the CSR intentions moderate, the links between green technology and zero waste management. The current research contributes to the development of a deeper understanding of management by demonstrating that green technology and the green supply chain play considerable roles in the achievement of zero waste management.

Keywords: green technology; green supply chain; zero waste management; CSR intentions; energy sector

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1. Introduction

Over the previous few years, the interest in, and the debate on, the understanding of the implementation of green technology and the enhancement of zero waste management practices in businesses have been increasing, both in academia and in practice [1]. Even though widespread research on the effects of the green technology has been conducted in recent times, the discussion among scholars remains as to how to explore the best methods of implementation. Additionally, mixed outcomes in terms of the impacts of green technology on zero waste management have been reported, which may be because of the means in which researchers conceptualize green technology [2]. This conceptualization varies significantly based on the expertise and backgrounds of the researchers. Globally, ecological problems are mainly occurring due to human actions and activities that damage organic networks and disturb the biological balance [3]. Therefore, zero waste management is a predictable trend and a crucial preference to allow a green dynamic society to be formed so that human life can be sustained ethically in society [4].

Zero waste management includes proactive environmental practices that prevent the occurrence of damage to the biological environment. There is a focus on three relationships, the acquisition, utilization, and clearance of different products, to weaken the hazardous impacts on the natural environment as much as possible [5]. Nevertheless, in order to encourage zero waste management, enterprises have to pay attention to how green technology affects zero waste management practices and how the green supply chain interplay and CSR intentions moderate zero waste management strategies in companies. Green technology can reduce ecological pollution and save resources during production. Stakeholders are forcing businesses to increase their interest in the expansion of the green supply chain and are emphasizing issues concerning product design and development to accomplish zero waste management [6]. Business stakeholders are also prompting businesses to optimize internal prototypes and production techniques in addition to gradually replacing traditional machinery with green technology to increase zero waste management practices in the company [7].

The green supply chain incorporates natural environment protection and development; it encompasses the use of management techniques that can decrease ecological pollution, for instance, by incorporating environmental protection, green supply, environmental management, green manufacturing, and accountable recycling [8]. The green supply chain is the operational management technique used to overcome the environmental impact along with increasing the life cycle of green products. It promotes ecofriendly green technology progress, which leads to zero waste management [9]. Suppliers are the primary polluters in the production chains of ventures. In other words, green supply chain procurement can promote the green technological collaboration between enterprises and their upstream suppliers, which can persuade enterprises to increase their ecological protection and support zero waste management practices [10]. Stakeholders' ecological demands motivate enterprises to attain better green technical levels and production procedures, which persuades enterprises to achieve zero waste management [11]. Specifically, the use of a green supply chain could decrease the discharge of destructive substances and encourage the recycling and reprocessing of waste. The green supply chain has grown to be a system that reduces biological pollution and enhances the efficiency of resource consumption during green procurement, manufacturing, and emissions [12]. When an enterprise is focused on its effectiveness and competitiveness and uses an optimization approach to enhance its market share and resource efficiency, it can achieve greater competitive benefits, which leads to the enhancement of zero waste management [13]. The green supply chain refers to the operational administration and management of the means and optimization approaches used to overcome ecological impacts, along with improving the life cycle of green products, from raw materials to end products [14].

With strong CSR intentions, green technology has enabled enterprises and their suppliers to incessantly reduce ecological pollution during manufacturing processes and product development, thereby promoting zero waste management throughout the whole industry sequence [15]. The CSR intentions and consumer understanding of ecological protection promotes enterprises to design green products and forces enterprises to accomplish zero waste management and meet the technological demands of the market [16]. Through expanding the awareness of zero waste management, enterprises with greater CSR intentions usually pay attention to ecological protection and attempt to put ecofriendly green technologies into practice.

In contrast, enterprises with a low environmental understanding may engage less in biological protection activities [17]. CSR intentions are initiatives that enterprises carry out to support societal and environmental challenges and superficially communicate to stakeholders to obtain their support through the implementation of green technologies directed toward zero waste management [18].

In this regard, we propose a unique empirical model that incorporates green technology, the green supply chain, and CSR intentions to determine the construction means, internal dynamic forces, and moderation constructs required to promote zero waste man-

agement in an enterprise. Previous studies examined zero waste management in different contexts, for example, as a performance measurement tool for waste management systems [19], a zero waste approach [20], and the measurement of zero waste management [21]. Green technology acts as a critical antecedent in the achievement of zero waste management. Thus, there is also a significant need to examine the green supply chain mediation and the moderation role of CSR intentions on the green technology and zero waste management links. To the best of our information, no previous study jointly investigated the effects of these variables in an empirical model.

To fill this research gap and lead management toward the reasons behind effective zero waste management, this study expands on the prior findings and assesses the impacts of variables such as green technology, the green supply chain (GSC), and CSR intentions on zero waste management. The model used in the current study model is significant and uniquely contributes to the findings of the prior literature in the following ways:

- Firstly, the primary aim of our study is to examine how green technology is positively associated with zero waste management.
- Secondly, this research proposes the investigation of how GSC mediates the link between green technology and zero waste management.
- Thirdly, this research examines how CSR intentions moderate the link between green technology and zero waste management.

The literature review is provided in the following text.

1.1. Green Technology and Zero Waste Management

Green technology describes the term science and technology used to overcome the harmful impacts of human activities on natural ecological settings. It includes the broad area of systematic research, comprising agricultural and atmospheric sciences, material and hydrology science [22].

The green supply chain involves the successful integration of environmentally responsible benchmarks and principles associated with manufacturing logistics, product design, material sourcing, and product management [13,23]. CSR intentions refer to the idea that enterprises should have positive and significant roles in the community and transparency of an enterprise's environmental and societal activities in terms of business decisions [24]. Zero waste management refers to the management of processes and the design of products to scientifically eliminate waste toxicity and increase the conservation of all resources in regard to consumption, reuse and responsible production, and the packaging and recovery of the products [7,25].

The use of green technologies is part of a significant push for zero waste management to support enterprises in carrying out research and development activities in the advancement phase [26]. Enterprises have frequently designed manufacturing procedures using the latest green technologies and advanced machines as a technical means for overcoming the discharge of greenhouse gases [27]. Green technology adaptation is a significant factor in supporting green activities that lead toward innovation and zero waste management, particularly to lessen the damage done to the atmosphere and to reduce the discharge of greenhouse gases in manufacturing processes [28]. Green technology advancements look to be the most efficient means for the accomplishment of zero waste management and ecological enhancement [29]. Therefore, the production effectiveness of an enterprise is closely concerned with its green technology research and development unit practices, which directly provide guidance toward the attainment of zero waste management. The use of green technologies is helpful for the creation of power by combustion in mechanized operations, which could boost an enterprise's capacity to increase their zero waste management and enhance their ecological performance [30]. Zero waste management, as a visionary practice, is considered to be a vital alternative solution to the pollution challenges that have arisen in recent decades [31]. Green technology developments have grown to become effective approaches for handling zero waste problems. The green technology notion has been embraced by management, as it supports sustainable manufacturing and

consumption processes, optimal resource recycling, and the restriction of environmental performance degradation, which supports zero waste management [32].

Hypothesis 1. *The use of green technology is positively associated with zero waste management.*

1.2. The Mediating Role of Green Supply Chain Management

The strategic integration of enterprises with suppliers helps them to achieve the desired results associated with their zero waste management performance, because suppliers have a collection of resources, which reduces the uncertainty associated with the risks linked with ecological compliance and concerns [33]. Enterprises that focus on zero waste management practices and have strong support from their suppliers via apt incentive schemes can have considerable linkages with successful applications of inventive green environment technologies [34]. Having an efficient and resourceful green supply chain performs a critical role in the attainment of zero waste management in enterprises. Green technology is considered to be an imperative factor in the production of ecofriendly products and services. However, the green supply chain also plays a vital role in the adaptation and development of innovative technologies for zero waste management and environmental enhancement practices in enterprises [35]. Thus, it is also important to think about the antecedent of zero waste management which is green technology adoption. Enterprises should use a good green supply chain that is not only based on conventional criteria but considers green compliance and ecological aspects that provide guidance toward the attainment of zero waste management [36]. Numerous scholars have recommended that enterprises should embed green technology in their production and operational activities through the green supply chain to improve their management of zero waste practices [37].

Hypothesis 2. *The relationship between green technology and zero waste management is mediated through the green supply chain.*

1.3. Moderation by CSR Intentions

CSR intentions are viewed as the predominant driver of the use of green technology and zero waste management. The CSR intentions motivate enterprises to adopt green technology, which is needed to allow them to act in accordance with ecological standards prior to achieving zero waste management sustainable goals [38]. Enterprises that focus on CSR in their strategies will regularly evaluate consumers' demands to consistently enhance their environmental performance and zero waste management strategy [15,39]. The use of green technology is vital because of the scarceness of resources and the degradation of the environment; CSR intentions support the management of resources and the implementation of methods that lead toward zero waste management [40]. Furthermore, CSR intentions are geared toward the achievement of zero waste management. The adoption of green technologies requires skillful members with multidisciplinary backgrounds and strong CSR intentions to tackle ecological issues and increase the proactive performance of the enterprise in relation to zero waste management [41]. This research speculates that when an enterprise implements green technology and also engages in CSR-related practices, its zero waste management practices will be enhanced. When an enterprise incorporates green technology into its green business strategies, this will have a direct positive influence on their zero waste management practices. CSR intentions are also critical for an enterprise to boost its ecological performance and to attain long-term sustainability [42]. To act in response to the customers' awareness of the green movement, businesses must implement green technology to design innovative ecofriendly products and services based upon CSR intentions and needs [43]. The rationale of CSR intentions could facilitate enterprises to support the use of valuable ecofriendly goods or services that are directed toward the achievement of zero waste management [44].

Hypothesis 3. *CSR intentions moderate the link between green technology and zero waste management.*

The theoretical framework used in this paper is presented in Figure 1.

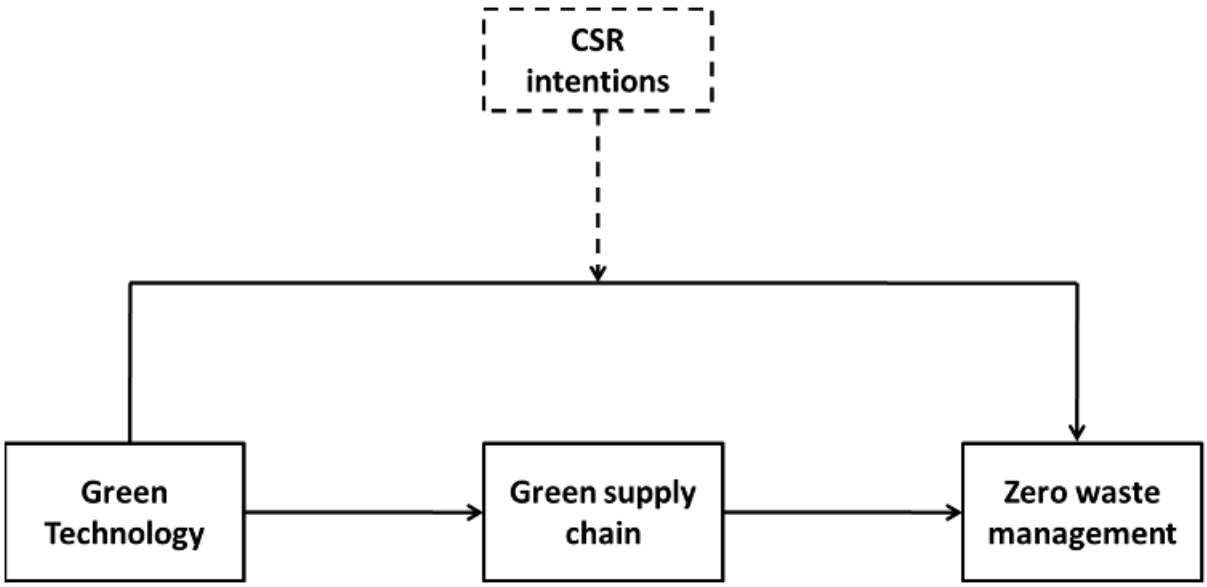

Figure 1. Theoretical framework. Source: Authors' concept.

2. Methodology

2.1. Research Design

A quantitative method and random sampling technique were used as survey instruments. To analyze the study hypotheses, a regression analysis, correlation, and structural equation modeling were used. To examine the mediating role of the green supply chain, 5000 bootstraps were used. The analysis unit used in this study was energy companies who are engaged in the production, manufacturing, refinement, and distribution of fuel.

2.2. Data Collection

To meet the objectives of this study, an explanatory method was used to examine causal linkages between the independent and dependent variables. The analysis unit was the energy sector of Saudi Arabia, and a stratified random sampling technique was employed. The targeted set of participants was divided into divisions. The stratum refers to the set of respondents from enterprises involved in fuel manufacturing that are accountable for improvements in performance and have expertise and understanding regarding strategic decisions related to zero waste management and the green supply chain of the enterprise, such as the management and administration.

The participants were randomly chosen from each stratum. The stratified random sampling technique was used to generate minor errors in the estimation, for instance, errors in the sample size, where targeted respondents were standardized similarly. To test the study hypotheses, questionnaires were distributed among respondents from the enterprises. For the data collection, we distributed 625 questionnaires to respondents with the help of two research assistants. After three months of brainstorming, we personally sent an e-mail to each respondent and also requested their participation in the study survey through several reminders. However, only 450 responses were complete and useable for further analysis, representing a 72% response rate. The remaining questionnaires were incomplete and were discarded. The criterion for participation in the study survey was that a company had to engage in the zero waste management practices and be implementing the latest green technology applications. The participants targeted in the study were members

of the senior administration, such as owners, chief executive officers (CEOs), and senior managers, who were involved in zero waste management activities.

The questionnaire included two sections. Section 1 contained questions on the demographics of the respondents, such as age, qualification, gender, and field experience. About 67.23% of the participants were male and were below the age of 40 years, and the other 32.77% of the respondents were female and were aged 27–40 years. Around 45% of the participants had a bachelor's level of education, and 23% of the respondents had a master's degree. The other 32% of the participants had a matric level of education. All participants had field experience ranging from 5 to 15 years.

2.3. Measurements

For measurement of the study constructs, items used in prior studies were modified and employed for the survey. The questionnaire was pre-checked by two academics and two scholars with proficiency in the business operational approach, and also, the aptness of each item in the questionnaire was considered. After feedback from scholars in the pretesting phase, the enhancement of long questions was conducted. To measure the study constructs, such as green technology (independent variable), the green supply chain (mediator), CSR intentions (moderator), and zero waste management (dependent variable), different item scales were adapted from previous studies. The validity of each item was measured with a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly disagree.

2.3.1. Green Technology

For the measurement of green technology, four item scales were used, a method adapted from [45]. This construct measures how green technology applications help to encourage the purchase of products that do not damage the environment. The sample item used was "In our enterprise, we constantly develop the potential for the achievement of green technology".

2.3.2. Green Supply Chain

To measure the green supply chain, a five-item scale was used. This was adapted from [46]. This variable measures how the internal management and supplier cooperation of an enterprise are beneficial for the achievement of ecological goals. An example question is "Our company purchases items and offers specific designs to suppliers that fulfill environmental obligations".

2.3.3. CSR Intentions

The CSR intentions were measured through a 4-item scale that was adapted from [47]. This variable measures the CSR intentions of the employees of an enterprise. A sample example is "Our Company makes use of media power to enhance our employees' CSR behavior".

2.3.4. Zero Waste Management

For the measurement of zero waste management, a 5-item scale was used. This was formulated with the help of [48]. This construct measures how greenhouse gas emissions, environmental improvements, engagement in recycling activities, and a reduction in waste lead to zero waste management. A sample example is "Our Company was highly committed to producing a quality product/service that supports zero waste management".

3. Results

The technique described in [49] was used to examine the discriminant validity. Table 1 presents the factor loading (FL), Cronbach alpha (α), and average variance extract (AVE) results. The discriminant validity and convergent validity were satisfied, as the convergent

validity (CR) and AVE results shown in Table 1 are greater than the cutoff values (i.e., CR greater than 0.70, AVE greater than 0.50, and CR greater than AVE).

Table 1. Composite Reliability, FL, and Average Variance Extracted.

	Items	FL	Cronbach's Alpha	CR	AVE
Green Technology	4	0.74–0.85	0.82	0.92	0.78
Green Supply Chain	5	0.71–0.82	0.86	0.93	0.74
CSR Intention	4	0.72–0.84	0.81	0.96	0.76
Zero Waste Management	5	0.76–0.87	0.87	0.94	0.72

The confirmatory factor analysis (CFA) is shown in Table 2. The construct validity was also identified through the CFA. This study linked a four-factor model with other alternative models: F1 = green technology (GT), F2 = green supply chain (GSC), F3 = CSR intentions (CSR Inn), and F4 = zero waste management (ZWM) were considered individual factors. According to [50], the results of the CFA model show a good fit to the data (χ^2 = 1065.44; $p < 0.001$; CFI = 0.96 and GFI = 0.98).

Table 2. Confirmatory Factor Analysis (CFA).

Model Description	χ^2	Df	χ^2/df	RMESA	GFI	CFI
Hypothesized four-factor model	1065.44	455	2.342	0.05	0.98	0.96
Three-factor model	1132.65	375	3.020	0.13	0.86	0.84
Two-factor model	1295.54	385	3.365	0.18	0.74	0.72
Single-factor model	1470.35	325	4.524	0.22	0.65	0.63

Table 3 specifies the results of the correlations for green technology, the green supply chain, CSR intentions, and zero waste management. Green technology was found to have a positive significant association with zero waste management (r = 0.32 **, p = sig). The green supply chain had a positive association with zero waste management (r = 0.34 **, p = sig. The CSR intentions had a positive significant relationship with zero waste management (r = 0.24 **, p = sig). The VIF scores also confirm that multicollinearity was not an issue in this study, as the values were less than 10.0.

Table 3. Results of the Means, Standard Deviations, and Correlations.

	Variable	Mean	SD	α	1	2	3	4	5	6	7
1	Business Size	3.00	1.02	0.83	1.00						
2	Respondent Experience	1.25	0.31	0.81	0.011	1.00					
3	Respondent Education	1.12	0.34	0.85	0.024	0.024	1.00				
4	Green Technology	3.26	0.22	0.87	0.105 **	0.016	0.022	1.00			
5	Green Supply Chain	3.75	0.35	0.84	−0.012	0.047 *	0.024 **	0.018	1.00		
6	CSR Intentions	3.24	0.31	0.86	−0.018	0.046 *	0.18 **	0.28 **	0.182 **	1.00	
7	Zero Waste Management	1.14	0.22	0.82	0.014	0.005	−0.03	0.327 **	0.348 **	0.245 **	1.00

Note: * $p < 0.005$; ** $p < 0.000$.

Table 4 shows the results regarding the hypothesis that green technology has a positive association with zero waste management. Structural equation modeling was utilized to check the positive influence of green technology on zero waste management. Table 4 shows that green technology was found to have a positively significant relationship with zero waste management, and this was proved analytically (β value = 0.24 **, Hypothesis 1 is proved $p \leq 0.000$).

Table 4. Hypothesis Testing of the Relationship between Green Technology and Zero Waste Management.

Model	Hypothesis Description	B	F	T	Sig	Remarks
Model #01	Green Technology to Zero Waste Management	0.24	24.035	0.1238	0.000	Accepted

The green supply chain mediates the link between green technology and zero waste management [51]. A method was applied to inspect the mediating effect of the green supply chain on the link between green technology and zero waste management (GT→GSC→ZWM). Table 5 shows an indirect effect, providing proof that the green supply chain acts as a mediator (β = 0.1645, Lower = 0.2470 to Upper = 0.3275). Thus, Hypothesis 2 (H2) was proved: the link between green technology and zero waste management is mediated by the green supply chain.

Table 5. Mediating Effect of the Green Supply Chain on the Link between Green Technology and Zero Waste Management.

Model Details	Data	Boot	SE	Lower	Upper	Sig
GT-SCM-ZWM	0.1645	0.2840	0.42	0.2470	0.3275	0.0000

The CSR intentions moderate the link between green technology and zero waste management. A hierarchal regression analysis was conducted to investigate the impact of green technology on zero waste management through the moderating role of CSR intentions. Table 6 shows the moderating role of CSR intentions on the link between green technology and zero waste management. The results provide proof that CSR intentions act as a positive moderator between green technology and zero waste management, i.e., (β = 0.26 **, $p < 0.01$). Hence, Hypothesis 3 (H3) was accepted.

Table 6. Hierarchal regression results for the moderating effect of CSR intentions.

	Zero Waste Management					
Detail	**Beta**	**T Value**	**Beta**	**T Value**	**Beta**	**T Value**
Step 1						
Business age	0.02	0.26	0.04	1.26	0.02	0.24
Business size	0.05	0.22	0.03	0.32	0.14	0.56
Respondent education	0.14	0.26	0.16	0.19	1.07	2.42
Respondent experience	0.12	0.24	0.18	0.54	0.02	0.14
Step 2						
Green technology			0.36 *	5.32	0.34 *	3.42
CSR intentions			0.24 *	4.65	0.28 *	5.63
Step 3						
GT*CSR-In					0.26 **	3.18
F		3.72 **		16.34 *		12.32 *
R2		0.02		0.24		0.22
R2				0.28		0.05

Notes: * $p < 0.0001$, ** $p < 0.05$ (two tailed); the results of the VIF were below the threshold level.

4. Discussion

The discussion on the findings begins with the significant hypotheses results and this is followed by a discussion on the insignificant results. This research supports three hypotheses and has vital implications for both theory and practice. As argued in the hypothesis section, the results of the considerable positive association between green technology and zero waste management aligns with the findings of previous research.

Hypothesis 1 (H1) states that the use of green technology has a positive influence on zero waste management. These outcomes are congruent and also confirm the findings of the previous research. The outcomes show that green technologies have been acknowledged as a significant aspect of zero waste management that supports enterprises in carrying out research and development activities in the advancement phase [26]. Green technology adaptation is a significant factor that supports green activities that lead to innovation and zero waste management, particularly in terms of lessening the deprivation of the atmosphere and reducing the greenhouse gas discharge during manufacturing processes [28]. Green technology developments have been growing to be effective approaches for handling zero waste problems. The findings confirm H1.

The H2 results demonstrate that the relationship between green technology and zero waste management is linked with the green supply chain. In this study, hypothesis 2 was supported by the empirical data showing that the green supply chain performs a mediation role in the link between green technology and strategic performance. The green supply chain plays a critical role in the achievement of the zero waste management in an enterprise. The green supply chain assists enterprises in acquiring knowledge about opportunities and methods that lead toward the attainment of zero waste management. The findings of this research support the work of prior scholars showing that the strategic integration of an enterprise with the help of suppliers can aid in the achievement of the desired zero waste management performance, because suppliers have a collection of resources, which reduces the uncertainty associated with the risks linked to ecological compliance and concerns [33]. Enterprises that focus on zero waste management practices and have strong support from suppliers via apt incentive schemes could have considerable linkages with successful applications of inventive green environment technologies [34]. The outcomes confirm that the green supply chain mediates the link between green technology and zero waste management.

H3 considered the moderating role of CSR intentions on the linkage between green technology and zero waste management. The outcomes were similar to the findings of previous studies that CSR intentions are the predominant driver of green technology use and zero waste management. CSR intentions motivate enterprises to adopt green technologies, which is primarily needed for companies to act in accordance with ecological standards before achieving zero waste management sustainable goals [38]. Enterprises that focus on CSR in their strategies will regularly evaluate consumers' demands to consistently enhance their environmental performance and zero waste management [39,52]. The outcomes support H3 by showing that CSR intentions strengthen the relationship between green technology and zero waste management.

4.1. Practical Implications

The findings of this study add to the justifications of policy makers and management in the following ways. Firstly, enterprises that impose advanced ecological standards and implement green technology in their production processes and activities could have lower development costs and produce higher quality products. One fascinating discovery is that about 69% of enterprises in the population do not use any green technologies or practice zero waste management [6]. Hence, this research suggests that the management of enterprises must emphasize the implementation of green technologies that support the improvement in zero waste management. Secondly, enterprises should play a proactive role in the design of green supply chain practices and green infrastructure based on the implementation of green technology and the provision of training to promote zero waste management competitive activities in the enterprise.

Thus, the current study suggests that enterprises should focus on both the external environment and interior management to put a spotlight on the operations of the company that influence its green supply chain. By paying attention to internal management activities and the green supply chain, an enterprise can solve dilemmas faced by the company through the implementation of green technologies, thereby guiding them toward the

achievement of zero waste management. Third, the current research adds to knowledge contained in the literature on green technology, CSR intentions, and zero waste management. Enterprises with high CSR intentions are able to implement green technologies that support effective zero waste management. Accordingly, this study recommends that management should improve their CSR intentions to enhance zero waste management in enterprises.

4.2. Theoretical Implications

The current research adds to the body of knowledge on green technology and zero waste management in several ways. First, this research adds to the body of knowledge on zero waste management by examining its antecedents from the viewpoint of green technology. Previous studies have emphasized other antecedents associated with zero waste management. Secondly, this research corroborates the empirical model by employing survey data from the energy sector. Therefore, this research broadens the body of knowledge on green technology and zero waste management by identifying the mediating role of the green supply chain. However, the awareness on the extent to which the green supply chain affects zero waste management is limited. The current study gives profound and timely insights on whether the green supply chain affects zero waste management. Third, our study expands the body of knowledge on green technology and zero waste management through investigating the role of CSR intentions on their link. This gives a probable reason for the inconsistent outcomes in the prior research. We showed that CSR intentions strengthen the linkage between green technology and zero waste management, which aids in green product development and the innovation process. Pressure from the government, corporate resources, expected economic benefits, government regulations, and the ecological understanding of the management are considered driving forces of zero waste management. Thus, the current research supplements the prior literature by investigating the influence of CSR intentions on zero waste management and its link with green technology.

4.3. Limitations and Future Directions

Although it provides insight for future research directions, this paper has several limitations. In addition to the different factors examined in this study, many other aspects can affect the intentions of an enterprise, for instance, product brand loyalty and product knowledge. Based on this perspective, upcoming studies could consider a more extensive range of factors to provide more accurate and inclusive results. Second, because zero waste management is a novel phenomenon for many companies, companies that are in their growth stage may have less knowledge and information about zero waste management. Third, this research was carried out on the Arab energy sector and had a small simple size. In future studies, scholars must conduct research on several other sectors, for instance, agricultural enterprises and big industries. Lastly, the current research used the green supply chain as a mediator and CSR intentions as a moderator. In the future, other constructs could be used as moderators and mediators in the same empirical model.

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