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How Green Organizational Strategy and Environmental CSR Affect Organizational Sustainable Performance Through Green Technology Innovation Amid COVID-19

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The growth of green-oriented businesses for sustainable development (SD) is no longer optional in the current dynamic world, especially for manufacturing businesses in general. Accordingly, the present study investigates the interlinkages between green organizational strategy (GOS), environmental corporate social responsibility (ECSR), and organizational sustainable performance (OSP) by exploring the key mediating role of green technology innovation (GTI). This study uses a quantitative method to gather data from Chinese manufacturing industries, employing a well-structured questionnaire. Senior and middle-level managers were the intended respondents. From the primary survey, 264 valid responses were gathered. The final data were analyzed using SmartPLS (version 3.3.9) by adopting structural equation modeling (SEM) to examine the associations between the targeted constructs, and the results add to the recent literature by offering a cohesive model of GOS, ECSR, GTI, and OSP. The findings revealed that GOS has a strong positive effect on ECSR, GTI, and OSP. Further, ECSR has a strong positive impact on GTI and OSP. Meanwhile, GTI is a key mediating variable in these relationships, which previous studies have not explored. This study innovatively integrates the three green traits, namely, GOS, ECSR, and GTI, into a comprehensive model that is understudied in existing literature in order to help businesses improve their sustainable competitive advantage. The ultimate aim is to help businesses improve their environmental performance and achieve solid sustainability over the long term.

Keywords: green organizational strategy, environmental CSR, organizational sustainable performance, green technology innovation, structural equation modeling

1 INTRODUCTION

Economic growth and development are inextricably related to social and environmental challenges (Chen et al., 2021). In the context of current fast-paced development, corporate stakeholders are increasingly concerned with societal and environmental emergencies (Le, 2022). A variety of harmful human actions and changing climatic circumstances pose a substantial hazard, resulting in various ecological repercussions (Yang et al., 2022). Further, the environmental regulation issue puts additional pressure on firms to take appropriate and timely steps to control the impact on the environment, economy, and society (Fernando et al., 2019). Environmental penalties for breaking environmental laws also affect environmental development and the community (Ding and Shahzad, 2022a). Against this backdrop, the United Nations (UN) developed the 2030 Agenda for Sustainable Development program, which discusses the multiple ongoing concerns connected to ecological degradation, climate change, zero hunger, and other adverse impacts of various manufacturing operations (Kumar et al., 2020). People have witnessed and uploaded blue sky pictures via social and print media due to the suspension of industrial activity during COVID-19 lockdowns, indicating that these lockdowns improved air quality worldwide. However, we cannot reduce or eliminate industrial operations; we can only encourage green manufacturing practices that adhere to sustainable development (SD) goals (Novitasari et al., 2022).

Despite the issues and concerns mentioned above, the corporate world's recent significant efforts toward socially responsible activities are noteworthy. Organizations are increasingly becoming extremely concerned with their ecological and sustainable performance; according to Shahzad et al. (2021), they can reduce the potential adverse effects of their operations on the natural environment by enhancing socially responsible behavior, innovation, and green organizational strategies. However, more efforts are required regarding environmental concerns such as "climate change," "pollution," and "glasshouse gas emissions," which have not been adequately addressed at the corporate level (Li et al., 2020). An individual or an organization cannot handle the environmental problem in the short term; it necessitates a synchronized shift of environmental awareness and policies (Kumar et al., 2020). In this regard, organizations play a critical part in this process since they must be able to translate an idea into an actual plan to tackle this matter. As a result, a green organizational strategy (GOS) has been proposed as a strategic resolution to position and then drive enterprises towards sustainable initiatives based on environmental and social challenges (Le, 2022).

GOS is described as a complementary approach to operational business strategies, designed to assist enterprises in decision-making that protects the natural environment (Olson, 2008). GOS helps keep businesses on track, remain ethical, and fulfill their commitments to meet their stakeholders' expectations. According to stakeholder theory (ST), environmental and social advantages and economic interests must be considered (Freeman et al., 2020). Therefore, GOS is critical both for organizations and stakeholders. However, GOS alone is insufficient for the firm to be sustainable; to achieve organizational sustainable performance (OSP), practices and actions aligned with the green strategic direction are required. Environmental corporate social responsibility (ECSR) and green technology innovation (GTI) are of the utmost importance in their association with GOS. ECSR and GTI are believed to be well-integrated with GOS in providing OSP as the business paradigm is shifting from a profit-oriented to a triple bottom line (TBL) approach, centered around the social, environmental, and economic dimensions of SD (Shahzad et al., 2020a). Given the worldwide concerns regarding achieving SD, world-renowned organizations such as DuPont Sorona have successfully transformed their conventional production into sustainable and innovative polymer production using renewable plant-based ingredients. Now they are using 40% less energy and releasing 56% less gas emissions (Dupont, 2019). Further, Google, Apple, and Accenture have started to prioritize green and sustainable business activities, as "more than 84% of S&P 500 executives" trust that their innovation is a precondition for the success of their corporation (Khalil and Nimmanunta, 2021; Le, 2022). These examples highlight the importance and understanding of environmental issues and their relationship with SD.

Despite its importance, no empirical study in the current literature has examined the impact of GOS, ECSR, and GTI on long-term business success (Sun and Razzaq, 2022). These features are currently being investigated in the prevailing literature in a non-collective manner, and combined research on GOS driving ECSR and GTI to realize OSP is noticeably lacking (Ding and Shahzad, 2022b; Jin et al., 2022; Le, 2022; Wang et al., 2022). Shahzad et al. (2020a) investigated the influence of various dimensions of CSR on environmental sustainability and GI in the manufacturing industry. The results highlighted that ECSR is the stronger predictor of ecological sustainability and GI. Wang et al. (2022) also identified that green strategies and sustainable decision-making help promote CSR and sustainable goals. Shahzad et al. (2020b) further highlighted that sustainable practices (environmental, economic, and social) also significantly impact corporate green innovation. In the study of Jin et al. (2022), the researchers explored how sustainable and green practices, including information and communication technology, positively affect GTI. Shahzad et al. (2022) acknowledged the critical role of ethical motives for green management practices in manufacturing organizations. Therefore, the present study intends to fill this gap by examining the relationship of GOS and ECSR in encouraging GTI towards attaining OSP, where GTI plays an interceding role in the GOS to OSP and ECSR to OSP relationships. In this context, manufacturing industries in evolving economies are considered for many reasons. First, the manufacturing sector is strongly associated with environmental problems and creates a very high proportion of countries' GDP (Sun et al., 2022). Subsequently, sustainability stimulates manufacturing in general, especially in emerging economies. This is because they generally have limited knowledge and resources (Bouzon et al., 2018; Shahzad et al., 2020c). Following the above discussion, the goal of this innovative work is to fully comprehend how GOS promotes ECSR and GIT

in organizations in order to achieve OSP in harmony with the TBL. These linkages are examined in this context using resource-based theory (RBV) and ST. In order to achieve this objective, this study aims to answer the following questions:

1) How do GOS and ECSR promote GTI to achieve OSP?
2) How does GTI mediate the relationship among GOS, ECSR, and OSP?

This research will supplement the literature regarding the association among GOS, ECSR, GTI, and OSP and provide significant implications and novel findings for business leaders to promote green and sustainable organizational strategies in an all-encompassing model. This research also emphasizes the key interceding role of GTI among the targeted constructs, which is still limited in prior works. Furthermore, the empirical analysis is performed using an innovative structural equation modeling (SEM) approach and the results have significant implications. The remainder of this study is structured as follows. Section 2 presents the theoretical basis and the development of the hypotheses. The research technique is described in **Section 3**. Section 4 details the data analysis procedures, and the results and implications, including future research directions, are discussed in Section 5.

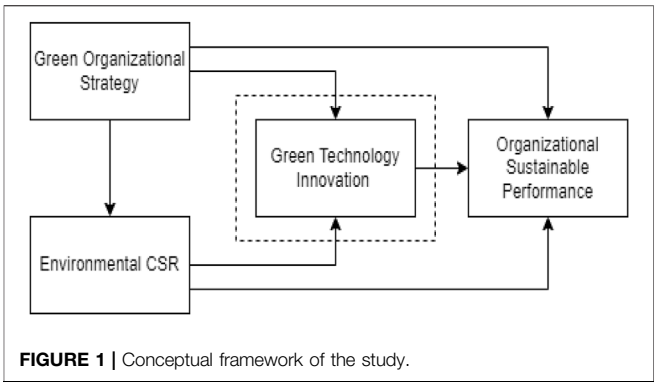

FIGURE 1 | Conceptual framework of the study.

2 THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

2.1 Theoretical Background

RBV has been persistently utilized in the sustainable management context to define internal organizational virtues and shortcomings and their relationship with a competitive edge and performance (Barney et al., 2011). RBV is a harmonizing theory that could help an organization to comprehend the most appropriate means and technologies to advance specific production and process efficiency (Savino and Shafiq, 2018). These resources include all skills, processes, tools, knowledge and information, organizational qualities, and other resources that enable a corporation to conceive and deploy plans that advance its effectiveness (Barney, 1991). Furthermore, Barney (1991) highlighted that these physiognomic resources are VRIN ["(a) valuable, (b) rare, (c) inimitable, and (d) non-substitutable"]. In contrast, RBV is restricted to unraveling firm-level repercussions and ignores the impact of SD on the environmental conditions (Andersén, 2021). In response, Hart (1995) developed natural RBV (NRBV). NRBV widens the scope of RBV by acknowledging the significance of the environment. It is further described as "a theory of competitive advantage based on the firm's relationship with the natural environment" (Hart, 1995). This theory further examines how organizational green resources might lead to competitive advantages and sustainable outcomes. By adopting NRBV, environmentalists and ecologists have claimed that GTI would make a business more affluent and boost its long-term success (Shahzad et al., 2020b).

Similarly, ST hypothesizes that diverse stakeholders' pressure and involvement encourage companies to advocate for sound ecological practices to realize sustainable and green development (Sarkis et al., 2011; Forcadell et al., 2021). If a company wishes to succeed, it should consider the benefits of all of its shareholders: every stakeholder is critical to the company's success (Freeman et al., 2020). In this study, GOS and ECSR initiatives are viewed as business endeavors to satisfy the concerns of many stakeholders, particularly those with a focus on the global environmental and societal crisis. Diverse stakeholders pressure businesses to develop green and sustainable strategies, policies, and activities aligned with the ecological goals to promote OSP (Fernando et al., 2019; Guo et al., 2020). RBV and ST support the theoretical framework that an organization employing GOS and ECSR has a high chance of adopting GTI to manufacture green products to promote OSP. Further, current research argues that GTI plays a magnificent role in enhancing OSP. The framework of the study is provided in **Figure 1**.

2.2 Hypotheses Development

2.2.1 Green Organizational Strategy (GOS)

GOS is well-defined conceptually as a coordinated plan for the business, operation, and resource strategies. It assists industries in making decisions that have the most significant favorable influence on nature and the environment (Olson, 2008; Le, 2022). It incorporates environmental considerations and hazards into decision-making to achieve ecological sustainability. Notably, such actions are applied voluntarily and willingly as a corporate responsibility to society and the environment and to provide long-term advantages to stakeholders (Chang, 2016). GOS is tackled in a different way than the traditional strategy: the traditional approach focuses solely on the economic, social, and political settings, ignoring the natural environment and environmental threats (Jin et al., 2022). Irrespective of the many tactics to achieve the objective of GOS, in this setting, it is viewed as actual CSR to stakeholders by including ecological challenges into company culture and commercial decision-making for long-term sustainable goals (Arfara and Samanta, 2020). Increased stakeholder knowledge the ecological emergency has acted as a driver for firms to respond quickly to address stakeholder demands in support of ecological issues (Ding and Shahzad, 2022b; Ding et al., 2022). GOS is commonly regarded as a complementary business strategy (public or private) that serves as a guide for resolving the ecological emergency in the best possible way. Previous studies

TABLE 1 | Demographic details.

	Frequency	Percent (%)
Gender		
Male	156	57.58
Female	108	42.42
Education		
Bachelor's	114	43.18
Master's	105	39.77
Others	45	17.05
Job title		
Coordinator	96	36.36
Supervisor	79	29.92
Senior Manager	67	25.38
CEO/Directors	22	8.33
Experience (years)		
<10	143	54.17
10 to 15	78	29.55
>15	43	16.29

have highlighted that adopting green and sustainable practices allows firms to differentiate themselves from their competition. As a result, the business gains a competitive edge, improves market performance, and increases efficiency, leading to improved economic and non-economic performance (Arfara and Samanta, 2020).

Furthermore, Le (2022) acknowledged the positive association between green strategy, CSR, and firm performance. According to Barney et al. (2011), GOS is viewed as a strategic enterprise resource crucial in boosting ECSR activities and GTI application to gain a sustainable competitive edge and attain OSP. Given the preceding rationale, the following hypotheses regarding the linkage between GOS, ECSR, GTI, and OSP are proposed:

H1. GOS has a favorable effect on ECSR.
H2. GOS has a favorable effect on GTI.
H3. GOS has a favorable effect on OSP.

2.2.2 Environmental CSR (ECSR)

In the current situation, where various socio-environmental concerns are threatening humanity, CSR has emerged as one of the rising areas in the literature on management, and its importance to the community is growing (Skarmeas et al., 2014). Carroll (1979) asserted that the "social responsibility of organizations includes the legal, economic, ethical, and philanthropic expectations that society has of businesses at a given point in time." Farooq et al. (2014) classified the four main dimensions of CSR as environmental, consumers, employees, and community. Further, ECSR revolves around organizational obligations for ecological protection, climate change, accountable industrial waste management, and emission reduction, among other things (Turker, 2009; Farooq et al., 2014; Shahzad et al., 2019). Previous research has identified that CSR positively affects sustainable performance in Asian countries. For example, Shahzad et al. (2019) claimed that more responsible firms outperform others in terms of sustainable performance. Moreover, Shahzad et al. (2020a) acknowledged that ECSR has a more substantial positive effect on environmental SD and green innovation than other CSR dimensions (consumers, employees, and community) using a novel second synthetic grey relational ranking approach. Integrating green initiatives into CSR activities is critical for improving enterprises' competitiveness in the marketplace and assisting enterprises in accumulating a competitive edge, reducing ecological costs via waste minimization, energy conservation, and revenue growth, improving company reputation and customer loyalty, and cultivating economic performance (Pan et al., 2020; Le, 2022).

Further, CSR also promotes green technology adoption. Environmental performance is also linked to business performance (Farooq et al., 2014). In the current setting, let us assume that ECSR is best suited for GTI to encourage the implementation of green innovation, ultimately facilitating OSP. Based on the above considerations, the following links between ECSR, GTI, and OSP are hypothesized:

H4. ECSR has a favorable effect on GTI.
H5. ECSR has a favorable effect on OSP.

2.2.3 Green Technology Innovation (GTI)

Green technologies that are energy effectual are predicted to become a leading factor in mitigating environmental problems resulting from the industrial revolution, effectively reducing targeted carbon emissions by over 60% (Jin et al., 2022). Monitoring pollution, waste management, and clean technology are examples of GTI (Chen and Lee, 2020). Furthermore, GTI may be contingent on the specific social, environmental, and economic aspects related to the TBL (United Nations, 2018) as GTI is way of developing new ideas, items, services, and processes that could be applied to address environmental issues (Sun et al., 2021). Understanding the inclusive relationship between TBL and GTI, on the other hand, is critical to achieving the UN's Sustainable Development Goals (SDGs). GTI implementation can increase competitive advantages through green product quality and cost reduction, enhance productivity and profitability, and simultaneously improve sustainable performance and growth (Shahzad et al., 2021; Sun et al., 2021; Jin et al., 2022). Furthermore, the degree of GTI favorably influences OSP in such a way that it improves product distinctiveness based on market trends (Ong et al., 2019). As a consequence, the business's market efficiency and environmental performance increase. Jum'a et al. (2022) also identified that sustainable-oriented innovation has a strong positive impact on all dimensions of sustainability, namely, social, environmental, and economic. Chang (2016) underlined that environmental and green technological abilities, ecological regulations, and market and customer green demands are also central elements of GTI. GTI also helps to save costs related to the amendment of products, operations, and processing (Novitasari et al., 2022).

As per the above discussion, the direct link between green innovation and operational performance is well-established; however, the research on GTI and OSP is still in its infancy. Furthermore, this study also proposes the key mediating role of

TABLE 2 | Fornell-Larcker criterion.

	ECSR	GOS	GTI	OSP
ECSR	0.833	-	-	-
GOS	0.666	0.807	-	-
GTI	0.572	0.720	0.812	-
OSP	0.544	0.689	0.665	0.814

ECSR, environmental CSR; GOS, green organizational strategy; GTI, green technology innovation; OSP, organizational sustainable performance.

TABLE 3 | HTMT ratio.

	ECSR	GOS	GTI	OSP
ECSR	-	-	-	-
GOS	0.615	-	-	-
GTI	0.793	0.772	-	-
OSP	0.564	0.762	0.718	-

ECSR, environmental CSR; GOS; green organizational strategy; GTI, green Technology Innovation; OSP, organizational sustainable performance.

GTI among ECSR, GOS, and OSP. Hence, the following hypotheses are proposed:

H6. GTI has a favorable effect on OSP.
H7. GTI partially mediates the relationship between GOS and OSP.
H8. GTI partially mediates the relationship between ECSR and OSP.

3 MEASURES AND VALIDATION

ISO-certified manufacturing industries listed on the Shanghai Stock Exchange comprise the target population. The focus of this study is on China for cross-sectional analysis, considering that Chinese manufacturing industries comprise over 90% of the overall business establishment, along with a considerable contribution to GDP. Chinese manufacturing industries contribute 56% to the annual GDP and create 75% of employment opportunities (Waheed and Zhang, 2020). Manufacturing has enormous potential to create economic growth and prosperity in developing countries (Shahzad et al., 2022). The number of workers working in the manufacturing industry is unclear because the analysis unit is individuals. The survey questionnaire was originally written in English before being translated into Chinese by Chinese researchers. Since they have detailed knowledge of corporate affairs and other relevant procedures, we communicated with upper, medium, and front-level staff members, in line with previous research (Shahzad et al., 2020b). Accordingly, these were considered the most suitable respondents for this study.

This study adopted a 10× rule for sample size. Hair et al. (2016) proposed "10 times the largest number of structural paths directed at a particular latent construct in a structural model." The questionnaire was circulated among 850 respondents via email, WeChat, LinkedIn, and other social media platforms. The data collection process took six months to complete, beginning in September 2021 and ending in March 2022. A total of 279 surveys with satisfactory responses were returned. We obtained 264 surveys after removing those that lacked key information or had missing data, resulting in an actual response rate of 31%. The sample summary is presented in **Table 1**.

For this study, the researchers split the survey into two main sections. The first section is related to the respondents' demographic information, and the other section contains survey items related to our targeted variables, namely, GOS, ECSR, GTI, and OSP. Four items were selected for ECSR (Turker, 2009; Farooq et al., 2014). Eight items were connected to GOS, adopted from Le (2022) and Olson (2008). Further, we used a six-item scale for GTI adopted from Chen et al. (2006) and Shahzad et al. (2020c). Furthermore, a six-item scale was adopted for OSP (Wang, 2019; Le, 2022). The items were rated by means of a seven-point Likert scale (7 = strong agreement; 1 = strong disagreement). We conducted a pilot study before official data collection to confirm the validity and reliability of the accepted constructs in the research environment.

4 RESULTS AND ANALYSIS

4.1 Analytical Approach

Following Hair et al. (2017), we utilized PLS-SEM to analyze the data in this research. The main attraction of this technique is that it allows academics to approximate complex models with multiple constructs without imposing data distribution assumptions. It is a causal prognostic approach to SEM that emphasizes predictions when estimating statistical models, the structure of which is envisioned to explain causal relationships (Hair Jr et al., 2016). This technique caters for small sample sizes while providing the most accurate results possible.

4.2 Common Method Bias (CMB)

Common method bias (CMB) is a primary concern in survey-based studies. CMB is caused by the bias or variances that exist in the measurement methods of the survey rather than being caused by the constructs (Podsakoff et al., 2012). Many expert statisticians and researchers have developed sophisticated statistical measures to control CMB. Preventive strategies include respondent anonymity, avoiding complicated and confusing questions, and providing extensive recommendations in the survey to avoid bias and inaccuracy. Along with these traditional measures to control CMB, we applied a modern approach suggested by Kock (2015). This measure is based on a full collinearity test using the inner variance inflation factor (VIF) of all constructs. We estimated the inner VIF by using each construct as the dependent variable. The standard value for the inner VIF recommended by Kock (2015) is 3.30; if the inner VIF value exceeds this threshold, it signals that there common method bias exists in the methodology. Our results illustrate that all values of inner VIF are less than the threshold of 3.30, proving that CMB does not exist in this research.

4.3 Outer or Measurement Model

PLS-SEM contains two main models: the outer or measurement model, which is used to assess the reliability and validity of

TABLE 4 | Reliability and validity.

Constructs	Item	Loading	α	CR	AVE	VIF
ECSR	ECSR1	0.76	0.89	0.91	0.69	1.894
	ECSR2	0.79				1.519
	ECSR3	0.77				1.672
	ECSR4	0.84				2.370
GOS	GOS1	0.78	0.90	0.92	0.67	2.284
	GOS2	0.75				2.437
	GOS3	0.82				1.876
	GOS4	0.84				2.511
	GOS5	0.83				1.894
	GOS6	0.84				1.519
	GOS7	0.78				1.572
	GOS8	0.79				2.370
GTI	GTI1	0.86	0.84	0.88	0.66	1.894
	GTI2	0.84				1.565
	GTI3	0.83				1.721
	GTI4	0.81				2.370
	GTI5	0.84				2.741
	GTI6	0.82				2.437
OSP	OSP1	0.71	0.88	0.89	0.68	2.421
	OSP2	0.74				2.722
	OSP3	0.79				1.863
	OSP4	0.85				2.151
	OSP5	0.81				1.984
	OSP6	0.82				1.719

ECSR, environmental CSR; GOS, green organizational strategy; GTI, green technology innovation; OSP, organizational sustainable performance.

constructs; and the inner structural model, which is used to test the hypothesized correlations. Following Hair et al. (2017), we evaluated the validity and reliability of the constructs by evaluating the internal consistency, discriminant validity (DV), and convergent validity. DV has been defined by Fornell and Larcker (1981) as "how the constructs of the study are different from each other in the context of the same model." Using the Fornell-Larcker criterion, we compared the root of average variance extracted (AVE) with the inter-construct correlation. The root of the AVE must be greater than the correlation values in the same column to confirm the DV of the constructs. **Table 2** illustrates the values for the Fornell-Larcker criterion; all the values fulfill the criteria (Fornell and Larcker, 1981). Another measure, suggested by Henseler et al. (2015), has been used to validate the DV of constructs, namely, the HTMT ratio. The threshold level of HTMT is 0.85. The HTMT ratio for all constructs was less than 0.85, indicating no DV issues (Henseler et al., 2015). **Table 3** presents the detailed results.

Reliability tests are employed to measure consistency, whereas DV and convergent validity tests are used to confirm the validity of the constructs (Hair et al., 2016). Factor loadings ensure that the questions for a construct measure precisely what that are intended to measure (Sarstedt et al., 2017). The threshold for the factor loading of items is 0.70, and items with loadings below this threshold should be dropped. **Table 4** illustrates the findings for the validity and reliability of the variables. Factor loadings fulfill the criteria of 0.70, as proposed by Hair et al. (2017). Cronbach's alpha (α) and composite reliability (CR) are used to assess the reliability of constructs; as shown in **Table 4**, the α and CR values surpass the threshold level as suggested by Cohen (1988) and Hair et al. (2017). Convergent validity, on the other hand, is evaluated through AVE; the results are shown in **Table 4**, which are larger than the threshold of 0.50, as suggested by Sarstedt et al. (2017).

4.4 Inner or Structural Model

Since the outer measurement model reflects the validity and reliability of the constructs, now the inner structural model is our main concern. The inner or structural model is intended to evaluate the path relationships. The inner model consists of path coefficients, significance tests, the goodness of fit, and the coefficient of determination.

4.4.1 Significance of Path Coefficients

PLS-SEM uses the path coefficient term, which is similar to the beta coefficient of regression analysis. Path coefficients reflect the unit variation in dependent variables caused by independent variables and provide the basis for hypothesis acceptance and rejection. The higher the value of the coefficient, the stronger the impact of that particular variable on the dependent variable. However, the beta coefficient alone is insufficient to determine hypothesis acceptance; it is the *t*-statistic that is used to assess the significance of the coefficient. The bootstrapping procedure was used to calculate the coefficients, *t*-statistics, and *p*-values. **Table 5** illustrates the results of the regression analysis. *H1* anticipated a positive association between GOS and ECSR, and results in **Table 5** support *H1* (β = 0.785, *t*-statistic = 12.19, p = 0.000). We detected a positive association between GOS and GTI (β =

TABLE 5 | Regression analysis.

Hypothesis	Coef.	*t*-statistic	*p*-value	Decision
H1: GOS—> ECSR	0.785	12.19	0.000	Supported
H2: GOS—> GTI	0.531	7.096	0.000	Supported
H3: GOS—> OSP	0.200	2.828	0.005	Supported
H4: ECSR—> GTI	0.197	2.512	0.012	Supported
H5: ECSR—> OSP	0.224	3.426	0.001	Supported
H6: GTI—> OSP	0.635	11.39	0.000	Supported
	Mediation analysis (total and indirect effects)			
GOS—> OSP	0.200	2.828	0.005	Supported partial mediation
H7: GOS—> GTI—> OSP	0.086	2.920	0.004	
ECSR—> OSP	0.224	3.426	0.001	
H8: ECSR—> GTI—> OSP	0.041	2.210	0.028	

p-*values = 0.000 shows significance level ***.*

TABLE 6 | Coefficient of determination.

	R^2	R^2 adjusted
OSP	0.709	0.706
GTI	0.633	0.628

TABLE 7 | The goodness-of-fit (GOF) index.

	AVE	R^2	GOF
ECSR	0.69		
GOS	0.67		
GTI	0.66	0.633	
OSP	0.68	0.709	
Average	0.675	0.671	
GOF			0.670

0.531, *t*-statistic = 7.096, p = 0.000); hence, *H2* is robustly accepted. *H3* posited a positive relationship between GOS and OSP; the results support *H3* (β = 0.200, *t*-statistic = 2.828, p = 0.005). *H4* posited a positive relationship between ECSR and GTI; this hypothesis is accepted empirically (β = 0.197, *t*-statistic = 2.512, p = 0.012). *H5* is also supported by the results (β = 0.224, *t*-statistic = 3.426, p = 0.001), which predicted a positive association between ECSR and OSP. In *H6*, we proposed a positive relationship between GTI and OSP, and the results strongly support this (β = 0.635, *t*-statistic = 11.39, p = 0.000). Further, we checked the mediation of GTI through the two-step approach proposed by Hair et al. (2017). In the first stage, this study looked at the indirect effect of GOS on OSP through GTI. With a β value of 0.200, the indirect impact of GOS was determined to be significant. We also looked at the direct impact of GOS on OSP without eliminating the mediator (GTI) in the second phase and found that GOS has a significant positive effect (β = 0.086). As a result, complementary partial mediation supports *H7*. Similarly, the indirect impact of ECSR on OSP via GTI was substantial (β = 0.224), while the direct effect of ECSR on OSP without GTI was shown to be significant (β = 0.041). As a result, *H8* is supported, showing complimentary partial mediation. These findings reveal partial mediation. Furthermore, both the indirect and direct effects showed a positive indication, showing that GTI exhibits complementary partial mediation. Thus, all the developed hypotheses in the study are accepted. Further, the coefficient of determination was employed to quantify the model's predictive accuracy and measure the overall effect size. **Table 6** provides R^2 values; the value for OSP is 0.709, explaining 70.9% variance in OSP. The R^2 value for GTI is 0.633, explaining 63.3% of variance.

4.4.2 Goodness-of-Fit (GOF) Index

The GOF index is utilized to quantify the model fit to confirm that model adequately explains the data (Hair et al., 2017). The GOF index ranges from 0 to 1, with 0.10 considered a minor value for validating the model, 0.25 a medium value, and 0.36 substantial enough to demonstrate the global validation of the model, while also indicating that the model is rational (Henseler et al., 2016). We used the formula given below to calculate the GOF index. The mean of AVE values and R^2 values were used to calculate GOF, which is 0.670, considered substantial and indicating a good model fit. The model fit is shown in **Table 7**; the SRMR value is also below the threshold value of 0.08, fulfilling the standard criteria (Hair et al., 2017).

$$GOF = \sqrt{\overline{AVE} * \overline{R^2}}$$

5 DISCUSSION AND CONCLUSION

5.1 Discussion of the Key Findings

This study integrates RBV and ST in a study framework that observes the GOS, ECSR, GTI, and OSP relationships. We collected data from Chinese manufacturing industries to test the hypotheses in this study. Despite the literature suggesting a positive association between GOS, ECSR, GTI, and OSP, no study has empirically examined these associations in an inclusive research model. This work makes a substantial contribution to the existing literature by being the first to assess the effects of these targeted variables in an all-encompassing model; further, identifying the critical mediating role of GTI is also a considerable contribution. According to the results of our data, GOS inspires ECSR, GTI, and OSP to implement environmental preservation methods as predicted by RBV theory. Our results suggest that GOS has a significant effect on ECSR, GTI, and OSP, with beta values of 0.785, 0.531, and 0.200, respectively, confirming *H1*–*H3*. These findings are in accordance with Le (2022) and Yousaf (2021). Arfara and Samanta (2020) also argued that GOS is not enough independently to explain the phenomenon under study; the present study shows that ECSR plays a key role in GTI implementation for OSP enhancement. This discovery adds to the existing literature since this mediation mechanism has not been empirically investigated in the past.

Additionally, the effects of ECSR on GTI and OSP were also found to be significant, with beta values of 0.197 and 0.224, respectively, supporting *H4* and *H5*. These outcomes are consistent with Shahzad et al. (2019) and Shahzad et al. (2020a). Khalil and Nimmanunta (2021) also claimed that ECSR could be a significant source for businesses to innovate proactively, which leads to OSP. Furthermore, GTI was shown to have a significant direct impact on OSP, with a beta value of 0.635, supporting *H6*. These findings align with Le (2022) and Shahzad et al. (2021), who found a positive connection between GTI and OSP. Jum'a et al. (2022) also emphasized that sustainable innovation significantly affects organizational TBL. According to these authors, the GTI level influences OSP to differentiate the company from competitors by producing eco-friendly and consumer-friendly innovative goods. Consequently, market efficiency improves, competitiveness improves, and ecological performance improves. In addition, GTI was also shown to play a key complementary partial mediating role among GOS, ECSR, and OSP, with beta values 0.086 and 0.041, supporting *H7* and *H8*. GTI thus plays an influential role in cultivating environmental awareness and achieving OSP. In this research,

sustainable innovation refers to new technologies and techniques that help the environment and businesses in a way that improves long-term competitive advantage and sustainable performance.

5.2 Research Implications

From a theoretical standpoint, this study adds to the limited literature in various ways. First, the suggested model adds to the sparse literature on GOS, ECSR, GTI, and OSP, especially in the Chinese industry context. This study has investigated an uncharted region and tried to fill a literature gap by empirically assessing the crucial role of GOS and ECSR in implementing GTI for enhancing OSP with the help of the RBV and ST. GOS and ECSR allow all stakeholders to stand on the same platform, which may assist firms in achieving their targeted sustainable goals. This study supports the assertion that incorporating ecological and social sustainability into organizational strategies and decision-making procedures drives organizational behavior toward societal norms, values, and environmental and social urgency. Second, this study has demonstrated the significance of the green tactic in the literature on sustainability. Awan et al. (2017) suggested that GOS and ECSR initiatives by firms are essential for improving environmental protection by signifying a strong environmental obligation. These initiatives also support the implementation of GTI. Further, the key mediating role of GTI also highlights that OSP becomes a reachable target by saving energy resources and reducing pollution, carbon emissions, industrial waste, and water pollution backed by GOS and ECSR initiatives. Further, according to our findings, GTI is the most significant motivator, providing answers for ecological deterioration and economic efficiency. As the global acceptance of hybrid and electric automobiles demonstrates, green solutions may change a sector with a significant carbon footprint into a sustainable, lucrative, and cost-effective business. The examples above and our results indicate that when organizations and stakeholders seek to pursue SD, environmental protection plans help them to the raise GTI.

Based on the current research findings, some practical implications and policy recommendations are proposed that may support the importance of incorporating GOS and ECSR activities into organizations' operations to help them become eco-innovative in terms of technological innovation and environmental sustainability. It is now advised that regulatory, government, and senior leaders commit to attaining SD. This commitment has been followed by increased interest in green strategies and ECSR programs. Our findings indicate that organizational commitment to CSR would drive GTI and eco-sustainability. Organizations must prioritize green strategy and ECSR to achieve more ecologically sustainable outcomes. Organizations have invested vast resources in CSR and TBL cognizance worldwide; however, these are ineffective in the Asian area, possibly because corporations are unaware of the desire to address environmental concerns (Farooq et al., 2014). Governments and legislators should take remedial actions to minimize environmental degradation caused by poor industrial practices and waste and invest in promoting sustainable operations through growing GTI in developing nations such as China. Finally, this research has highlighted that techno-driven firms that focus on new technologies and capitalize on process and product innovation are able to attain SD; GOS and ECSR actions are also among the contemporary economy's key components.

6 CONCLUSION

This research study contributes to the growing literature in the SD field by examining the impact of GOS, ECSR, GTI, and OSP on the manufacturing industry by using the SEM with a sample size of 264. We developed eight hypotheses based on previous literature and RBV and ST. The direct association between GOS, ECSR, GTI, and OSP was investigated in this study. Further, the discovery of the mediating role of GTI in these relationships represents a significant contribution. The findings show that GOS, ECSR, and GTI are essential in accomplishing OSP goals, both directly and indirectly, through GTI. Based on the results, the following suggestions to key stakeholders are made. First, organizations should use green and sustainable strategies in their decision-making to reap the benefits of green development. Second, organizations should implement a green plan. Notably, the green approach should be integrated with the ECSR strategy to promote GTI and sustainable growth. Furthermore, the findings of this study can be used as a yardstick for augmenting OSP in the future.

This study has limitations due to a lack of resources and time; however, these constraints may allow further research. We adopted a cross-sectional strategy for this investigation; in the future, a longitudinal or experimental study is recommended to acquire more conclusive results. Further, we gathered data mostly from developing countries. Researchers should replicate this research model and expand this study to different locations in the future to get obtain comprehensive results. A contrast study is also suggested, as it may advance the generalizability of this study.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material, and further inquiries can be directed to the corresponding authors.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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