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RESEARCH ARTICLE

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Green supply chain management in manufacturing firms: A resource-based viewpoint

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Abstract

As sustainability draws increasing attention due to the COVID-19 pandemic, interest in the green supply chain has likewise substantially increased. The present study contributes deeper insights into the logical integration of the resource-based characteristics that can facilitate the effective transition from traditional to green supply chains while also increasing the effectiveness of existing green supply chains. The proposed model, rooted in the resource-based view (RBV) theory, examines the associations of supply chain connectivity (SCC), supply chain information sharing (SCIS), top management commitment (TMC) and green procurement and logistics acceptance (GPLA) with green supply chain management (GSCM). Analysis of data from employees at 381 manufacturing firms in the United Kingdom confirmed the positive associations of SCC and SCIS with TMC and GPLA, of TMC with GPLA and GSCM and of GPLA with GSCM. The results also confirmed the serial mediation effect of TMC and GPLA on the associations of both SCC and SCIS with GSCM. The study offers several practical insights and theoretical contributions, including a novel GSCM scale.

KEYWORDS

green supply chain management (GSCM), GSCM scale, manufacturing firm, resource-based view (RBV), UK

1 | INTRODUCTION

Unsustainable business practices have left the world vulnerable to severe sustainability risks (Jan et al., 2019). Global warming, climate change, the degradation and misuse of resources, increasing instances of human rights abuses, food shortages, hazardous waste generation and chemical accumulation are among the key sustainability risks (Muhammad et al., 2016). Since the turn of the decade, sustainability risks have increased significantly, with scholars noting the depletion of substantial natural resources, which should have been accessible to coming generations (e.g., Dunphy, 2011). Recognising the increasing global sustainability risks, the United Nations announced its Sustainable Development Goals (SDGs) in 2015. Encompassing social, environmental and economic sustainability, the SDGs aim to transform business practices, including supply chain management practices, to create sustainable industries and thereby reduce global sustainability risks (Tseng et al., 2019). This push towards global sustainable industrial transformation has encouraged businesses to upgrade their

List of Abbreviations/Acronyms: CC, cooperation with customers; ECO, eco-design; GP, green purchasing; GPLA, green procurement and logistics acceptance; GSCM, green supply chain management; IEM, internal environmental management; IVR, investment recovery; RBV, resource-based view theory; SCC, supply chain connectivity; SCIS, supply chain information sharing; SCM, supply chain management; SDGs, Sustainable Development Goals; TMC, top management commitment.

traditional supply chain management (SCM) framework to a green supply chain management (GSCM; Çankaya & Sezen, 2019; Cousins et al., 2019; Green et al., 2019) framework. The move towards GSCM is also an outcome of increasing customer pressure on firms to adopt environmental sustainability (green) practices that comply with green and eco-friendly strategies and thereby reduce the adverse environmental impact of their products and services (Ahmed et al., 2019).

GSCM involves integrating environmental concerns, such as reducing CO_2 and other emissions, reducing waste and preserving biodiversity, among others, along the supply chain (Chin et al., 2015). Key components of GSCM include internal environmental management (IEM) (Passetti et al., 2018), green purchasing (GP) (Yen & Yen, 2012), cooperation with customers and suppliers (Brito et al., 2014), eco-design (ED) (Eltayeb & Zailani, 2014) and investment recovery (IVR) (Kumar & Chandrakar, 2012). The process of GSCM includes sustainable choices related to product design, the selection and procurement of required materials, the manufacturing process, the delivery of finished products and post-delivery management (Çankaya & Sezen, 2019; Muduli et al., 2020). With this orientation, GSCM has the potential to make industries more sustainable by considerably reducing global sustainability risks relative to traditional SCM (K. Muduli & Barve, 2013).

Academic research has examined GSCM from various perspectives, such as practices and special aspects of GSCM (Islam et al., 2018), its commonalities with sustainable supply (Digalwar et al., 2020; Fahimnia et al., 2015; Gedam et al., 2021; Sharma et al., 2021), barriers (Tumpa et al., 2019), firm performance (Cousins et al., 2019), the impact on environmental sustainability (Green et al., 2019; Roscoe et al., 2019; Yong et al., 2020) and sustainable development (Green et al., 2012). Existing scholarship has also noted GSCM's various positive outcomes for firms, including increased customer satisfaction, lower production costs, profit maximisation, improved cooperation, competitive advantage and others (e.g., Lotfi, Mukhtar, et al., 2013). Seeking to ensure their own competitive advantage (Ferasso et al., 2020; Filser et al., 2020; Mangla et al., 2013; Sharabati, 2021) and to pacify multiple stakeholders, including customers, governmental and environmental bodies (Cousins et al., 2019), firms are thus making concerted efforts to modify their designs and production methods to incorporate greener practices (Ahmed et al., 2019). Nevertheless, recent studies have observed a lack of diffusion of GSCM (e.g., Kumar & Barua, 2021), particularly in the manufacturing sector, despite its being acknowledged as a way of allowing the firms in the sector to operate more sustainably (e.g., Trujillo-Gallego et al., 2021). Past studies have also noted that in general, manufacturing firms have been rather slow in shifting from a traditional SCM framework towards a GSCM framework despite increasing customer pressure and global sustainability requirements (Green et al., 2019). Recognising the slow pace of the transformation to GSCM and the crucial need to accelerate it, the present study proposes to examine various factors that can positively impact GSCM.

A review of the prior extended literature indicates the influential role of various resource-based supply chain characteristics, such as SCC (Brandon-Jones et al., 2014), SCIS (Fawcett et al., 2009; Huo et al., 2014), TMC (Gunasekaran et al., 2017) and green procurement and logistics acceptance (GPLA) (Holt & Ghobadian, 2009), in transforming traditional SCM to GSCM. Research findings have substantiated the importance of these aspects, revealing that firms—particularly smaller firms—have been slow to move towards GSCM due to limitations in their capabilities and resources (e.g., Silva et al., 2021). However, a closer look reveals visible gaps in the extant research, which may limit the knowledge base in the area. These gaps are as follows: (a) The prior literature has left unclear whether a particular sequential flow involving various resource-based characteristics should be applied to effectively transform traditional SCM to GSCM. (b) Despite the complex nature of any kind of organisational transformation, scholars have not adequately explored intervening paths and variables that may affect the smooth transition to GSCM. For instance, the literature has scarcely examined the mediating role of top management and GPLA in the relationships between various resource-based characteristics and GSCM practices. (c) Comprehensive measures of GSCM are also limited, which reduces the efficacy of past findings that have measured GSCM through a narrower lens. In fact, the recent literature has highlighted the need to develop comprehensive measures of GSCM (e.g., Tseng et al., 2019). The present study contends that illuminating these aspects can motivate additional research in the area and guide practice. Thus, we propose to address these gaps through three key research questions (RQs): RQ1. How do key resource-based characteristics of SCM, such as supply chain connectivity (SCC), supply chain information sharing (SCIS), top management commitment (TMC) and GPLA associate with GSCM? RQ2. Do TMC and GPLA serve as intervening mediating mechanisms between SCC and SCIS, on the one hand, and GSCM, on the other? RQ3. How can GSCM be measured so that it encompasses all aspects associated with the greening of the supply chain in manufacturing organisations?

Recognising the crucial role of resources and the growing prevalence of the resource-based view (RBV) in this context (e.g., Stekelorum et al., 2021), this study utilises the RBV as an overarching theoretical framework. We thus ground the associations proposed to address RQ1 and RQ2 in the RBV. RQ3 aims to conceptualise GSCM as a reflective construct, which comprises all of its varied aspects identified in the literature. To address all three questions, we analysed data collected from 318 manufacturing firms in the United Kingdom through structural equation modelling (SEM).

The notable contributions of the present study may be summarised as follows: (a) The study raises and explores a pertinent question regarding the logical role of key resource-based characteristics, which have been recognised in the past literature, as important to the transition from traditional SCM to GSCM. The results of the multiple serial mediation model tested here describe a plausible sequence in which various firm resources impact the greening of traditional SCM. (b) Consistent with prior studies, this research constructs GSCM comprehensively as a reflective measure comprising five dimensions: IEM, GP, cooperation with customers (CC), ED and IVR. The study thus validates the existing interpretation of GSCM and offers future researchers a robust measure for GSCM. (c) The study contributes to the theoretical advancement of research in the area by employing a pertinent yet under-utilised theory, that is, RBV, in the present context. By effectively uncovering the logical integration of the variables of interest in the RBV setting, moreover, the study contributes to advancing the theory's relevance and usefulness in supply chain contexts.

2 | BACKGROUND LITERATURE AND HYPOTHESES

2.1 | RBV

The RBV is a popular management framework for determining the resources that any firm can use to gain a competitive advantage (Barney, 1991). Scholars recognise it as a key theoretical lens for explaining associations among pertinent variables in various areas of management, including human resources (Malik et al., 2018), operations (Walker et al., 2015) and marketing (Stefanelli Oliveira et al., 2021).

The RBV asserts that resources can be combined and utilised together to create capabilities (Grant, 1991). As Figure 1 below shows, resources can be tangible or intangible, such as an integrating framework, information system, technology, human capital, physical capital and reputation (Gunasekaran et al., 2017). These resources are vital for any firm's survival in the environment in which it operates (Gunasekaran et al., 2017). However, resources themselves cannot provide firms any value until they are logically combined (Sirmon et al., 2008). Indeed, logically combining resources can provide firms a competitive advantage (Sirmon et al., 2008). Extending the discussion further, scholars suggest that integrating these resources appropriately (Sirmon et al., 2008) requires a well-honed information network (Rivard et al., 2006), a SCC channel (Shibin et al., 2020) and top management capabilities (Mahoney & Pandian, 1992).

Noting strong evidence for the significant role of various resource-based supply chain characteristics (e.g., Brandon-Jones et al., 2014; Fawcett et al., 2009; Gunasekaran et al., 2017; Huo et al., 2014) in transforming traditional SCM to GSCM, the present study grounds its conceptualisations in the RBV. Specifically, based on a review of literature, the study proposes SCC, SCIS, TMC and GPLA as tangible and intangible resources and GSCM as the outcome variable. This conceptualisation is consistent with the RBV framework because the extant literature in the area has identified GSCM as a source of competitive advantage (e.g., Ferasso et al., 2020; Filser et al., 2020; Sharabati, 2021). At the same time, the study seeks to logically integrate the identified resource characteristics and thereby explicate a sequence through which they can enhance value. To this end, the study conceptualises TMC and GPLA as intervening/mediating variables. The subsequent sub-sections present the background literature on GSCM with its five dimensions, followed by hypotheses development. Figure 2 presents the proposed research model, and Table 1 describes the study measures.

2.2 | GSCM

The concept of GSCM has evolved from traditional SCM (Chin et al., 2015). It refers to the process of integrating environmental concerns, such as reducing CO_2 emissions, waste and other harmful

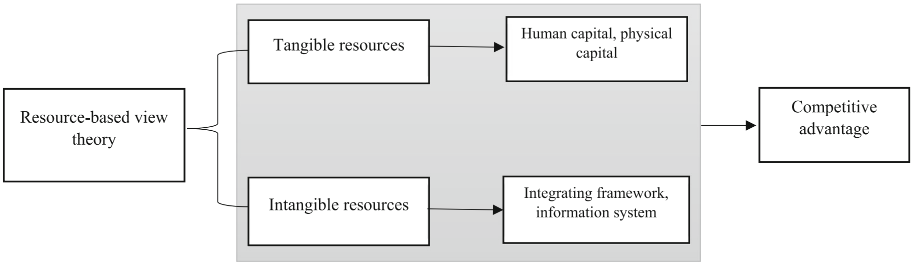

FIGURE 1 Overview of resource-based view (RBV) theory

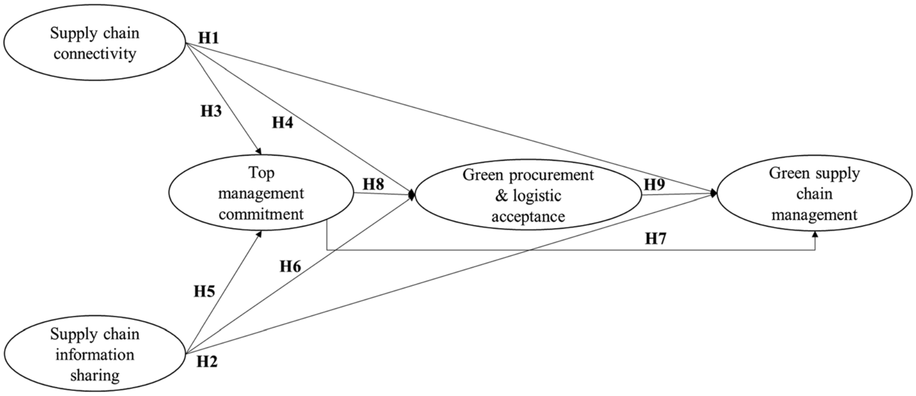

FIGURE 2 Proposed research model

TABLE 1 Description of study variables

First-order measures	Second-order measures	Description	Source
Green supply chain management	Internal environmental management	All aspects of an organisation's internal operations, such as environmental planning and operational activities	Passetti et al. (2018)
	Green purchasing	An environmentally friendly purchasing strategy that encourages the recycling and reclamation of purchased products as well as reductions in waste sources	Yen and Yen (2012)
	Cooperation with customers	The variety of positive customer relationships observed in GSCM from a process standpoint	Sony (2019)
	Eco-design	Designing product and service offerings that comply with environmental sustainability	Eltayeb and Zailani (2014)
	Investment recovery	A company's strategic use of reverse logistics, redeployment, reselling and other related strategies to obtain greater value from materials and goods	Kumar and Chandrakar (2012)
Supply chain connectivity		An organisation's capacity to collect and exchange information related to the supply chain using information technology	Brandon-Jones et al. (2014)
Supply chain information sharing		A system that establishes meaningful coordination based on the sharing/exchange of relevant information among supply chain participants—producers, suppliers, customers and distributors	Fiala (2005); Tran et al. (2016)
Top management commitment		The basic human agency that converts external influences into managerial actions and integrates them with internal knowledge for designing new rules or changing existing organisational rules	Liang et al. (2007)
Green procurement and logistics acceptance		Maintaining an environmental sustainability orientation in the purchase of inputs and flow of goods from the points of origin to consumption	PytlikZillig et al. (2018); Rane and Thakker (2019); Rodrigue et al. (2017)

emissions and preserving biodiversity, along the supply chain (Chin et al., 2015; Tseng et al., 2019). The prior literature has suggested that GSCM consists of five main dimensions: IEM, GP, cooperation with customers and suppliers, ED and IVR (Lee et al., 2014; Zhu et al., 2008, 2010). Scholars have further noted that these five GSCM processes must be integrated, which necessitates cross-functional collaboration (Lee et al., 2014). To capture this aspect fully, the current study considers GSCM as a reflective measure comprising the five dimensions discussed below.

2.2.1 | IEM

IEM refers to the formulation of a firm's environmental policies and the setting of targets to ensure environmental protection (Çankaya & Sezen, 2019). It includes activities such as managerial support for environmental practices, cooperation among departments for environmental improvements and the establishment of a management system for the environment (Zhu et al., 2005). Zhu et al. (2010) observed that Japanese manufacturing firms have implemented prudent IEM strategies to improve GSCM practices. Recent studies have noted IEM as a key dimension of GSCM (e.g., Do et al., 2020; Lee & Lim, 2020; Sahoo & Vijayvargy, 2020). Accordingly, this study includes IEM among the vital elements of GSCM, acknowledging that it improves overall GSCM practices.

2.2.2 | GP

GP refers to a procurement strategy motivated by the ideals of reducing, reclaiming and recycling to prevent resource wastage (Carter & Carter, 1998; Khan & Qianli, 2017; Yen & Yen, 2012). Past studies have confirmed the positive effect of GP in transforming the traditional supply chain into GSCM and in improving firms' environmental and financial performance (Ji et al., 2015; Khan et al., 2017; Yu et al., 2019). However, the prior literature has noted that implementing GP in the supply chain is challenging, and green training is essential to implement it. Appreciating the importance of GP in enabling and making GSCM effective, the present study includes it among the dimensions measuring GSCM.

2.2.3 | CC

CC is the process of collaborating with customers to build cleaner manufacturing processes that result in environmentally sustainable products packaged in environmentally friendly packaging (Sundram et al., 2017). The literature has observed a significant association between firms' GSCM external engagement and their operational performance (e.g., de Sousa Jabbour et al., 2015). Indeed, this environmentally conscious CC promotes GSCM by closing supply chain loops at the point of distribution (Yu et al., 2014). CC is a crucial GSCM factor for firms endeavouring to improve their performance (Zhu et al., 2017). Drawing upon these findings, the present study includes CC among the dimensions that constitute GSCM.

2.2.4 | ED

ED refers to decisions taken during a product's development to reduce the product's environmental impact throughout its lifecycle—from material procurement to manufacturing, use and disposal—without compromising performance or increasing cost (Eltayeb & Zailani, 2014). The past literature has noted that including ED within the GSCM enhances firm performance (e.g., Khan & Qianli, 2017; Khan et al., 2017). Likewise, studies have acknowledged the positive outcomes of ED practices in terms of improved sustainability performance (Rasit et al., 2019). Other studies have also confirmed the positive impact of GSCM, including ED, in reducing environmental pollution and operating cost (Mumtaz et al., 2018). Based on past evidence and recent studies identifying ED as an emerging dimension of GSCM (Li & Sarkis, 2021), the present study includes it among the dimensions measuring GSCM.

2.2.5 | IVR

IVR is the process of promoting sustainability by identifying and selling surplus assets or shifting idle assets from locations where they are not needed to locations where they are needed to reduce purchases of additional materials (Atkinson, 2002). Many past studies have examined IVR as a component of GSCM/green practices (e.g., Kumar & Barua, 2021; Lee et al., 2014; Nezhadi & Faraji, 2021). For example, examining IVR among the elements of GSCM, Chan et al. (2012) found it to be positively associated with firm performance. In addition, Jawaad and Zafar (2020) revealed the mediating role of IVR green activities and firm performance, and Sundram et al. (2017) found that IVR positively affects a firm's performance from an environmental standpoint. In light of these findings, the present study includes IVR among the dimensions to measure GSCM.

2.3 | Hypotheses

2.3.1 | SCC and SCIS

Connectivity captures the capacity of any firm to collect and exchange knowledge by leveraging information and communication technology (Fawcett et al., 2011). Specifically, SCC refers to the tools that enable the flow of information between various supply chain nodes (Brandon-Jones et al., 2014). SCC can improve collaboration and integration along the supply chain, thereby enhancing performance and reducing redundancy (Cao & Zhang, 2011; Chen et al., 2009; Fawcett et al., 2011). Organisations such as Dell have improved their SCC by implementing IT-enabled solutions (Enslow, 2000; Fields, 2002). Based on the preceding evidence, the present study interprets SCC as a tangible resource in the form of an ICT solution.

SCIS refers to a system that establishes meaningful coordination based on the sharing/exchange of information among various supply chain participants (Fiala, 2005; Tran et al., 2016). Importantly, however, merely sharing information is not sufficient. Rather, the quality of the information shared is key to improving integration among various supply chain participants (Prajogo & Olhager, 2012). In fact, while acknowledging the importance of information sharing, the existing scholarship has categorically stated that mere investment in ICT solutions is insufficient to ensure the quality of information (e.g., Lai et al., 2015; Wu et al., 2014). Based on this discussion, the present study posits information sharing as an intangible resource.

We anticipate that efficacious SCC and SCIS can drive GSCM by providing an enabling environment that reduces duplication and overpurchase and enhances efficient decision-making when implementing GSCM. Prior findings revealing the positive impact of SCC and SCIS on environmental performance (e.g., Shibin et al., 2020) support this argument. Hence, we propose the following:

H1. SCC is positively associated with GSCM.

H2. SCIS is positively associated with GSCM.

While the past literature has suggested that closed-loop GSCM systems can enhance information sharing and SCC (Bag et al., 2020) and that SCC and information sharing can enhance supply resilience and robustness by increasing visibility capability (Brandon-Jones et al., 2014), researchers do not yet sufficiently understand the impact of this connectivity and the sharing of available information on other resources and GSCM. In addition to the preceding observations, the past literature has suggested that (a) exchanging prudent information serves as the foundation for managerial decisions (Tran et al., 2016) and (b) green procurement and green logistics require the exchange of information among other activities (PytlikZillig et al., 2018; Rodrigue et al., 2017). Thus, this study suggests that one of the way logical integration of resources which should considered is how do SCC and SCIS associate with TMC and GPL. In other words, the present study suggests that IT-enabled connectivity solutions and the quality of information exchanged can impact TMC and GPLA by providing timely and relevant inputs. Hence, we propose the following:

H3. SCC is positively associated with TMC.

H4. SCC is positively associated with GPLA.

H5. SCIS is positively associated with TMC.

H6. SCIS is positively associated with GPLA.

2.3.2 | TMC, GPLA and GSCM

TMC can be understood as the basic human agency that transforms external influences into managerial actions and integrates those external influences' with internal knowledge to formulate new organisational rules or revise existing ones (Liang et al., 2007). Noting that the actions of top management influence firm performance, the past literature has identified TMC as the central pillar of firm success (Chinomona et al., 2017). Past findings have also recognised the crucial role of TMC in the successful implementation of GSCM (e.g., Banik et al., 2022; Liu, Hu, et al., 2020). Other recent studies likewise support this observation. For instance, Gao et al. (2021) included top management support among the five top practices for effectively implementing GSCM. Ahmed et al. (2020) asserted that suitable policy support from top management is essential to implement GSCM.

Hence, we propose the following:

H7. TMC is positively associated with GSCM.

Green procurement refers to a collection of procurement rules, actions and connections developed in response to environmental concerns (Amemba et al., 2013; Bag, 2017; Ninlawan et al., 2010). Similarly, the term green logistics refers to a type of logistics that is intended to be both environmentally beneficial and economically viable (Pazirandeh & Jafari, 2013; Seroka-Stolka, 2014). Together, green procurement and logistics represent firms' commitment to environmentally friendly practices. Scholars have identified top management support—a sign of management's commitment to sustainability—as a significant factor impacting a firm's implementation of various environmental practices (Liu, Liu, & Yang, 2020). The expectation that TMC influences green procurement and logistics thus becomes plausible. We also ground this supposition in past findings, which have confirmed the impact of top management support on the successful promotion of green procurement (Blome et al., 2014; Huang & Yang, 2015; Islam et al., 2017). Similarly, the literature has acknowledged the impact of top management as a facilitator of green logistics adoption (Denisa & Zdenka, 2015; Niemann et al., 2017; Lew et al., 2018).

Notably, various international regulatory bodies have enacted rules and regulations to prevent environmental damage caused by firms' procurement and logistics policies, which include the production, distribution and sale of products (Lai & Wong, 2012). Thus, top management must facilitate green procurement and green logistics and thereby pacify these regulatory pressures and achieve institutional legitimacy, particularly when operating in the international context where a green image is favourable (Lai & Wong, 2012; Zhu et al., 2011). Other studies in the area have also confirmed the role of TMC in enabling green procurement and logistics (Dou et al., 2014; Sukjit & Vanichchinchai, 2020). Based on the preceding discussion, the present study suggests while examining possible logical integration of resources that precede GSCM, positioning GPLA after TMC can yield useful practical insights. Hence, we propose as follows:

H8. TMC is positively associated with GPLA.

While firms' traditional purchasing decisions are driven largely by three aspects—quality, cost and delivery (Ghosh, 2019), green procurement goes beyond these criteria to consider environmental issues as well (Yook et al., 2018). Underscoring the importance of green procurement, Blome et al. (2014) argued that the procurement function can encourage firms to purchase green inputs for the supply chain, especially by seeking environmentally sensitive suppliers. The implementation of green logistics, meanwhile, is linked to a more circular and greener production system, which is primarily motivated by the need to reduce emissions and the use of fossil fuels and to increase the recycling of used materials (de Souza et al., 2021).

On the other hand, GSCM implies maintaining an environmentally friendly orientation across all phases of the supply chain—from procurement to distribution (Soda et al., 2016; Zsidisin & Siferd, 2001). The preceding discussion suggests that firms seeking to implement effective GSCM must achieve efficiency in green procurement and logistics. Indeed, the existing literature has confirmed the positive association of green procurement and logistics with GSCM (e.g., Kahanaali et al., 2015; Luthra et al., 2014; Salam, 2008). Because green procurement and logistics policies thus pave the way for enhancing a firm's GSCM (Zhu et al., 2008, 2011), we propose the following:

H9. GPLA are positively associated with GSCM.

In addition to the above-discussed direct associations, the present study proposes the serial mediation effects of TMC and GPLA on the associations of SCC and SCIS with GSCM. To the best of our knowledge, scholars have not yet investigated these effects. However, the evidence in the extant literature regarding the potential of top management to utilise the available information to implement green practices suggests that such effects are plausible. For instance, the vital information that SCC and SCIS facilitate and make available to top management (Denolf et al., 2015) conveys the perspectives of various

TABLE 2 Complete model (GSCM scale)

Measures	Measurement items	Factor loading	CR	AVE
Supply chain connectivity (Brandon-Jones et al., 2014)	SCC1: In my organisation, the current information systems satisfy supply chain communication requirements.	0.89	0.92	0.79
	SCC2: In my organisation, information applications are highly integrated within the firm and supply chain.	0.90		
	SCC3: In my organisation, there exist adequate information systems linkages with partners in the supply chain network (suppliers).	0.88		
Supply chain information sharing (Huo et al., 2014)	SCIS1: My organisation exchanges timely information with suppliers.	0.88	0.93	0.78
	SCIS2: My organisation exchanges relevant information with suppliers.	0.88		
	SCIS3: My organisation exchanges accurate information with suppliers.	0.90		
	SCIS4: My organisation exchanges complete information with suppliers.	0.84		
Top management commitment (Gunasekaran et al., 2017)	TMC 1: My organisation engages in supply chain partnering to obtain significant business benefits.	0.84	0.93	0.74
	TMC2: My organisation engages in supply chain partnering to create a significant competitive arena.	0.86		
	TMC3: My organisation articulates a vision for supply chain collaboration.	0.89		
	TMC4: My organisation formulates a strategy for organisational information sharing.	0.85		
	TMC5: My organisation establishes the metrics to monitor supply chain success through partnering.	0.87		
Green procurement and logistics acceptance (Holt & Ghobadian, 2009)	GPLA1: My organisation considers ethical and human rights/welfare issues informally in our purchasing decisions.	0.77	0.93	0.70
	GPLA2: My organisation has green purchasing or logistics guidelines that recommend the environment is considered.	0.89		
	GPLA3: My organisation considers ethical and human rights/welfare issues formally in our purchasing decisions.	0.83		
	GPLA4: My organisation has a formal policy on green procurement/purchasing.	0.89		
	GPLA5: My organisation is bound by external purchasing directives governing green procurement and logistics policies.	0.81		
	GPLA6: My organisation has a formal policy on green logistics/transport.	0.81		
Internal environmental management (Zhu et al., 2008)	IEM1: The senior managers of our organisation are committed to green supply chain management.	0.87	0.93	0.68
	IEM2: The mid-level managers of our organisation support green supply chain management.	0.83		
	IEM4: My organisation has total quality environmental management.	0.85		
	IEM5: My organisation has environmental compliance and auditing programmes.	0.84		
	IEM6: My organisation has ISO 14001 certification.	0.66		
	IEM7: My organisation has environmental management systems.	0.84		

(Continues)

TABLE 2 (Continued)

Measures	Measurement items	Factor loading	CR	AVE
Green purchasing (Zhu et al., 2008)	GP1: My organisation offers eco-labelling of products.	0.71	0.90	0.69
	GP2: My organisation has cooperation with suppliers for environmental objectives.	0.85		
	GP3: My organisation has an environmental audit for suppliers' internal management.	0. 84		
	GP5: My organisation has a second-tier supplier environmentally friendly practice evaluation.	0.84		
Cooperation with customers (Zhu et al., 2008)	CC1: My organisation has cooperation with customers for eco-design.	0.94	0.92	0.81
	CC2: My organisation has cooperation with customers for cleaner production.	0.94		
	CC3: My organisation has cooperation with customers for green packaging.	0.80		
Eco-design (Zhu et al., 2008)	ED1: My organisation offers a design of products for reduced consumption of material/energy.	0.89	0.91	0.79
	ED2: My organisation offers a design of products for reuse, recycling, recovery of material and parts.	0.87		
	ED3: My organisation offers the design of products to avoid or reduce the use of hazardous products and/or their manufacturing process.	0.89		
Investment recovery (Zhu et al., 2008)	IVR1: My organisation invests in green practices due to which they engage in the investment recovery (sale) of excess inventories/materials.	0.90	0.90	0.76
	IVR2: My organisation invests in green practices due to which they engage in the selling of scrap and used materials.	0.85		
	IVR3: My organisation invests in green practices due to which they engage in the sale of excess capital equipment.	0.86		

stakeholders. This information, in turn, ultimately facilitates top management's efforts to formulate strategies for integrating the required green practices (Tran et al., 2016). Scholars have observed that top management relies on such information to upgrade traditional procurement and logistics policies by introducing green practices along the entire supply chain, that is, locating, obtaining and purchasing products and services as well as tendering and bidding between points of origin and consumption (Zhu et al., 2011). In other words, TMC enables the conversion of available information into managerial actions and integrates these actions with the available knowledge to formulate or update existing guidelines/policies (GPL in this case; Liang et al., 2007). Because these are a part of the supply chain, these efforts enhance GSCM. To explain further, the anticipated serial mediation hypotheses suggest TMC and GPLA as chain linking mediators, which flow in a specified direction from both SCC and SCIS to GSCM. For example, SCC may impact TMC, which, in turn, may impact GPLA; GPLA, finally, may impact GSCM. We also ground this assumption regarding the flow of mediation effects in the most recent literature, which has argued that GSCM is evolving into a closed-loop supply chain rather than direct path investigations (Nahr et al., 2021). The extended research evidence and practical viability of the proposition provide us with an overarching basis to propose the following:

H10. TMC and GPLA serially mediate the association between SCC and GSCM.

H11. TMC and GPLA serially mediate the association between SCIS and GSCM.

3 | METHODOLOGY

3.1 | Research instruments and data collection

Data were collected using a questionnaire method with a scale ranging from 1 for *strongly disagree* to 5 for *strongly agree*. The *Prolific Academic* database enabled us to collect data from 318 employees in various positions in the UK manufacturing sector, a sample size sufficient for the purpose of the study (Al-Aomar & Hussain, 2017). We measured all variables under study through pre-validated scales, as

TABLE 3 Discriminant validity (Fornell–Larcker criterion)

		1	2	3	4	5	6	7	8	9
1	CC	**0.90**								
2	ED	0.67	**0.89**							
3	GP	0.68	0.67	**0.83**						
4	GPLA	0.66	0.63	0.75	**0.85**					
5	IEM	0.63	0.59	0.80	0.76	**0.83**				
6	IVR	0.62	0.60	0.63	0.64	0.63	**0.87**			
7	SCC	0.37	0.36	0.47	0.54	0.52	0.43	**0.9**		
8	SCIS	0.37	0.39	0.50	0.52	0.47	0.40	0.7	**0.88**	
9	TMC	0.46	0.43	0.54	0.58	0.58	0.48	0.6	0.57	**0.86**

Note: Diagonal bold values are square root of AVE.

described in Table 2. The dependent variable—GSCM—was measured as a reflective construct via five dimensions given in Table 2. The other variables—SCC, SCIS, TMC and GPLA—were measured as formative constructs.

3.2 | Data analysis

We analysed the data using variance-based SEM (VB-SEM). Specifically, the study examined a multiple serial mediation model using two mediating variables—TMC and GPLA. Consistent with recent studies (e.g., Abbasi et al., 2020), we utilised SmartPLS version 3.2.8 for this purpose. As is the case with SEM, we first constructed the measurement model. We thus performed the confirmatory factor analysis and generated and assessed the various construct reliability, validity and model fit indices. Next, we generated and analysed the structural model to examine the proposed hypotheses.

4 | RESULTS

4.1 | Measurement mode

According to Hair et al. (2011), items with factor loadings between (0.4 and 0.7) should be deleted from the model only if their deletion positively affects the model validity and vice versa (Hair et al., 2011). As a result, we deleted two items, IEM3 and GP4, proceeding with the rest for further analysis (see Table 2). The Cronbach's alpha values also conformed to the suggested cut-off value of .7 for all constructs.

Next, we assessed the validity and reliability statistics. Exploratory studies have considered composite reliability (CR) values between 0.6 and 0.7 satisfactory (Hair et al., 2011). Furthermore, according to Shamim et al. (2017), a CR value greater than 0.70 confirms the construct reliability of the scale in a model. As Table 2 shows, the CR values exceeded 0.70 and thus confirmed the construct reliability of all variables under study. Consistent with the recommendation of Hair et al. (2006), AVE values greater than 0.50 confirm discriminant validity. All study constructs met this criterion as well, as presented in Table 2. In addition, the Fornell and Larcker (1981) criterion confirms discriminant validity if the square root of the AVE (values highlighted in bold in Table 3) for each variable exceeds the corresponding correlations. The present study variables met this criterion as well. The model fit measures—$SRMR = 0.061$ and $NFI = 0.736$—also confirmed an acceptable fit. We reached this conclusion based on Hair et al.'s (2014) assertion that an *SRMR* value below 0.08 indicates the fitness of a model (Hair et al., 2014). Similarly, the NFI value should exceed 0.90. However, nearby values are also acceptable (Lohmöller, 1989), as in this study.

In addition, the results of the PLS measurement model helped to confirm a new measurement scale (GSCM scale) comprised of five dimensions. Validity, reliability and model fit criteria in the prescribed range supported the scale's authenticity.

4.2 | Structural model

We tested the hypotheses using bootstrapping based on the 5000 subsamples. Because PLS does not consider data to be normally distributed, this process requires repeated random sampling to create a bootstrap sample, which results in the generation of standard errors and coefficient values required for hypotheses testing (Hair et al., 2011). The results presented in Table 4 indicate that all hypotheses except H1 and H2 received support.

Along with the direct effects, this study examined two serial mediation hypotheses. The results of the first serial mediation hypothesis (H10) were as follows. H1, proposing a direct association between SCC and GSCM, was unsupported, as indicated by a *p*-value >.05. This result is consistent with the approach to mediation analysis proposed by Baron and Kenny (1986); their approach suggests that the insignificance of the direct path offers strong evidence for single or multiple mediation effects. On this basis, this study tested the potential mediation effects of TMC and GPLA. To this end, we first examined the mediation effect of TMC on the association between SCC and GPLA. Here, the *p*-value confirmed the significance of the direct impact of SCC on GPLA (H4). Testing the mediational influence of TMC on the association between these two variables, however, also required us to examine the mediation effect in terms of the

TABLE 4 Results of hypotheses testing

Hypothesis	Association	Std beta	Std error	*t*-value	*p*-value	Decision
H1	SCC → GSCM	0.02	0.07	0.320	0.749	Not supported
H2	SCIS → GSCM	0.038	0.064	0.621	0.534	Not supported
H3	SCC → TMC	0.459	0.062	7.339	0.000***	Supported
H4	SCC → GPLA	0.198	0.067	2.920	0.004***	Supported
H5	SCIS → TMC	0.263	0.068	3.890	0.000***	Supported
H6	SCIS → GPLA	0.181	0.065	2.793	0.005***	Supported
H7	TMC → GSCM	0.188	0.065	2.888	0.004***	Supported
H8	TMC → GPLA	0.360	0.062	5.856	0.000***	Supported
H9	GPLA → GSCM	0.683	0.057	16.227	0.000***	Supported

*$p < .05$. **$p < .01$. ***$p < .001$.

indirect paths (*path-a*: H3 and *path-b*: H8). Here, the *t*-value for the direct effect was 2.920 (*path-c*: H4), and the *t*-values for the (indirect) mediating paths were 7.339 (*path-a*: H3) and 5.856 (*path-b*: H8). The interaction value of the indirect paths (*path-a*: H3 = 7.339 * *path-b*: H8 = 5.856) exceeded the *t*-value of the direct path (*path-c*: H4 = 2.920). This confirmed the mediation effect of TMC on the association between SCC and GPLA.

The results of the second serial mediation hypothesis (H11) were as follows. As in the case of the first mediation hypothesis, H2, which proposed a direct association between SCIS and GSCM, was unsupported. We drew this conclusion based on a *p*-value >.05, which met Baron and Kenny's (1986) criterion discussed above. On this basis, the study tested the potential mediation effects, that is, the mediation effect of TMC and GPLA. To this end, we first examined the mediation effect of TMC on the association between SCIS and GPLA. Here, the *p*-value confirmed the significance of the direct impact of SCIS on GPLA (H6). Testing the mediational influence of TMC on the association between these two variables, however, required examining the mediation effect in terms of the indirect paths (*path-a*: H5 and *path-b*: H8). Here, the *t*-value for the direct effect was 2.793 (*path-c*: H6), and the *t*-values for the (indirect) mediating paths were 3.890 (*path-a*: H5) and 5.856 (*path-b*: H8). The interaction value of the indirect paths (*path-a*: H5 = 3.890 * *path-b*: H8 = 5.856) exceeded the *t*-value of the direct path (*path-c*: H6 = 2.793). This confirmed the mediation effect of TMC on the association between SCIS and GPLA.

Next, utilising the first mediating variable (TMC) as the independent variable, the study examined second-order mediation, that is, the mediation effect of GPLA on the association between TMC and GSCM. The direct association between TMC and GSCM (*path-c*: H7) was significant, as confirmed by the *p*-value. Verifying the mediating role of GPLA on the association between TMC and GSCM, however, required examining the indirect paths (*path-a*: H8 and *path-b*: H9). Here, the *t*-value of the direct was 2.888 (*path-c*: H7), and the *t-values* for the (indirect) mediating paths were 5.856 (*path-a*: H8) and 6.577 (*path-b*: H9). The interaction value of the indirect paths (*path-a*: H8 = 5.856 * *path-b*: H9 = 16.22) exceeded the *t*-value of the direct path (*path-c*: H7 = 2.888). These results confirmed a complimentary mediation.

5 | DISCUSSION

The primary aim of this study was to examine the logical integration of four resource-based characteristics—SCC, SCIS, TMC and GPLA—as independent variables impacting GSCM. A secondary aim was to generate a broad measure of GSCM in terms of five key dimensions. To achieve the primary objective, the study proposed 11 hypotheses grounded in the RBV and tested them by analysing data collected from 318 employees working in various positions in the manufacturing sector of the United Kingdom. We constructed a measure for GSCM by analysing the measurement model generated during data analysis based on VB-SEM. We discuss the results of the hypotheses testing below.

To begin, the results of the statistical analysis did not support H1 and H2, which had proposed the positive associations of SCC and SCIS, respectively, with GSCM. These results indicate the existence of potential mediational effects. These results are consistent with recent findings (e.g., Ribeiro & Barbosa-Povoa, 2018), which have argued that research has evolved from merely examining direct paths in the supply chain towards considering the closed-loop supply chain perspective. This evolution is due to the complex innovations that are taking place in the global supply chain. Thus, considering mediational paths, rather than mere direct relationships, may be more instructive. Consistent with the closed-loop supply chain philosophy, this study also proposed and confirmed a novel serial mediating role on the association between SCC and SCIS, on the one hand, and GSCM, on the other. Support for both mediation hypotheses (H10 and H11), as explained in the preceding section, confirmed the mediation effect of TMC and GPLA. Hence, we uncovered an intervening mechanism for the transmission of impact from SCC and SCIS to GSCM.

All other direct effect hypotheses, H3 to H9, were statistically significant. Support for H3 and H4 indicates the positive association of SCC with TMC and GPLA, respectively, as we anticipated based on the prior literature (e.g., Brandon-Jones et al., 2014; Tran et al., 2016). This outcome implies that the ability of a firm's existing information systems to satisfy supply chain communications requirements—via information applications that are highly integrated within the firm and supply chain and information systems that accommodate linkages with partners in the supply chain network (i.e., suppliers)—enhances the association between TMC and GPLA. To elaborate, an effective information system increases top management's commitment to engage in supply chain partnering, articulate a vision for supply chain collaboration, formulate strategies for information sharing and establish metrics to monitor supply chain success through partnering. At the same time, a well-honed SCC enhances organisations' formal and informal consideration of ethical and human rights/welfare issues in their purchasing decisions, their inclination to formulate procurement and logistics guidelines and formal policies that consider the environment and their adherence to external purchasing directives governing green procurement and logistics policies.

Similarly, support for H5 and H6 indicates the positive associations of SCIS with TMC and GPLA, respectively, as we anticipated based on the prior literature (e.g., PytlikZillig et al., 2018; Rane & Thakker, 2019; Rodrigue et al., 2017). This implies that firms' exchange of timely, relevant, accurate and complete information with suppliers positively impacts TMC, motivating managers to develop effective partnering and collaboration strategies related to the supply chain. The exchange of quality information also enhances organisations' formulation of and adherence to environmentally friendly procurement and logistics policies.

Next, the results of the statistical analysis supported H7 and H8, indicating the positive associations of TMC with GSCM and GPLA, respectively. These results were also consistent with our expectations based on prior studies (e.g., Ahmed et al., 2019; Gao et al., 2021; Sukjit & Vanichchinchai, 2020). The results imply that management's commitment to support supply chain partnering, promote supply chain collaboration, formally encourage information sharing and monitor supply chain success through partnering positively impacts GSCM and GPLA. In other words, higher TMC is linked with more efficacious GSCM through the latter's five key dimensions—IEM, GP, CC, ED and IVR. At the same time, committed management positively impacts not only informal green practices but also the formulation of formal procurement and logistics guidelines to ensure consideration of ethical and human rights/welfare as well as environmental issues, also duly reflecting external purchasing directives.

The last direct path, proposed in H9, was also statistically significant, confirming a positive association between GPLA and GSCM, as we had hypothesised based on prior findings (e.g. Kahanaali et al., 2015; Soda et al., 2016; Zsidisin & Siferd, 2001). This result indicates that the better and greener a firm's procurement and logistics policies and the higher its adherence to external purchasing directives governing green procurement and logistics policies, the better will be the GSCM through a positive impact on all the dimensions that constitute it.

6 | CONCLUSION

Drawing on the theoretical framework of the RBV, the present study examined the antecedents of GSCM. Three research questions specified the study's aims. In response to RQ1, we examined the associations of four resource-based characteristics—SCC, SCIS, TMC and GPLA—with GSCM. The results confirmed the positive associations of SCC and SCIS with TMC and GPLA, TMC with GPLA and TMC and GPLA with GSCM. In response to RQ2, the study examined and confirmed the serial mediation effect of TMC and GPLA on the associations of SCC and SCIS with GSCM. To address RQ3, the study examined whether GSCM could be developed as a reflective construct measured through five dimensions. The validity, reliability and model fit criteria of the generated PLS measurement model confirmed the proposed novel measurement scale (GSCM scale). The contributions of the study can be summarised via its theoretical and practical inferences, which we discuss below.

6.1 | Theoretical implications

The study offers three theoretical implications. First, by examining new associations, it offers a useful and logical integration of resource-based characteristics. These include SCC as a tangible resource characteristic and SCIS as an intangible resource characteristic as well as TMC, GPLA and GSCM. The study also confirms the serial mediation effects of TMC and GPLA, thereby providing relevant insights to the evolving literature, which has emphasised the need to consider the closed-loop supply chain when examining relevant relationships (Ribeiro & Barbosa-Povoa, 2018). In this way, the study not only advances the accumulated knowledge but also provides useful insights for future research in the area.

Second, by utilising the RBV (Barney, 1991) as a theoretical framework to ground its conceptualisations and visualise the logical integration of resource-based characteristics, the study supports the theoretical extension of research in areas that will, on one hand, ground future studies linking other supply chain resources with the elements of the RBV and, on the other, enhance the applicability of the RBV in research focused on sustainability.

Finally, the study proposes and validates a novel measurement scale (i.e., the GSCM scale) to comprehensively measure GSCM as a variable of interest. With acceptable validity, reliability and fitness indices, the measurement model supports the construction of the GSCM scale in terms of five dimensions or sub-reflective factors for the latent variable. The first dimension, IEM, comprises six items; the second dimension, GP, comprises four items; the third dimension, CC, comprises three items; the fourth dimension, ED, comprises three items; and the fifth dimension, IVR comprises three items. Furthermore, the results of the PLS measurement model offer three robust items for measuring SCC, four for SCIS, five for TMC and six for GPLA.

6.2 | Practical implications

This study's findings offer three practical inferences. First, the results offer a useful sequence and logical integration of resource-based characteristics that managers can leverage to implement efficacious GSCM in their firms. Greening the SCM process will promote firms' compliance with regulatory requirements. These efforts, in turn, will pacify environmental regulators and reduce the pressure of suppliers and customers on managers to introduce and employ sustainable business practices (Lee, 2008; Walton et al., 1998). More effective GSCM, moreover, will improve firm performance, as existing scholarship has suggested (e.g. Cousins et al., 2019). In sum, on-the-ground implementation of the proposed model will promote sustainable development and improve firms' performance. More specifically, the proposed framework, when implemented, will support the flow of up-to-date and vital information conveying the pulse of various stakeholders to top management. Such information can support top management's efforts to formulate policies and devise strategies essential for integrating required green supply chain practices. Strategic alignment of various resources in the proposed logical sequence will—with the support of prudent management—undoubtedly help to update traditional SCM to GSCM.

Second, the study's findings reveal the key role of information systems and applications in accumulating and transmitting vital information to both internal and external stakeholders across the supply chain. A highly integrated information system that provides effective SCC increases top management's commitment to support supply chain partnering and collaborations, which, in turn, enable organisations to obtain significant benefits. These connections and the sharing of quality information also enable organisations to develop a green image, which is particularly useful in improving operational legitimacy internationally and pacifying multiple stakeholders (Zhu et al., 2011). Furthermore, as business models continue to advance and increase in complexity, the lack of adequate and accurate information exchanges can be disastrous (Martínez-Olvera, 2008). To gain a competitive advantage, moreover, firms are essentially obliged to share quality information (Lotfi, Sahran, & Mukhtar, 2013). Thus, the present study suggests that operations departments should actively engage with their respective IT departments to ensure that information system choices as a whole are well equipped to ensure effective SCC and that they include built-in filters to promote information quality.

Finally, the findings underscore the key role of green procurement and green logistics in enabling the implementation and sustenance of effective GSCM. Specifically, our study suggests that adhering to external purchasing directives governing green procurement and logistics policies and formulating formal internal policies regarding these two aspects can drive positive organisational outcomes in the form of effective GSCM. GSCM, in turn, has been acknowledged to have a beneficial impact on both firm performance and sustainability (Cousins et al., 2019; Green et al., 2019; Roscoe et al., 2019; Yong et al., 2020).

6.3 | Limitation and future research directions

Although this study offers various contributions, these contributions must be evaluated in light of the following limitations. First, to develop the novel GSCM scale, this study collected data from a single source, which may entail potential bias in some cases. Nevertheless, the study represents a step in the right direction. Future researchers can validate the scale by collecting data from multiple sources and multiple industry settings. Second, the data analysis approach using VB-SEM in PLS entails its own set of limitations, which may raise questions about the robustness of the findings. Nonetheless, the use of PLS-SEM is quite popular, particularly in the areas of operations and SCM. Finally, the data were collected through a single-wave, self-report, cross-sectional study, which likewise creates the possibility of biases. We thus recommend that future researchers utilise mixed-method research designs or collect data through multiple waves. In addition, future researchers can expand the scope of the proposed conceptual model by considering (a) additional resource-based characteristics, (b) other theories, such as stakeholder theory (Freeman, 1984) or actor–network theory (Latour, 2005), and (c) the moderation effects of variables such as firm size, sector, location and others.

CONFLICT OF INTEREST

The authors do not have any competing interests to declare.

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