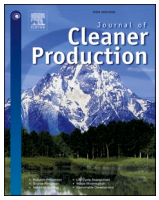
Journal of Cleaner Production 450 (2024) 141575

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Green strategic leadership capability: Construct development and measurement validation

Eijaz Ahmed Khan [a], Mohammad Alamgir Hossain [b,g], Mohammed Abu Jahed [c], Rabeya Akter [d], Ilias O. Pappas [e,f,*]

[a] College of Business, Law and Governance, James Cook University, Townsville, QLD, 4814, Australia
[b] School of Accounting, Information Systems, and Supply Chain, RMIT University, Melbourne, VIC, 3000, Australia
[c] Department of Management, Saint Bonaventure University, Saint Bonaventure, 3261 W State St, St Bonaventure, NY, 14778, United States
[d] Department of Banking and Insurance, University of Chittagong, Chittagong, Bangladesh
[e] Department of Computer Science, Norwegian University of Science and Technology, Sem Sælandsvei 9, Gløshaugen, Trondheim, Norway
[f] Department of Information Systems, University of Agder (UiA), Campus Kristiansand, Universitetsveien 25, 4630, Kristiansand, Norway
[g] Business and Human Rights (BHRIGHT) Centre, RMIT University, Melbourne, VIC, 3000, Australia

ARTICLE INFO

Handling editor:

Keywords:
Green strategic leadership capability
Green training
Natural-resource-based view
Scale development
Partial least squares structural equation modelling

ABSTRACT

Green strategic leadership capability (GSLC) has emerged as a major study topic in strategic management in light of urgent global crises such as climate change. There is, however, a paucity of theoretically conceptualised and empirically validated measurement models evaluating the various leadership capabilities of top managers. GSLC implies that top managers endorse green management practices in organisational operations to minimise their environmental impact. Our research conceptualises GSLC from a natural-resource-based view by considering top managers' capabilities to develop GSLC measurement models. We used a multi-study, multi-method approach to develop GSLC multidimensional scales using field interviews, thematic analysis and bulk surveys. GSLC is operationalised as a hierarchical and multidimensional scale consisting of three core dimensions, namely green foresight capability, green adaptive capability and green absorptive capability, along with nine subdimensions – resulting in 31 measurement items. The developed and validated scales may be applied to extend the theory and practice of green management, while offering a valuable source for organisations to assess their GSLC and identify and prioritise areas for green growth.

1. Introduction

A firm's green management practices and strategic leadership capabilities can enhance its competitiveness and safeguard the environment (Lin and Chen, 2017). With such practices and capabilities, firms promote long-term growth and business performance while reducing their environmental impact. Green strategic leadership capability (GSLC) is considered an important factor in research and practice (e.g., Gouldson et al., 2015), but little is known about its conceptualisation and implementation. This is undesirable, particularly since firms are under increasing pressure to demonstrate environmental accountability and responsibility in their business operations (Pappas et al., 2023; Sarwar et al., 2023). Manufacturing firms, for instance, such as Pandora, Unilever, L'Oréal, IKEA, PepsiCo, IBM and Nissan, are improving their GSLC and green management practices in response to the global climate change crisis and net-zero goals by reducing carbon emissions and raw material consumption, reusing water and recycling and/or reusing waste.

A great deal of research has examined environmental leadership from the perspectives of green leadership (e.g. Tan et al., 2015), green transformational leadership (e.g. Li et al., 2020), servant leadership (e.g. Zarei et al., 2022), charismatic leadership (e.g. Vlachos et al., 2013) and ethical leadership (e.g. Wang et al., 2017). These types of leadership entail the common theme of green leadership capability. Practitioners and scholars have long believed that firms can enhance environmental performance by developing GSLC, particularly when competing in dynamic environments. Effective green leadership is driven by a sense of environmental responsibility. A responsible top manager not only

* Corresponding author. Department of Computer Science, Norwegian University of Science and Technology, Sem Sælandsvei 9, Gløshaugen, Trondheim, Norway.
E-mail addresses: eijaz_2@yahoo.com (E.A. Khan), mohammad.hossain@rmit.edu.au (M.A. Hossain), mjahed@sbu.edu (M.A. Jahed), rabeyaakter01815@gmail.com (R. Akter), ilpappas@ntnu.no, ilias.pappas@uia.no (I.O. Pappas).

https://doi.org/10.1016/j.jclepro.2024.141575
Received 8 May 2023; Received in revised form 28 January 2024; Accepted 28 February 2024
Available online 13 March 2024

focuses on economic benefits, but develops an ecosystem where the interests of all stakeholders are incorporated and harm to the environment is minimised (Donald, 2009). This environmental responsibility further culture needs to connect with their specific capabilities (i.e. GSLC), which are crucial to firms' environmental responses (Pappas et al., 2023). Hence, top managers need to act in an ethical, inclusive and respectful manner, and have sufficient GSLC to reconcile their firms' sustainability goals (Hermano and Martín-Cruz, 2016) by acquiring and leveraging resources (Wong and Ngai, 2021). Thus, the value of GSLC has been understood in relation to top managers' activities and abilities that are vital for firm success (Kurucz et al., 2017). In line with its purpose, a chief sustainability officer from PepsiCo stated that 'We are committing to reduc [ing] our emissions in line with limiting global warming to 1.5 °C, while also developing a long-term strategy for achieving net-zero emissions by 2050' (Bothwell, 2020). This reflects the importance of GSLC as a catalyst for constructive change to create a stronger sustainable future.

Firms' development towards a sustainability agenda and eventual deployment of green strategies require them to understand the true nature of GSLC (Anjali et al., 2023). Although some studies have identified different dimensions of GSLC, they are too fragmented to reach to a consensus on the underlying measures of GSLC (Anjali et al., 2023). For example, some studies consider only foresight capability to anticipate the future (e.g., Laan and Erwee, 2012), while another stream considers absorptive capability to be critical of organisational learning, knowledge sharing and capability development (Flatten et al., 2011). Adaptive capability studies highlight technology, market and management capabilities (Akgün et al., 2012), while research on innovation capability focuses on technology, products and strategic alignment (Vicente et al., 2015). Studies on networking capability identify the initiation, development and termination of relationships as key factors (Mitrega et al., 2012). Also, most studies have not validated the dimensions of GSLC, leaving GSLC an obscure concept. Moreover, prior scales to measure strategic leadership capability tend to be generic, and not specifically designed for GSLC settings where environmental factors and contexts should be taken into account. Incorrect specification of GSLC measurement scales creates ambiguity and ambivalence around the concept and may even lead to poor decisions. Against this backdrop, our study seeks to answer the following question: What are the dimensions of GSLC and how they are related to their respective subdimensions?

To this end, our research draws on the natural-resource-based view (NRBV) (Hart, 1995) to theorise GSLC as a higher-order multidimensional construct. Accordingly, we consolidate and synthesise fragmented findings of the green strategic management literature to conceptualise the term GSLC and identify its nature and associated dimensions. The instrument validation process consists of evaluating the psychometric properties of the GSLC scale and assessing its nomological and predictive validity. The findings demonstrate that GSLC is a third-order multidimensional construct with 3 s-order constructs that are reflected in nine first-order constructs.

Our research makes several theoretical and practical contributions. First, based on the NRBV, the measurement scale for the GSLC construct is developed and validated by integrating the fragmented literature on green strategic management, representing a unique contribution. Based on the NRBV, our research deems that firms should have foresight capability, adaptive capability and absorptive capability to use resources ecologically to benefit the firm. Such capabilities can be perceived as the GSLC of organisational managers to handle and overcome green management challenges. Second, our research focuses on filling the current gap in accurate measurement and empirical testing that exists in research on the NRBV of GSLC. In this vein, we contribute to NRBV research by using the 'pollution prevention', 'product stewardship' and 'sustainable development' principles of Hart (1995) to develop and validate a measurement model for GSLC.

The remainder of the paper is structured as follows. Section 2 identifies and conceptualises the nature and dimensions of the GSLC construct and presents our literature review method and the theoretical grounding of the research. Section 3 presents the instrument development process. Section 4 tests the instrument. Section 5 describes the confirmatory study. Section 6 presents the discussion and research implications, along with study limitations and paths for future research, and Section 7 concludes.

2. Literature review

2.1. Literature review method

To explore the extant dimensions of GSLC, we conducted a literature review along with thematic analysis (Tranfield et al., 2003), drawing on Scopus and Web of Science as our major data sources. The Scopus database was prioritised over Web of Science. Further, we used Google Scholar to ensure no papers were missed. During the *search phase*, the keyword searches on 'green strategic leadership capabilities' and 'green leadership capabilities' returned no results. A keyword search on 'strategic leadership capabilities', however, turned up three, five and seven records. These search results suggest that strategic leadership capabilities have received scant research attention. As a final search string, we used 'leadership capabilities'. This search produced 364 papers. Papers from January 2001 to May 2022 were included in the search. Following the *screening* and *extraction* phases, we extracted 172 papers that included conference papers, book chapters, editorials and reviews, but retained only the journal articles, which reflect the state-of-the-art on a research topic. We also excluded 16 papers from unrelated fields, such as nursing, physics and medicine. In the final *synthesis phase*, we screened the paper abstracts, selecting 18 for further analysis (see Appendix A). The literature review and thematic analysis produced three main capability themes and nine subthemes (Braun and Clarke, 2006) (discussed in the following section; see Appendix B). We verified these themes using the content analysis reliability measure of Krippendorff's alpha (i.e. Kalpha; Krippendorff, 2009), finding a significant Kalpha value (0.814) (>0.80). The following section summarises the definition of GSLC and presents its conceptualisation and theoretical justification.

2.2. Defining green strategic leadership capability

Strategic leadership centres on shaping a vision for the future and motivating, stimulating and engaging subordinates in strategy-supportive interactions (Elenkov et al., 2005). It is also defined as a manager's ability to set the tone and objectives of a firm and determine its strategic direction. It is the capability of top managers to obtain, manage and utilise appropriate resources and execute procedures that enable the firm to achieve its goals and increase performance (Ambilichu et al., 2022). According to Sosik et al. (2005), strategic leadership is a set of procedures that determine an organisation's effective functioning in terms of processes, people, technology and business opportunities, intended to create social, economic and intellectual value for its stakeholders, community and society as a whole. As defined by Ireland and Hitt (1999), leaders must be capable of forecasting and sourcing their organisation's future, and must be adaptable in the face of dynamic change that threatens the firm's existence. Thus, the strategic leadership capabilities of top managers affect firm performance in three ways: foresight, adaptation and absorption (Laan and Erwee, 2012; Flatten et al., 2011). A good strategic leader demonstrates actions that enable the firm to execute its strategy efficiently and effectively.

The concept of strategic leadership capabilities has been studied in relation to sustainability and environmental concerns (e.g. Taylor et al., 2012). In Thomas et al.'s (2004) view, top managers have the responsibility to design and sustain sustainable and environmental climates as part of their strategic leadership role. Therefore, from a sustainability and environmental perspective, organisations must ensure that top managers have sufficient technology, knowledge and

information to tackle environmental challenges and a solid understanding of how to create a community based on reduce–reuse–recycle to ensure environmental sustainability. In particular, managers require several strategic leadership capabilities: i) grasping the multifaceted global aspects of sustainability, ii) a unique outlook on protecting the environment; iii) engaging in collective decision-making using consensus building; and iv) meeting stakeholders' needs through strong partnerships (Mino and Hanaki, 2013). Thus, we define GSLC as the ability of a firm to govern and influence the organisation through top managers applying individual techniques and skills related to green management towards developing a vision of a sustainable future in a dynamic environment (Yoon and Suh, 2021).

2.3. Conceptualisation of green strategic leadership capability

A thematic analysis (see Appendix B) of this literature review suggests that strategic leadership capability is a hierarchical dispositional construct that consists of foresight capability, adaptive capability and absorptive capability. In accordance with our research objective, we conceptualise strategic leadership capability as GSLC, which consists of three dimensions – green foresight capability, green adaptive capability and green absorptive capability – and nine subdimensions – green tester, green framer, green management system, green market, green technology, green acquisition, green assimilation, green transformation and green exploitation.

Green foresight capability refers to the ability to establish strategic directions for a firm in its processes, methods or practices employing a green mindset to fit with current and future needs (Paliokaitė et al., 2014). This kind of capability contributes to strategic agility, organisational ambidexterity and learning, as well as to decision-making that enables growth in uncertain environments (Rhisiart et al., 2015). Two primary themes are found to constitute green foresight capability: 'green framer' and 'green tester' (Laan and Erwee, 2012), where a 'green framer' is able to change management styles according to the demands and circumstances of the natural environment and a 'green tester' can experiment with and adapt to new green trends (Gary, 2009).

Green adaptive capability refers to the ability to detect and exploit new market and technology opportunities effectively and in an eco-friendly manner (Staber and Sydow, 2002). This capability helps organisations to ensure speedy responses to market potential, recognise business prospects and exercise effective problem-solving skills (Wei and Lau, 2010). Three core themes underpin green adaptive capability: 'green management system', 'green market' and 'green technology' (Akgün et al., 2012). An effective 'green management system' motivates staff to engage in green practices and respond promptly to changes in the market. A 'green market' refers to the ability to search the market, screen competitors and customers for green issues, and allocate resources accordingly (Tuominen et al., 2004). 'Green technology' is characterised by an ability to monitor, access and combine green technologies and make high-quality green products (Tuominen et al., 2004).

Green absorptive capability is a critical dimension of GSLC proposed by this study. Green absorptive capability refers to the capacity to interact with the external environment, combining newly acquired green knowledge with current knowledge and successfully utilising this knowledge in business (Cooper and Molla, 2014). Green absorptive capability is important for successfully utilising external knowledge resources to improve innovation related to processes, products and services (Zhou et al., 2021). Green absorptive capability has four major themes: 'green acquisition', 'green assimilation', 'green transformation' and 'green exploitation' (Flatten et al., 2011). 'Green acquisition' refers to the ability to find, recognise, value and obtain outside green knowledge, whereas 'green assimilation' refers the ability to absorb outer green knowledge to analyse, process, interpret, understand, internalise and classify it (Zahra and George, 2002). 'Green transformation' implies improving and upgrading internal procedures that facilitate the transmission of prior knowledge and blending it with green knowledge, while 'green exploitation' means to acquire, assimilate and transform green knowledge into green operations, competence, routines, products and organisations (Zahra and George, 2002; Kogut and Zander, 1992). The conceptualisation of the GSLC is outlined in Table 1.

2.4. Theoretical justification

In recent years, the NRBV – an extension of the resource-based view (RBV) – has emerged as a key consideration in green strategic management (Hart and Dowell, 2011). Within the context of the emerging need for ecological improvements in firm operations, NRBV is critical in understanding and guiding effective organisational responses through rapid adaptation and reconfiguration of three essential factors – pollution prevention, product stewardship and sustainable development. Therefore, NRBV can be useful for theorising the emerging demand for ecological developments in firm activities, and GSLC can be considered from the perspective of the NRBV.

Not all firms have GSLC; only those that do are able to adopt state-of-the-art green management practices that lead to competitive advantages. Under GSLC, the foresight capability of the firm can be understood and expanded through the lens of the NRBV. According to the NRBV, a firm must capture business opportunities in a crisis and set a direction to gain long-term competitiveness and enhance ecological performance (Hart, 1995). To accelerate environmental performance, firms must have foresight capability in scanning green issues and transforming these into environmentally friendly practices (Scoblic, 2020).

Adaptive capability can also be explained in consideration of the NRBV. Firm management must remain calm in stressful situations and be able to effectively adjust to potential environmental damage, which is apposite to the firm's green adaptive capability to respond to green challenges and take advantage of green opportunities. Further, to improve organisational learning, a firm must improve capacity to a level that enables it to understand the importance of green information, integrate this information, and use it to achieve marketable ends (Dzhengiz and Niesten, 2020).

The NRBV states that a firm requires three key approaches: product stewardship, pollution prevention and sustainable development, which

Table 1
Conceptualisation of green strategic leadership capability.

Construct	General definition	Reference	Conceptualisation for the study
Green foresight capability	'… strategic foresight not only as a process, a method, or a practice, but also as an embedded organizing capability that enables organisations to cope with the future'.	Paliokaitė et al. (2014. pp-165)	Green foresight capability is the ability to set strategic directions for a firm in their process, a method, or a practice with a green mindset to fit with current and future needs.
Green adaptive capability	Firm's ability to identify and capitalize emerging market and technology opportunities to develop and manage new innovative ideas.	Staber and Sydow (2002)	Green adaptive capability is the ability to detect and exploit with new market and technology opportunities effectively and eco-friendly manner.
Green absorptive capability	'Absorptive capacity [capability] … refers to the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends'.	Cooper, and Molla (2014. pp-275)	Green absorptive capability is the ability of interacting with external environment and combining newly acquired green knowledge with existing knowledge, and successful utilisation in business.

differ across capabilities, resources and competitiveness (Hart, 1995). Thus, we surmise that firms must develop GSLC among staff members to reduce its environmental damage and attain long-term sustainable competitive advantage.

3. Instrument development process

Fig. 1 shows an overview of our selected studies. To develop and measure a GSLC instrument, we begin by inspecting commonly cited factors, as discussed in the literature review in Section 2.1. This process identifies three dimensions and nine subdimensions that reflect managers' leadership capability perceptions. Further, we conceptualise these nine subdimensions in relation to GSLC based on sound theoretical justification as discussed in the literature review in Sections 2.2, 2.3 and 2.4 (Churchill, 1979). Throughout our conceptual exploration, a firm's leadership capabilities are constantly referred to as a context-specific, hierarchical and multidimensional construct; thus, we assume that several particular subdimensions define the core dimensions of GSLC. Thus, to ascertain the contextual pertinence of the core dimensions and their subdimensions in the literature, we conduct a qualitative study.

3.1. Qualitative study

We selected Bangladesh as the research context. According to the Global Climate Risk Index, despite contributing a very small share of global emissions, Bangladesh is the seventh most at-risk nation to climate change (Germanwatch, 2021). It has been estimated that Bangladesh needs 100 billion dollars annually from developed nations to balance adaptation to and mitigation of climate change (National Adaptation Plan of Bangladesh, 2022). Several studies show that the impact of climate change is reducing production across many sectors in Bangladesh, including agriculture, manufacturing, construction, mining, transportation and services (Hossain, et al., 2022). For example, the World Bank reported that, by 2050, owing to climate change, one-third of agricultural sector GDP may be lost and GDP might collapse by 9% (Work Bank, 2022). Therefore, leaders from different sectors in Bangladesh must adopt GSLC and show strong leadership on green practices to sustain long-term business goals and meet future environmental demands of stakeholders. Given all this, Bangladesh offers a fitting context for this research-.

To establish the findings drawn from the literature, we employ the triangulation method (Patricia et al., 2018) and organised 21 semi-structured interviews with practitioners and firm managers. Using the snowball and convenience sampling procedures, participants (aged from 18 to 65 years) were recruited and interviewed for 30–40 min. Most respondents were male, reflecting the lack of gender diversity in management professions in Bangladesh (Meah et al., 2021) (see Table 2).

Participants were asked several questions to obtain an understanding of their perceptions and experiences relating to green leadership capability. The objective of the study was to identify new and confirm existing items in the literature. Each participant discussed green leadership capabilities (e.g. 'Our firm has a green mindset to enter new markets or create niches in existing markets' and 'Our firm can take advantage of nascent opportunities with green ideas'; see Appendix D). Throughout the interviews, the respondents stated that GSLC is a multilevel, multidimensional concept that can be explained via three green capabilities: green foresight capability, green adaptive capability and green absorptive capability. Some of the respondents further referred to the subdimensions, including green tester, green management system and green exploitation.

3.2. Scale development

3.2.1. Item creation

We created a pool of items for each construct (subdimensions of

Table 2
Demographic profile of the qualitative study participants.

Items	Categories	n = 21	(%)
Gender	Male	13	62%
	Female	08	38%
Age	26–35	6	29%
	36–45	7	33%
	46–55	6	29%
	>55	2	10%
Education	Bachelor	9	43%
	Masters	9	43%
	Research degree	3	14%
Profession	Top executive	2	10%
	Quality Manager	2	10%
	General Manager (Sales & Marketing)	1	5%
	Manager (Audit)	2	10%
	Manager (Business Development)	2	10%
	Manager (Production)	2	10%
	Deputy Manager (IT)	1	5%
	Manager (Commercial)	2	10%
	Senior Manager (Capacity Building)	2	10%
	Manager (Supply Chain)	2	10%
	Manager (Environment and Climate change)	1	5%
	Leadership researcher	1	5%
	Academic scholars	1	5%

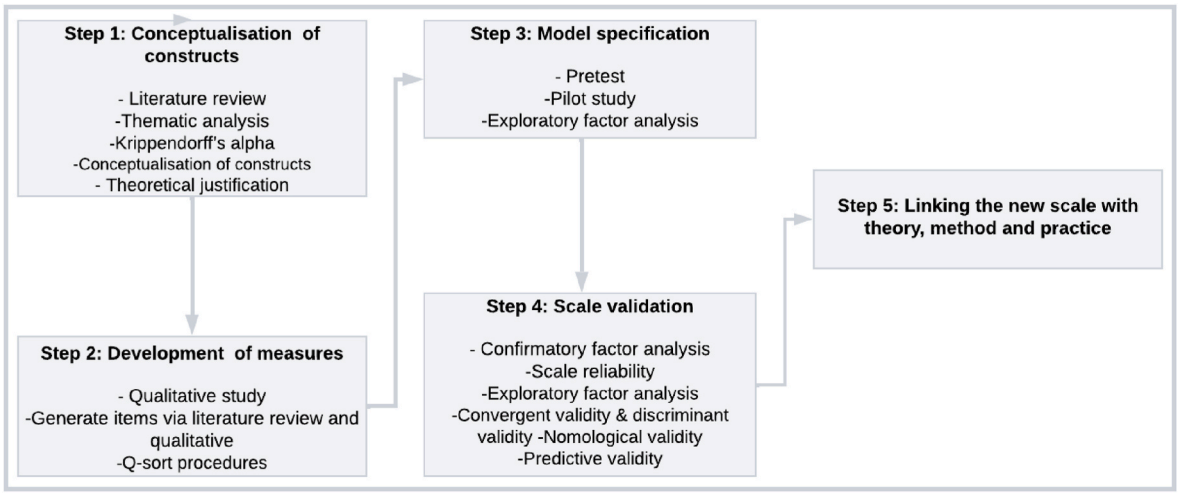


Fig. 1. Overview of studies.

GSLC) employing current instruments along with other items developed through our qualitative study. When selecting items from existing scales, in most cases, we use the Cronbach's alpha coefficient value 0.6 as the cut-off value (Straub et al., 2004). For example, for market capability, four items (Cronbach's alpha >0.6) were adopted from Akgün et al. (2012) and one was added from the qualitative study (see Appendix D). Qualitative outcomes were cross-checked and fitted with the construct meanings of present scales. Given that most of the extant scales follow a 5-point Likert scale (ranging from 'strongly disagree' to 'strongly agree'), we apply this in our research.

3.2.2. Item sorting

At this stage, we calculated the validity of each construct by checking the reliability of the associated items and domain coverage. First, with the help of three expert (i.e. a manager, a student and a professor) judgements, we employed a *Q*-sort technique to sort the items under the relevant GSLC subdimensions. This approach helped to ensure the extent of the 'right' positioning of items within different groups of constructs. Second, we undertook two rounds of sorting with the help of two different experts (i.e. a manager and a scholar).

We assessed item classification reliability for different dimensions by employing the data from the two rounds of the *Q*-sort process. Reliability was assessed based on the 'placement ratio' of the item underlying a particular construct (see Appendix C). The assessment revealed that of 105 viable item placements (35 measurement items), 91 correct placements were attained, leading to an accumulated placement ratio of 86.16%. In the final round of the Q-sorting process, all the individual placement ratios were above the cut-off value of 75% (Menor and Roth, 2007). The means from round 1 and round 2 revealed that a combined mean kappa (Cohen, 2013) for each construct's inter-judge agreement scores was greater than the cut-off value (≥65%) (Moore and Benbasat, 1991). Thus, for the initial questionnaire development, an aggregate of 35 items from different subdimensions were chosen (see Appendix D).

4. Instrument testing

A pre-test was performed using 13 convenience samples before conducting a pilot study. The pre-test proved the question wording, layout and format, content, sequence, instructions, question difficulty and range of the scales (i.e. 5-point Likert scale). We made context-specific adjustments to refine the final version of the questionnaire. In light of the educational profile (bachelor's and master's) of the respondents, it was decided to use the English version of the questionnaire for the survey. Respondents received the survey instrument along with a letter explaining the purpose of and instructions for the survey, as well as explanations of key terms. This ensured that the items were understandable for the respondents.

4.1. Pilot study

A pilot study was conducted in February 2021 using the purposive sampling method. We used the Bangladesh Standard Industrial Classification (BSIC) 2020 database (Bangladesh Bureau of Statistics, 2020). In accordance with this, three types of business operations – manufacturing, services and trading – were categorised. We invited 500 randomly selected firms to participate; 403 responses were collected (response rate of 80.06%), of which 378 were useable. We considered the firm manager as the unit of analysis.

To test the initial measurement scale, exploratory factor analysis (EFA) was applied with the varimax rotation (see Appendix D). Eigenvalues greater than 1.0 were extracted with nine factors. After rotation, the values for the nine factors were 4.572, 4.151, 3.662, 3.490, 3.188, 3.186, 2.763, 1.676 and 1.034. The reliability of the nine factors was assessed using Cronbach's alpha; these were all >0.70, confirming the adequate reliability of all factors (Carmines and Zeller, 1979). Throughout the EFA process, items that loaded weakly on a specific factor (<0.40) were deleted (see Appendix D). This process removed the following items: GSLC16, GSLC20, GSLC26 and GSLC32. For the next run of EFA, 31 items were taken, split into nine factors: green tester, green framer, green management system, green market, green technology, green acquisition, green assimilation, green transformation and green exploitation. Thus, we established the reliability of the refined model (see Table 3).

4.2. Model specification

This study proposes GSLC as a multi-order hierarchical model consisting of dimensions and subdimensions (see Fig. 2). GSLC is conceptualised as a third-order model consisting of three core dimensions – green foresight capability, green adaptive capability and green absorptive capability. Each dimension has respective subdimensions. Appendix F explains our multidimensional, hierarchical, reflective GSLC model. We used Jarvis et al.'s (2003) guidelines to determine whether the GSLC factors were reflective or formative. First, the exploratory results firmly established the reflective viewpoint. Based on the results, both the correlation among the measures and the internal consistency were significant (Petter et al., 2007; Bollen and Lennox, 1991). Second, the results also confirmed the unidimensionality of reflective constructs, allowing the removal of several measures during the scale refinement step without affecting construct validity. Third, GSLC model is a reflective model; theoretically, causality runs from construct to the items. This implies that under a construct share a common theme (Polites et al., 2012). For example, 'development of green prototypes', 'Our firm adapts green technologies accordant to new knowledge' and 'Our firm can work more effectively by adopting new green technologies' share a similar theme and are interchangeable. Overall, extant studies on strategic leadership capability and its measurement model specifications support this view of the reflective nature of the construct (e.g., Laan and Erwee, 2012; Flatten et al., 2011).

5. Confirmatory study

To provide sufficient proof of discriminant, convergent and nomological validity, we use confirmatory factor analysis (CFA). In August 2021, a survey with 244 (205 of which were useable) was conducted using the same database as in the pilot study (see Appendix E).

This study estimates the hierarchical GSLC model by employing partial least squares (PLS), which is variance-based structural equation modelling (SEM). Using PLS allows us to model all links simultaneously (Straub et al., 2004), thus removing multicollinearity. In addition, PLS is suitable for a new context of measurement and initial phase of theory development. Further, it is useful to develop a model with higher-order latent constructs by applying a small sample size (Chin and Wang, 2010). In our study, we use SmartPLS software (Ringle et al., 2015) and apply nonparametric bootstrapping (with 500 resamples) to find the standard errors of the estimates (Wetzels et al., 2009).

To estimate our hierarchical model for GSLC, we employ the repeated indicators approach (see Wetzels et al., 2009). For example, green foresight capability is measured using the eight items from green tester and green framer capability. Similarly, GSLC (the third-order construct) is estimated by considering all the items of green foresight, green adaptive and green absorptive capability (the second-order constructs).

5.1. Assessment of the first-order scale

CFA proves that all the item values are higher than the cut-off value of 0.70 and significant ($p < 0.01$) in the case of the first-order model (see Table 4). Composite reliability (CR) and average variance extracted (AVE) values are satisfactory; that is, above the cut-off values of 0.70 and 0.50, respectively (Chin and Wang, 2010). Next, the cross-loading matrix confirms convergent validity. Further, we ensure discriminant

Table 3
Results of exploratory factor analysis of the refined scale in the pilot study.

Factors	Items	Loading	Item total correlation	Eigenvalues	Cumulative variation	Cronbach's alpha
Green tester	GSLC1	0.868	0.654	3.976	12.826	0.887
	GSLC2	0.839	0.673			
	GSLC3	0.611	0.725			
	GSLC4	0.532	0.731			
Green framer	GSLC5	0.735	0.560	3.815	25.134	0.788
	GSLC6	0.695	0.545			
	GSLC7	0.675	0.543			
	GSLC8	0.620	0.654			
Green management system	GSLC9	0.839	0.429	3.305	35.794	0.918
	GSLC10	0.744	0.574			
	GSLC11	0.734	0.663			
Green market	GSLC12	0.756	0.721	2.999	45.468	0.832
	GSLC13	0.668	0.835			
	GSLC14	0.653	0.705			
	GSLC15	0.596	0.812			
Green technology	GSLC17	0.810	0.607	2.841	54.632	0.870
	GSLC18	0.795	0.614			
	GSLC19	0.473	0.704			
	GSLC21	0.446	0.709			
Green acquisition	GSLC22	0.654	0.681	2.782	63.605	0.837
	GSLC23	0.500	0.860			
	GSLC24	0.490	0.749			
Green assimilation	GSLC25	0.765	0.641	2.518	71.728	0.830
	GSLC27	0.700	0.684			
	GSLC28	0.455	0.814			
Green transformation	GSLC29	0.873	0.464	1.509	76.596	0.711
	GSLC30	0.497	0.720			
	GSLC31	0.458	0.809			
Green exploitation	GSLC33	0.737	0.613	1.118	80.203	0.807
	GSLC34	0.475	0.732			
	GSLC35	0.447	0.862			

Note(s): Green strategic leadership capability (GSLC).

validity. The AVE square root values are greater than the intercorrelations of the construct with the other constructs' values (Chin and Wang, 2010) (see Table 5).

5.2. Assessment of the higher-order scale

The analysis demonstrates that the second-order constructs of green foresight capability ($\beta = 0.937$), green adaptive capability ($\beta = 0.925$) and green absorptive capability ($\beta = 0.912$) explain 88%, 86% and 83% of overall GSLC (the third-order construct variance), respectively (see Fig. 2). This result confirms a strong association between GSLC (the third-order construct) and the second-order constructs. The analysis also reveals a strong association between the second-order constructs and the first-order constructs. For example, green foresight capability is mirrored by green tester ($\beta = 0.946$), and green framer ($\beta = 0.953$), of which green framer mirrors the highest variance of green foresight capability. The results confirm the coefficients of the paths corresponding to the third-order constructs to the second-order and the first-order constructs are significant at $p < 0.01$ (see Appendix G). This indicates that the 31 items categorised under the nine factors can be applied to measure GSLC.

5.3. Assessment of the nomological and predictive validity

Research has observed a direct association between green training and green capabilities, as well as between green capabilities and firm performance. Cabral and Dhar (2019) confirm that green training affects the green capabilities of managers. An organisation committed to environmental improvements conducts green training to equip managers to undertake ecologically minded developments in firm operations (Nalini and Bonnie, 2004). In fact, green training assists in boosting managers' capability to deal with environmental challenges in a practical manner. With the increasing ecological challenges, firms are confronting pressure to reduce their adverse effects on the environment while operating the business. Thus, GSLC helps managers to effectively improve and execute green management practices to protect and reduce damage to the natural environment (Algarni et al., 2022). Based on this, we posit the following hypotheses to test the nomological validity of the GSLC model.

H1. Green training has a direct positive impact on GSLC.

H2. GSLC has a direct positive impact on firm environmental performance.

We employ multi-item scales for green training and firm environmental performance from Jabbour (2015) and Montabon et al. (2007), respectively. All the path coefficients, that is, green training −> GSLC ($\beta = 0.863$) and GSLC −> firm environmental performance ($\beta = 0.781$) are significant at $p < 0.001$, which confirms H1 and H2. In addition, we find R^2 values of 0.610 and 0.744 for firm environmental performance and GSLC, respectively, which are significant (>0.30) (Hair et al., 2011). Thus, our results confirm the nomological validity of the GSLC model. Moreover, we find a Q^2 value of 0.637 and 0.346 for firm environmental performance and GSLC, respectively, using the cross-validated redundancy approach (Chin and Wang, 2010). Thus, we demonstrate predictive validity.

5.4. Assessment of the overall parameters

To confirm the robustness of the higher-order GSLC scale, we first estimate the goodness-of-fit (GoF) index, calculated as the geometric mean of the average R^2 and average communality for all endogenous constructs (Tenenhaus et al., 2005). We obtained a GoF value of 0.696 for the overall GSLC scale, which exceeds the cut-off value of 0.36 for large effect sizes of R^2 (Wetzels et al., 2009). Therefore, the model has good predictive power and satisfactorily validates the PLS model globally. Second, we estimated the power ($1-\beta$) of the model to test its ability to reject a false null hypothesis (H0) (Cohen, 2013). In our study, the size of the estimated power (0.99) significantly exceeded the cut-off

Fig. 2. GSLC model.

Table 4
Psychometric properties of the hierarchical green strategic leadership capability scale.

First-order constructs				
Constructs	Items	Loadings	AVE	CR
Green tester	4	0.896–0.957	0.882	0.968
Green framer	4	0.765–0.923	0.742	0.920
Green management system	3	0.873–0.918	0.798	0.922
Green market	4	0.757–0.840	0.737	0.880
Green technology	4	0.777–0.909	0.743	0.920
Green acquisition	3	0.840–0.909	0.758	0.904
Green assimilation	3	0.858–0.916	0.788	0.917
Green transformation	3	0.946–0.964	0.914	0.970
Green exploitation	3	0.905–0.925	0.837	0.939

value of 0.80, confirming good confidence in the hypothesised relationships.

6. Discussion

6.1. Implications for theory

Our study has several implications for the literature on strategic management. First, past studies lack adequate knowledge of GSLC and its associated practices, impeding the application of GSLC. We theoretically conceptualise and empirically validate a GSLC measurement model based on the NRBV to fill this research gap. This study establishes GSLC as a multidimensional and hierarchical construct in the green strategic management domain through various research stages. These efforts capture different green strategic capabilities of managers to respond to firm environmental performance. The GSLC scale is highly relevant to current business practices where many businesses struggle to be environmentally responsible, with recent articles arguing for the need for more research on responsible digital transformation (Pappas et al., 2023; Zimmer et al., 2023).

Second, most scholars have used NRBV as a theoretical basis for examining environmental management affairs (e.g. AlNuaimi et al.,

Table 5
Mean, standard deviation (SD) and correlations of first-order constructs.[a].

Constructs	Mean	SD	gtes	gfra	gman	gmar	gtec	gacq	gass	gtra	gexp
Green tester (gtes)	4.057	1.043	0.939								
Green framer (gfra)	3.276	1.096	0.804	0.862							
Green management system (gman)	3.532	1.106	0.706	0.816	0.893						
Green market (gmar)	3.273	0.928	0.675	0.813	0.792	0.858					
Green technology (gtec)	3.065	1.026	0.544	0.762	0.714	0.853	0.862				
Green acquisition (gacq)	3.667	0.989	0.657	0.712	0.624	0.733	0.728	0.870			
Green assimilation (gass)	4.013	0.891	0.662	0.582	0.518	0.602	0.505	0.690	0.887		
Green transformation (gtra)	3.841	1.077	0.632	0.654	0.509	0.598	0.501	0.720	0.715	0.956	
Green exploitation (gexp)	3.611	1.119	0.602	0.634	0.649	0.686	0.650	0.651	0.581	0.617	0.915

Note(s): a Discriminant validity: square root of AVE on the diagonal > correlation coefficients.

2021; Hanif et al., 2023). Other studies have used the dynamic capability view (DCV) (e.g., Chen and Chang, 2013; Jiang et al., 2018) or institutional theory (IT) (e.g., Dubey et al., 2015; Babiak and Trendafilova, 2011). DCV's three core elements are sensing, seizing and transforming, which emphasise the firm's ability to refine and rebuild its competencies in a rapidly changing environment, rather than focusing on particular environmental issues (Teece et al., 1997). In contrast, IT focuses on legitimacy, ethics and productivity rather than the firm's environmental practices, structures and decisions (Scott, 2008). Therefore, IT is also far from addressing environmental issues. Given this, we propose that NRBV can be employed to address the emerging need for ecologically minded development of firm operations. By incorporating intangible resources or capabilities related to environmental issues, our study extends the NRBV to the strategic management domain. Our empirically validated GSLC scale offers solid evidence of the NRBV's interconnected strategies, including production stewardship, pollution prevention and sustainable development.

Finally, by developing and validating useful measures of the GSLC scale and proving its psychometric properties, we set out the principles of a capability concept specific to green management practices of organisations that affect long-term sustainable growth and the protection of the environment. By integrating environmental leadership with the core capabilities, we add value to the environmental underpinnings of the capability construct and thus open avenues for further shaping of capability research and investigating the relationship between the GSLC of top managers, their environmental decision-making and actions, and an organisation's sustainability performance. By applying our measurement model, a firm can modify and change their GSLC and track the results of those modifications in view of successfully accomplishing their goals.

6.2. Implications for practice

The implications of this research are highly relevant to the decision makers involved in green management practices. First, in the context of ever-rising environmental concerns, green management practices are crucial for creating benefits and competitiveness for firms. As a result, top managers are increasingly expected to demonstrate GSLC. A theoretically conceptualised and empirically validated construct (i.e. GSLC) provides top managers with an effective tool for outlining specific leadership capabilities related to green management practices. The findings suggest that top managers evaluate GSLC at an overall level, a dimensional level (i.e. green foresight capability, green adaptive capability and green absorptive capability) and a subdimensional level (i.e. green tester, green framer, green management system, green market, green technology, green acquisition, green assimilation, green transformation and green exploitation). These findings improve our understanding of how top managers evaluate GSLC. In particular, they suggest that managers focus on improving green leadership capability across the three primary dimensions by, in turn, focusing on the nine subdimensions. For instance, green foresight capability could be improved by increasing green tester and green framer capability. Likewise, green adaptive capability could be improved by developing green management systems, markets and technology, and green absorptive capability could be enhanced by updating green acquisition, assimilation, transformation and exploitation capability.

Second, by using the GSLC's subdimensional model, top managers can identify specific leadership capabilities, and can plan, organise and control the appropriate green management decisions. Further, the model can be used to analyse, design and integrate firms' required leadership capabilities related to green management practices. For example, green foresight capability alone is not sufficient to develop the desired levels of GSLC. Therefore, top managers should consider other capabilities (i.e. green adaptive capability or green absorptive capability) while developing GSLC. This approach also highlights that green management issues occur differently at different levels of an organisation. For example, foresight capability concerns setting strategic directions for the future, while adaptive capability concerns detecting and exploiting new market and technological opportunities.

Third, in the development phase, green management practices can be planned to use the GSLC model. Using the model, top managers can launch green management practices, identify and prioritise upgrading zones, make appropriate interventions, and evaluate the application of green management. Further, the GSLC model enables top managers to plan and organise resources (e.g. cost) and develop infrastructure (e.g. machinery, processes) for green management practices. Furthermore, organisations can plan, organise and control their green management practices with a proper evaluation and implementation of the GSLC model. Moreover, top managers can use the GSLC model to examine green management practices in their business operations, identify their weaknesses and strengths in sustainability and environmental matters, and plan interventions.

Finally, the GSLC model established in this research provides top managers with insight into how single capability dimensions and the entire GSLC configure in determining firm environmental performance. In this process, green training increases top managers' capability to tackle environmental challenges. This association is considered a key challenge in recognising and implementing the best green management practices around the globe, and practitioners argue that understanding this relationship will assist the scalability of the new green strategic management paradigm. Our research results indicate that, overall, GSLC is an important forecaster of firm environmental performance and green training is an essential element in determining GSLC. Our findings imply that top managers believe that GSLC is a vital strategic goal, confirming the desire of firms to ensure good environmental performance. This can be achieved by providing effective green training to managers. Overall, our proposed GSLC model may assist practitioners to address green management challenges through developing GSLC among managers, and above all, to accomplish long-term environmental performance.

7. Limitations and future research directions

Although our research has important implications for practice and theory, several limitations must be noted. First, Bangladeshi

manufacturing, services and trading firms were used in the study, limiting its applicability to other developing countries. It is recommended that future research modify and examine the GSLC construct and its effect on performance outcomes by gathering data from other developing nations to extend its generalisability. In terms of strategic leadership capabilities and green management practices, there are significant differences and challenges between developing and developed nation firms. Second, the sample frame in survey phases of our study was manufacturing, services and trading firms in Bangladesh. Although this sample presents a strong empirical base to understand GSLC, future studies may consider other sectors to increase the generalisability of findings. In particular, government agencies and NGOs are increasingly integrating and extending their green strategic management practices that target meeting sustainability and environmental goals.

Third, the study relied on cross-sectional data to examine GSLC and its causal relationship. To address sustainability and environmental issues, the implementation of GSLC could result in an increased cost for green management operations. Researchers may use longitudinal data to examine the costs and benefits of implementing GSLC and green management practices in the future. Such temporal investigations would significantly enhance our understanding of GSLC. Fourth, this study validates the multidimensionality of the GSLC construct. Future research may explore different dimensions, such as green networking capability or/and green innovation capability of GSLC relevant to this context. Fifth, our study focuses on developing a GSLC measurement model with limited analysis of its performance outcomes. While our current study tests the relationship between GSLC and firm environmental performance, empirical research may consider examining the impact of GSLC implemented by firms on other specific performance outcomes such as green services, green manufacturing and green procurement. This is particularly important as research on Industry 5.0 is increasing for different types of industries (Kazancoglu et al., 2023; Pappas et al., 2023) Examining GSLC's role in affecting performance outcomes is crucial in determining green management practices and green growth. Similarly, different types of organisational capabilities may be considered, especially those that have been found relevant from a sustainable development perspective (Fosso Wamba et al., 2024) or when resource availability becomes a key barrier for firm performance (Queiroz et al., 2023). Finally, environment-related strategic leadership capabilities can change over time, and be identical and industry-specific at the same time. Replication of studies in the future would contribute to the advancement of green strategic management literature.

8. Conclusion

The purpose of our study was to develop and validate a scale that measures top managers' GSLC. While past research has examined environmental leadership from the perspective of different leadership styles and green competencies, our study is the first to conceptualise GSLC, develop constructs and validate a GSLC measurement scale. The findings suggest that GSLC is a multidimensional, hierarchical and reflective model comprising 31 items, nine subdimensions and three dimensions. This measurement model is highly reliable and valid, and can be used to plan, organise and control green management activities. The study contributes novel knowledge to the theory and practice of green management. Hence, our research offers a deep understanding of the existing state-of-the-art in strategic management.

CRediT authorship contribution statement

Eijaz Ahmed Khan: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft. **Mohammad Alamgir Hossain:** Methodology, Resources, Software, Supervision, Writing – review & editing. **Mohammed Abu Jahed:** Investigation, Writing – review & editing. **Rabeya Akter:** Investigation, Writing – review & editing. **Ilias O. Pappas:** Supervision, Visualization, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Summary of literature search

Search	Search string	Database	Results/useful	Database	Results/useful	Database	Results/useful
1	"Green Strategic Leadership Capabilities"	Scopus	0	WoS	0	Google scholar	0
2	"Green Leadership Capabilities"	Scopus	0	WoS	0	Google scholar	0
3	"Strategic Leadership Capabilities"	Scopus	7/1	WoS	5/1	Google scholar	3/0
4	"Leadership Capabilities"	Scopus	364/8	WoS	135/8	Google scholar	90/2
Total	18 (used)						

Note(s): WoS-Web of Science.

Appendix B. Summary of dimensions of leadership capabilities from literature review

Selected studies	Selective themes	Aggregate overarching themes	Main themes
Balasubramanian and Fernandes (2022); Crosby and Bryson (2005); Etemadi et al. (2022); Sinha (2017); Benitez et al. (2022); Lianto et al. (2022); Amelda et al. (2021); Ghasemy et al. (2018); Frawley and Fasoli (2012); Andrews (2019); Sharma (2020); Johnson et al. (2021); Yoon and Suh (2021); Mukherjee et al. (2012) Bell and Hofmeyr (2021); Summer et al. (2006); Kivipõld, and Vadi (2010)	Shapes strategic thinking; creating a combined Worldview; visionary; model the way; challenge the process; capacity to change; cognitive capability; change-oriented capability; R&D capability; continuous improvement	Tester, farmer	Foresight capability
	Adaptiveness; business skills; daily management; project management skill; technology capability; marketing capability	Management system; market; technology	Adaptive capability
	Managerial wisdom; capacity to leverage resources; business transformation; knowledge management capacity; openness and communication; consultation and collaboration; productive working relationships; structure and system	Acquisition; assimilation; transformation; exploitation	Absorptive capability

Appendix C. Inter-rater reliability

Theoretical construct classification	Actual construct classification											
	gtes	gfra	gman	gmak	gtec	gacq	gass	gtra	gexp	Total	% Hits	Average Kappa scores
gtes	15	1						1		17	88.24%	81.10%
gfra	1	16		1						18	88.89%	80.72%
gman			10				1			11	90.91%	84.20%
gmak				8				1		9	88.89%	84.73%
gtec			1		6			1		8	75.00%	85.07%
gacq					1	8	1			10	80.00%	84.23%
gass						1	8			9	88.89%	84.40%
gtra	1							11	1	13	84.62%	83.15%
gexp	1								9	10	90.00%	83.66%
Total	18	17	11	9	7	9	10	14	10	105	86.16%	
% Hits	83.33%	94.12%	90.91%	88.89%	85.71%	88.89%	80.00%	78.57%	90.00%			

Note(s): green-tester = gtes, green = framer-gfra, green-management system = gman; green-market = gmar, green-technology = gtec, green-acquisition = gacq, green-assimilation = gass, green-transformation = gtra, and green-exploitation = gexp

Appendix D. Results of exploratory factor analysis in the pilot study

Code	Items	Factors									Items supported by (literature) and or (interviews)
		1	2	3	4	5	6	7	8	9	
GSLC1	Our firm can test new green trends/products early	0.864									Laan and Erwee (2012) (a,b,c,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC2	Our firm aware of huge green trends in society	0.837									Laan and Erwee (2012) (a,b,c,d,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC3	Our firm can go along when new green trends come	0.611									Laan and Erwee (2012) (a,b,c,d,e,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC4	Our firm can take advantage of nascent opportunities with green ideas*	0.531									(a,b,c,d,e,f,h,k,l,m,n,o,s,t,u)
GSLC5	Our firm is able to consider how green trends interact				0.757						Laan and Erwee (2012) (a,b,c,d,e,f,g,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC6	Our firm can focus on future questions related to green issues				0.693						Laan and Erwee (2012) (a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC7	Our firm has interest in future questions related to green issues				0.685						Laan and Erwee (2012) (a,b,c,d,e,f,g,h,i,k,l,m,n,o,p,q,r,s,t,u)
GSLC8	Our firm can focus on greater future questions related to green issues				0.567						Laan and Erwee (2012) (a,b,c,d,e,f,g,h,i,j,l,m,n,o,p,q,r,s,t,u)
GSLC9	Our management systems can inspire people to develop green concepts		0.812								Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,m,n,o,p,q,r,s,t,u)
GSLC10	Our management systems are flexible enough to respond quickly to green issues		0.782								Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,n,o,p,q,r,s,t,u)
GSLC11	Our management systems can evolve rapidly in response to green shifts		0.528								Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,o,p,q,r,s,t,u)
GSLC12	Our firm can regularly monitor changes in markets related to green issues			0.666							Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,p,q,r,s,t,u)
GSLC13	Our firm can frequently adopt new marketing techniques related to green issues			0.521							Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,q,r,s,t,u)
GSLC14	Our firm can continuously monitor competitors' actions related to green issues			0.521							Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,q,r,s,t,u)
GSLC15	Our firm can allocate a substantial part of resources to green marketing practices			0.485							Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,s,t,u)
~~GSLC16~~	~~Our firm has green mindset to enter new markets or create niches in existing markets~~[a] ~~*~~										(a,b,c,d,f,h,i,j,l,m,n,o,p,q,r,t)

(continued on next page)

(*continued*)

Code	Items	Factors									Items supported by (literature) and or (interviews)
		1	2	3	4	5	6	7	8	9	
GSLC17	Our firm is able to capture green technical capabilities					0.698					Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,u)
GSLC18	Our firm can monitor technical changes related to green issues					0.611					Akgün et al. (2012) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t)
GSLC19	Our firm can access new technological opportunities with green lens					0.602					Akgün et al. (2012) (a,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
~~GSLC20~~	~~Our firm is able to achieve technical complementarity related to green issues~~[a]										Akgün et al. (2012) (b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC21	Our firm can avert potential risks related to green issue					0.531					Akgün et al. (2012) (d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC22	Our firm can frequently search relevant green information concerning industry						0.838				Flatten et al. (2011) (a,b,c,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC23	Our firm can motivate the people to use information sources related to green issues						0.722				Flatten et al. (2011) (a,b,c,d,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC24	Our firm expects from the people to deal with information related to green issues						0.712				Flatten et al. (2011) (a,b,c,d,e,f,h,i,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC25	In our firm, green ideas and concepts are communicated cross-departmental									0.754	Flatten et al. (2011) (a,b,c,d,e,f,g,i,j,k,l,m,n,o,p,q,r,s,t,u)
~~GSLC26~~	~~Our firm emphasizes cross-departmental support to solve green issues~~[a]										Flatten et al. (2011) (a,b,c,d,e,f,g,h,j,k,l,m,n,o,p,q,r,s,t,u)
GSLC27	In our firm, there is a quick information flow related to green issues									0.691	Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,k,l,m,n,o,p,q,r,s,t,u)
GSLC28	Our firm demands periodical cross-departmental meetings related to green issues									0.459	Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,l,m,n,o,p,q,r,s,t,u)
GSLC29	Our firm can structure, and use collected green knowledge							0.840			Flatten et al. (2011) (b,c,d,e,f,g,h,i,j,k,m,n,o,p,q,r,s,t,u)
GSLC30	Our firm can absorb and distribute new green knowledge							0.475			Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,k,l,n,o,p,q,r,s,t,u)
GSLC31	Our firm can successfully link existing green knowledge with new insights							0.443			Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,k,l,m,o,p,q,r,s,t,u)
~~GSLC32~~	~~Our firm can apply new green knowledge in practical way~~[a]										Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,p,q,r,s,t,u)
GSLC33	Our firm supports the development of green prototypes								0.733		Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,q,r,s,t,u)
GSLC34	Our firm adapts green technologies accordant to new knowledge.								0.459		Flatten et al. (2011) (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,r,s,t,u)
GSLC35	Our firm can work more effective by adopting new green technologies*								0.472		(a,b,c,d,e,h,i,j,k,l,m,p,q,s,t)
	Cronbach's Alpha	0.887	0.861	0.916	0.788	0.910	0.832	0.795	0.807	0.860	

Note(s): a Item scores not reported due to low factor loadings (<0.40) or similar loadings on more than one factor. * new items are generated from interviews, green strategic leadership capability (GSLC).

Appendix E. Demographic profile of respondents

		Pilot study		Confirmatory study				Pilot study		Confirmatory study	
Items	Categories	No	%	No	%	Items	Categories	No	%	No	%
Firm age	<10	82	22%	41	20%	Gender	Male	251	66%	124	60%
	11 to 20	119	31%	69	34%		Female	128	34%	81	40%
	21 to 30	109	29%	57	28%	Age	<35	153	40%	82	40%
	30+	69	18%	38	19%		36 to 45	133	35%	71	35%
Firm size	<100	41	11%	21	10%		45+	93	25%	52	25%

(*continued on next page*)

(*continued*)

		Pilot study		Confirmatory study				Pilot study		Confirmatory study	
Items	Categories	No	%	No	%	Items	Categories	No	%	No	%
	101 to 200	93	25%	61	30%	Experience	<5	125	33%	67	33%
	201 to 300	111	29%	59	29%		6 to 10	139	37%	75	37%
	301 to 400	91	24%	41	20%		10+	115	30%	63	31%
	400+	43	11%	23	11%	Education	Bachelor	256	68%	131	64%
Industry type	Manufacturing	153	40%	83	40%		Masters	123	32%	74	36%
	Service	121	32%	63	31%						
	Trading	105	28%	59	29%						

Appendix F. The estimation and formula of the higher-order model

Formula and notation	
First-order model	$y_i = \Lambda_y.\eta_j + \varepsilon$
	y_i = manifest variables (e.g., indicators of *tester* Λ_y = loadings of first-order LVs, η_j = first-order LVs (e.g., *tester*) ε_i = measurement error
Second-order model	$\eta_j = \Gamma.\ \xi_k + \zeta_j$
	η_j = first-order factors, Γ = loadings of second-order LVs, ξ_k = second-order LVs (e.g., green foresight capability) ζ_j = error of first-order factors
Third-order model	$\eta_j = \beta.\ \eta_j + \Gamma.\ \xi_k + \zeta_j$
	η_j = second-order factors
	$\beta.\ \eta_j$ = higher-order LVs with loadings (i.e., from first to the *n*th order, except the highest order), $\Gamma.\ \xi_k$ = highest-order LV with loadings (i.e., third-order - Green strategic leadership capability) and ζ_j = error of second-order factors

Appendix G. Path coefficients and t-statistics

Paths in the research model	Path coefficients	Standard error	t- value
Green foresight capability > green tester	0.946	0.013	75.262
Green foresight capability > green framer	0.953	0.009	102.039
Green adaptive capability > green management system	0.944	0.012	80.346
Green adaptive capability > green market	0.949	0.010	97.006
Green adaptive capability > green technology	0.829	0.041	20.322
Green absorptive capability > green acquisition	0.889	0.033	26.961
Green absorptive capability > green assimilation	0.864	0.031	28.173
Green absorptive capability > green transformation	0.885	0.027	32.467
Green absorptive capability > green exploitation	0.819	0.058	14.170
GSLC > Green foresight capability	0.937	0.015	62.150
GSLC > Green adaptive capability	0.925	0.017	54.626
GSLC > Green absorptive capability	0.912	0.017	55.271

Note(s): Green strategic leadership capability (GSLC).

References

Akgün, A.E., Keskin, H., Byrne, J., 2012. Antecedents and contingent effects of organizational adaptive capability on firm product innovativeness. J. Prod. Innovat. Manag. 29, 171–189.

Algarni, M.A., Ali, M., Albort-Morant, G., Leal-Rodríguez, A.L., Latan, H., Ali, I., Ullah, S., 2022. Make green, live clean! Linking adaptive capability and environmental behavior with financial performance through corporate sustainability performance. J. Clean. Prod. 346, 131156.

AlNuaimi, B.K., Singh, S.K., Harney, B., 2021. Unpacking the role of innovation capability: Exploring the impact of leadership style on green procurement via a natural resource-based perspective. J. Bus. Res. 134, 78–88.

Ambilichu, C.A., Omoteso, K., Yekini, L.S., 2022. Strategic leadership and firm performance: the mediating role of ambidexterity in professional services small-and medium-sized enterprises. Eur. Manag. Rev.

Amelda, B., Alamsjah, F., Elidjen, E., 2021. Does the digital marketing capability of Indonesian Banks Align with digital leadership and technology capabilities on Company performance? CommIT (Communication and Information Technology) Journal 15 (1), 9–17.

Andrews, K., 2019. Leadership capabilities in Fiji's civil service: perspectives of senior officials. Asia Pacific Journal of Public Administration 41 (1), 48–55.

Anjali, S., Lim, W.M., Jha, S., Kumar, S., 2023. The state of the art of strategic leadership. J. Bus. Res. 158. Article 113676.

Babiak, K., Trendafilova, S., 2011. CSR and environmental responsibility: Motives and pressures to adopt green management practices. Corp. Soc. Responsib. Environ. Manag. 18 (1), 11–24.

Balasubramanian, S., Fernandes, C., 2022. Confirmation of a crisis leadership model and its effectiveness: lessons from the COVID-19 pandemic. Cogent Business & Management 9 (1), 2022824.

Bangladesh Bureau of Statistics, 2020. Retrieved. http://203.112.218.65:8008/CodeClassifications.aspx?MenuKey=4. (Accessed 15 January 2020).

Bell, L., Hofmeyr, K., 2021. Enabling organisational ambidexterity: a leadership perspective. S. Afr. J. Bus. Manag. 52 (1), 15.

Benitez, J., Arenas, A., Castillo, A., Esteves, J., 2022. Impact of digital leadership capability on innovation performance: the role of platform digitization capability. Inf. Manag. 59 (2), 103590.

Bollen, K., Lennox, R., 1991. Conventional wisdom on measurement: a structural equation perspective. Psychol. Bull. 110 (2), 305.

Bothwell, L., 2020. 23-last Update, PepsiCo on Target with Recycling. Goals [Homepage of Informa], [Online].

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101.

Cabral, C., Dhar, R.L., 2019. Green competencies: construct development and measurement validation. J. Clean. Prod. 235, 887–900.

Carmines, Edward G., Zeller, Richard A., 1979. Reliability and Validity Assessment. Sage publications.

Chen, Y.S., Chang, C.H., 2013. The determinants of green product development performance: green dynamic capabilities, green transformational leadership, and green creativity. J. Bus. Ethics 116, 107–119.

Chin, J. Henseler, Wang, H. (Eds.), 2010. Handbook of Partial Least Squares: Concepts, Methods and Application. Springer, Germany, pp. 645–689.

Churchill Jr., G.A., 1979. A paradigm for developing better measures of marketing constructs. J. Market. Res. 16 (1), 64–73.

Cohen, J., 2013. Statistical Power Analysis for the Behavioral Sciences. Academic press.

Cooper, V.A., Molla, A., 2014. Absorptive capacity and contextual factors that influence green IT assimilation. Australasian Journal of Information Systems 18 (3).

Crosby, B.C., Bryson, J.M., 2005. A leadership framework for cross-sector collaboration. Publ. Manag. Rev. 7 (2), 177–201.

Donald,, S.S., 2009. Green management matters only if it yieds more green: an economic/strategic perspective. Acad. Manag. Perspect. 23 (3), 5–16.

Dubey, R., Gunasekaran, A., Ali, S.S., 2015. Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: a framework for green supply chain. Int. J. Prod. Econ. 160, 120–132.
Dzhengiz, T., Niesten, E., 2020. Competences for environmental sustainability: a systematic review on the impact of absorptive capacity and capabilities. J. Bus. Ethics 162 (4), 881–906.
Elenkov, D.S., Judge, W., Wright, P., 2005. Strategic leadership and executive innovation influence: an international multi-cluster comparative study. Strat. Manag. J. 26 (7), 665–682.
Etemadi, M., Hamzehpoor, M., Nawaser, K., Hanifah, H., Vafaei-Zadeh, A., 2022. Identification and prioritisation of factors affecting lean leadership model. Int. J. Manag. Pract. 15 (3), 364–388.
Flatten, T.C., Engelen, A., Zahra, S.A., Brettel, M., 2011. A measure of absorptive capacity: scale development and validation. Eur. Manag. J. 29 (2), 98–116.
Fosso Wamba, S., Queiroz, M.M., Pappas, I.O., Sullivan, Y., 2024. Artificial Intelligence capability and firm performance: a sustainable development perspective by the mediating role of data-driven Culture. Inf. Syst. Front 1–15 (online first).
Frawley, J., Fasoli, L., 2012. Working together: Intercultural leadership capabilities for both-ways education. Sch. Leader. Manag. 32 (4), 309–320.
Gary, J.E., 2009. Evaluation of the Dian Scales as a Foresight Measure. Doctoral dissertation, Regent University.
Germanwatch, 2021. Global Climate Risk Index 2021. Available at: https://www.germanwatch.org/en/19777. (Accessed 7 April 2023).
Ghasemy, M., Hussin, S.B., Abdul Razak, A.Z.B., Maah, M.J.B., Ghavifekr, S., 2018. Determining the key capacities of effective leaders in Malaysian public and private focused universities. Sage Open 8 (4), 2158244018807620.
Gouldson, A., Carpenter, A., Afionis, S., 2015. Environmental leadership? Comparing regulatory outcomes and industrial performance in the United States and the European Union. J. Clean. Prod. 100, 278–285.
Hair, J.F., Ringle, C.M., Sarstedt, M., 2011. PLS-SEM: Indeed a silver bullet. J. Market. Theor. Pract. 19 (2), 139–152.
Hanif, S., Ahmed, A., Younas, N., 2023. Examining the impact of environmental management accounting practices and green transformational leadership on corporate environmental performance: the mediating role of green process innovation. J. Clean. Prod. 414, 137584.
Hart, S.L., 1995. A natural-resource-based view of the firm. Acad. Manag. Rev. 20 (4), 986–1014.
Hart, S.L., Dowell, G., 2011. Invited editorial: a natural-resource-based view of the firm: Fifteen years after. J. Manag. 37 (5), 1464–1479.
Hermano, V., Martín-Cruz, N., 2016. The role of top management involvement in firms performing projects: a dynamic capabilities approach. J. Bus. Res. 69 (9), 3447–3458.
Hossain, S.S., Delin, H., Mingying, M., 2022. Aftermath of climate change on Bangladesh economy: an analysis of the dynamic computable general equilibrium model. Journal of Water and Climate Change 13 (7), 2597–2609.
Ireland, R.D., Hitt, M.A., 1999. Achieving and maintaining strategic competitiveness in the 21st century: the role of strategic leadership. Acad. Manag. Perspect. 13 (1), 43–57.
Jabbour, C.J.C., 2015. Environmental training and environmental management maturity of Brazilian companies with ISO14001: empirical evidence. J. Clean. Prod. 96, 331–338.
Jarvis, C.B., MacKenzie, S.B., Podsakoff, P.M., 2003. A critical review of construct indicators and measurement model misspecification in marketing and consumer research. J. Consum. Res. 30 (2), 199–218.
Jiang, W., Chai, H., Shao, J., Feng, T., 2018. Green entrepreneurial orientation for enhancing firm performance: a dynamic capability perspective. J. Clean. Prod. 198, 1311–1323.
Johnson, O., Sahr, F., Begg, K., Sevdalis, N., Kelly, A.H., 2021. To bend without breaking: a qualitative study on leadership by doctors in Sierra Leone. Health Pol. Plann. 36 (10), 1644–1658.
Kazancoglu, Y., Mangla, S.K., Berberoglu, Y., Lafci, C., Madaan, J., 2023. Towards industry 5.0 challenges for the textile and apparel supply chain for the smart, sustainable, and collaborative industry in emerging economies. Inf. Syst. Front 1–16 (online first).
Kivipõld, K., Vadi, M., 2010. A measurement tool for the evaluation of organizational leadership capability. Baltic J. Manag. 5 (1), 118–136.
Kogut, B., Zander, U., 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. Organ. Sci. 3 (3), 383–397.
Krippendorff, K., 2009. Testing the Reliability of Content Analysis Data. *The Content Analysis Reader*, pp. 350–357.
Kurucz, E.C., Colbert, B.A., Luedeke-Freund, F., Upward, A., Willard, B., 2017. Relational leadership for strategic sustainability: practices and capabilities to advance the design and assessment of sustainable business models. J. Clean. Prod. 140, 189–204.
Laan, L., Erwee, R., 2012. Foresight styles assessment: a valid and reliable measure of dimensions of foresight competence? Foresight 14 (5), 374–386.
Li, W., Bhutto, T.A., Xuhui, W., Maitlo, Q., Zafar, A.U., Bhutto, N.A., 2020. Unlocking employees' green creativity: the effects of green transformational leadership, green intrinsic, and extrinsic motivation. J. Clean. Prod. 255, 120229.
Lianto, B., Dachyar, M., Soemardi, T.P., 2022. Modelling the continuous innovation capability enablers in Indonesia's manufacturing industry. J. Model. Manag. 17 (1), 66–99.
Lin, Y.H., Chen, Y.S., 2017. Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. Qual. Quantity 51 (4), 1663–1685.
Meah, M.R., Sen, K.K., Ali, M.H., 2021. Audit characteristics, gender diversity and firm performance: evidence from a developing economy. Indian Journal of Corporate Governance 14 (1), 48–70.
Menor, L.J., Roth, A.V., 2007. New service development competence in retail banking: construct development and measurement validation. J. Oper. Manag. 25 (4), 825–846.
Mino, T., Hanaki, K. (Eds.), 2013. Environmental Leadership Capacity Building in Higher Education: Experience and Lessons from Asian Program for Incubation of Environmental Leaders. Springer.
Mitrega, M., Forkmann, S., Ramos, C., Henneberg, S.C., 2012. Networking capability in business relationships—concept and scale development. Ind. Market. Manag. 41 (5), 739–751.
Montabon, F., Sroufe, R., Narasimhan, R., 2007. An examination of corporate reporting, environmental management practices and firm performance. J. Oper. Manag. 25 (5), 998–1014.
Moore, G.C., Benbasat, I., 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. Inf. Syst. Res. 2 (3), 192–222.
Mukherjee, D., Lahiri, S., Mukherjee, D., Billing, T.K., 2012. Leading virtual teams: how do social, cognitive, and behavioral capabilities matter? Manag. Decis. 50 (2), 273–290.
Nalini, G., Bonnie, F., 2004. Motivating employees for environmental improvement. Ind. Manag. Data Syst. 104 (4), 364–372.
National Adaptation Plan of Bangladesh (2023-2050). 2022. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www4.unfccc.int/sites/Submi ssionsStaging/Documents/202211020942— National%20Adaptation%20Plan%20of%20Bangladesh%20(2023-2050).pdf (Accessed 7 April 2023).
Paliokaitė, A., Pačėsa, N., Sarpong, D., 2014. Conceptualizing strategic foresight: an integrated framework. Strat. Change 23 (3–4), 161–169.
Pappas, I.O., Mikalef, P., Dwivedi, Y.K., Jaccheri, L., Krogstie, J., 2023. Responsible digital transformation for a sustainable society. Inf. Syst. Front 25, 945–953.
Patricia, Fusch, Fusch Gene, E., Ness Lawrence, R., 2018. Denzin's paradigm Shift: Revisiting triangulation in qualitative research. Journal of Social Change 10 (1), 19–32.
Petter, S., Straub, D., Rai, A., 2007. Specifying formative constructs in information systems research. MIS Q. 623–656.
Polites, G.L., Roberts, N., Thatcher, J., 2012. Conceptualizing models using multidimensional constructs: a review and guidelines for their use. Eur. J. Inf. Syst. 21, 22–48.
Queiroz, M.M., Fosso Wamba, S., Raut, R.D., Pappas, I.O., 2023. Does resilience matter for supply chain performance in disruptive crises with scarce resources? Br. J. Manag. (online first).
Rhisiart, M., Miller, R., Brooks, S., 2015. Learning to use the future: developing foresight capabilities through scenario processes. Technol. Forecast. Soc. Change 101, 124–133.
Ringle, C., Da Silva, D., Bido, D., 2015. Structural equation modeling with the SmartPLS. Bido, D., da Silva, D., & Ringle, C.(2014). Structural Equation Modeling with the Smartpls. Brazilian Journal of Marketing 13 (2).
Sarwar, H., Aftab, J., Ishaq, M.I., Atif, M., 2023. Achieving business competitiveness through corporate social responsibility and dynamic capabilities: an empirical evidence from emerging economy. J. Clean. Prod. 386, 135820.
Scoblic, J.P., 2020. Strategic Foresight as Dynamic Capability: A New Lens on Knightian Uncertainty. Harvard Bus. School. Working paper, Boston, MA, USA, pp. 20–93.
Scott, W.R., 2008. Approaching adulthood: the maturing of institutional theory. Theor. Soc. 37, 427–442.
Sharma, S., 2020. Co-creational leadership capability for driving health-care service innovation. Measuring Business Excellence 25 (4), 434–451.
Sinha, S., 2017. Aspire to build an ethical and sustainable organization? Renew thyself. Strat. Dir. 33 (1), 7–9.
Sosik, J.J., Jung, D.I., Berson, Y., Dionne, S.D., Jaussi, K.S., 2005. Making all the right connections:: the strategic leadership of top executives in high-tech organizations. Organ. Dynam. 34 (1), 47–61.
Staber, U., Sydow, J., 2002. Organizational adaptive capacity: a structuration perspective. J. Manag. Inq. 11 (4), 408–424.
Straub, D., Boudreau, M.C., Gefen, D., 2004. Validation guidelines for IS positivist research. Commun. Assoc. Inf. Syst. 13 (1), 24.
Summer, M., Bock, D., Giamartino, G., 2006. Exploring the linkage between the characteristics of it project leaders and project success. Inf. Syst. Manag. 23 (4), 43–49.
Tan, B., Pan, S.L., Zuo, M., 2015. Harnessing collective IT resources for sustainability: Insights from the green leadership strategy of C hina mobile. Journal of the Association for Information Science and Technology 66 (4), 818–838.
Taylor, A., Cocklin, C., Brown, R., 2012. Fostering environmental champions: a process to build their capacity to drive change. J. Environ. Manag. 98, 84–97.
Teece, D.J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and strategic management. Strat. Manag. J. 18 (7), 509–533.
Tenenhaus, M., Vinzi, V.E., Chatelin, Y.M., Lauro, C., 2005. PLS path modeling. Comput. Stat. Data Anal. 48 (1), 159–205.
Thomas, T., Schermerhorn Jr., J.R., Dienhart, J.W., 2004. Strategic leadership of ethical behavior in business. Acad. Manag. Perspect. 18 (2), 56–66.
Tranfield, D., Denyer, D., Smart, P., 2003. Towards a methodology for developing evidence- informed management knowledge by means of systematic review. Br. J. Manag. 14 (3), 207–222.
Tuominen, M., Rajala, A., Möller, K., 2004. How does adaptability drive firm. J. Bus. Res. 57 (5), 495–506.

Vicente, M., Abrantes, J.L., Teixeira, M.S., 2015. Measuring innovation capability in exporting firms: the INNOVSCALE. Int. Market. Rev. 32 (1), 29–51.
Vlachos, P.A., Panagopoulos, N.G., Rapp, A.A., 2013. Feeling good by doing good: Employee CSR-induced attributions, job satisfaction, and the role of charismatic leadership. J. Bus. Ethics 118, 577–588.
Wang, D., Feng, T., Lawton, A., 2017. Linking ethical leadership with firm performance: a multi-dimensional perspective. J. Bus. Ethics 145 (1), 95–109.
Wei, L.Q., Lau, C.M., 2010. High performance work systems and performance: the role of adaptive capability. Hum. Relat. 63 (10), 1487–1511.
Wetzels, M., Odekerken-Schröder, G., Van Oppen, C., 2009. Using PLS Path Modeling for Assessing Hierarchical Construct Models: Guidelines and Empirical Illustration.
Wong, D.T., Ngai, E.W., 2021. Economic, organizational, and environmental capabilities for business sustainability competence: findings from case studies in the fashion business. J. Bus. Res. 126, 440–471.
Work Bank, 2022. Urgent climate action crucial for Bangladesh to sustain strong growth. Available at: https://www.worldbank.org/en/news/press-release/2022/10/31/urgent-climate-action-crucial-for-bangladesh-to-sustain-strong-growth#:~:text=Climate%20change%20will%20hit%20poor,as%20much%20as%209%20percent. (Accessed 7 April 2023).
Yoon, J., Suh, M.G., 2021. The key elements of strategic leadership capabilities to the latecomer firm: the case of RT Mart's success in the Chinese retail industry. Asia Pac. Bus. Rev. 27 (1), 29–52.
Zahra, S.A., George, G., 2002. Absorptive capacity: a review, reconceptualization, and extension. Acad. Manag. Rev. 27 (2), 185–203.
Zarei, M., Supphellen, M., Bagozzi, R.P., 2022. Servant leadership in marketing: a critical review and a model of creativity-effects. J. Bus. Res. 153, 172–184.
Zhou, M., Govindan, K., Xie, X., Yan, L., 2021. How to drive green innovation in China's mining enterprises? Under the perspective of environmental legitimacy and green absorptive capacity. Resour. Pol. 72, 102038.
Zimmer, M.P., Järveläinen, J., Stahl, B.C., Mueller, B., 2023. Responsibility of/in digital transformation 16, 100068.