DOCTORAL (PhD) DISSERTATION

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University of Sopron

Sopron

2025

University of Sopron
István Széchenyi Economics and Management Doctoral School

Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh

Doctoral (PhD) dissertation

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Sopron
2025

The evaluation of the dissertation

Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh

Dissertation to obtain a PhD degree

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Prepared by the University of Sopron

István Széchenyi Economics and Management Doctoral School

within the framework of the **Business Economics and Management** Programme

Supervisor(s): **Dr. Istvan Janos Bartok**

The supervisor(s) has recommended the evaluation of the dissertation be accepted: yes / no

_____

supervisor(s) signature

Date of the comprehensive exam: 20_____ year _____ month _____ day

Result of the comprehensive exam: _____ %

The evaluation has been recommended for approval by the reviewers (yes/no):

1. judge: Dr. _____ yes / no _____

(signature)

2. judge: Dr. _____ yes / no _____

(signature)

Result of the public dissertation defence: _____ %

Sopron, 20____ year _____ month _____ day

_____

Chairperson of the Judging Committee

Qualification of the PhD degree: _____

_____

UDHC Chairperson

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ABBREVIATION

SL: Sustainable leadership

GDC: Green dynamic Capablities

I4.0A: Industry 4.0 adoption

SP: Sustainability performance

BGMEA: Bangladesh Garment Manufacturers and Exporters Association

EU: The European Union

GDP: Gross domestic product

LEED : Leadership in Energy and Environmental Design

GHG: Greenhouse gas

RMG: Ready-made Garments

FICCA: Fashion Industry Charter for Climate Action

RSC: RMG Sustainability Council

USGBC: US Green Building Council

USA: The United States of America

UN: United Nations

SDGs: Sustainable Development Goals

PLS: SEM: Partial least square- structural equation modelling

WTO: World Trade Organisation

TBL: Triple bottom line

Abstract

The study aimed to explore and measure the factors of sustainable leadership and sustainability performance and examine the impact of sustainable leadership on sustainability performance along with the mediating role of green dynamic capabilities and Industry 4.0 adoption on the relationship between sustainable leadership and sustainability performance in the context of the ready-made garment (RMG) industry in Bangladesh. The research adopted sequential exploratory mixed-method research. Data from a qualitative field study using semi-structured interviews with senior managerial professionals in the RMG sector in Bangladesh were analysed using the NVivo 14 software package. Subsequently, the findings from the thematic analysis of the qualitative field study were compared with the content analysis of the existing literature. After that researcher developed a second-order hierarchical research model, which was empirically validated using a quantitative research approach consistent with a mixed-method research methodology. A total of 355 usable quantitative survey responses were obtained from the RMG companies in Bangladesh and analysed using the partial least square (PLS)--based structural equation modelling (SEM) technique to test the hypothesized relationship in the proposed model. New psychometric scales were developed to assess sustainable leadership and sustainability performance constructs. The study empirically confirmed that pro-employee behaviour, long-term orientation, stakeholder orientation and collaborative attitude are the four dimensions of sustainable leadership constructs. At the same time, environmental, economic, and social performance are the dimensions of sustainability performance. The findings also indicated that sustainable leadership positively and significantly influences sustainability performance. Additionally, green dynamic capabilities and Industry 4.0 adoption mediate the influence of sustainable leadership on sustainability performance. The insights from this research may offer practical guidance for apparel industry professionals and policymakers to integrate sustainable leadership strategies with improving dynamic capabilities and adopting Industry 4.0 technologies to achieve sustainable firm performance.

Keywords: Sustainable leadership, Sustainability performance, Green dynamic capabilities, Industry 4.0 adoption and RMG industry

1 INTRODUCTION

1.1 Background of the Study

Sustainable development has become a central global discourse in recent years as the world faces complicated issues such as climate change, natural resource depletion, and societal disparity (Torres de Oliveira et al., 2023). The United Nations (hereinafter UN) has developed 17 Sustainable Development Goals (hereinafter SDGs) applicable for all sectors and business units worldwide to address the global challenges. In the present business landscape, interest groups, such as government, public, and non-governmental organizations, are pressing enterprises to operate sustainably and achieve sustainability (Borah et al., 2024). Due to resource- and labour-intensive and highly polluting features of the Ready-made garments (hereinafter RMG) manufacturing industry, sustainability performance has become imperative to sustain and gain competitive advantages in the changing business environment (Gomes et al., 2024; Sajjad et al., 2024). Despite a 2% contribution to the gross domestic product (hereinafter GDP) of the world and more than 300 million employment, the global textile and apparel industries account for 10% of the carbon footprint and 20% of global wastewater and unfair labor treatment (European Parliament, 2024; Sarker & Bartok, 2024a). Threfore, the RMG companies must integrate social equity, economic efficiency, and environmental initiatives into their operations to achieve sustainable firm performance (Li, 2022) . Furthermore, the global community's efforts, for instance, the Paris Agreement, the European Green Deal, the UN 2030 agenda, national environmental regulation, and growing public awareness push apparel manufacturing companies to adopt sustainability practices to minimize the world's grand challenges (Zheng et al., 2022).

In the literature, sustainability has been extensively defined and linked to individual, group and organizational levels of processes and outcomes. Sustainability performance in the perspective of manufacturing companies refers to how effectively a company implements sustainability practices reflected in environmental, social and economic initiatives. It evaluates the results and outcomes of a company’s efforts to achieve sustainability goals (Yusliza et al., 2020). Sustainability performance can be achieved in manufacturing organizations by lowering carbon emissions, preserving natural resources, promoting ethical labor practices, and positively impacting the communities in which the company operates (Nikolaou et al., 2019).

However, a firm's sustainability performance depends on effective leadership that embeds sustainable practices into their organizations and communities while stimulating economic development (Burki et al., 2018; Foo et al., 2021). Numerous scholars have highlighted sustainable leadership as an effective form of leadership to enhance sustainability performance of a company (Ahsan & Khawaja, 2024; Foo et al., 2021; Lim et al., 2022; Suriyankietkaew, 2023) . Sustainable leadership represents a paradigm shift from conventional leadership approaches. It focuses on humanity and development, ethical conduct, inclusivity, and systematic thinking that integrate economic priorities, social responsibility, and environmental stewardship to benefit organizations and society long-term (Xin et al., 2024). This sustainable leadership fosters a sense of connection and empathy, as it aims to balance between current profitability and future growth along with initiatives that uplift the overall wellbeing of all stakeholders (McCann & Sweet, 2014; Yadegaridehkordi et al., 2023). It integrates sustainability principles across individual, organizational, and societal spheres to enhance stakeholder relationships and facilitate sustainable organizational development (Baird et al., 2023).

Furthermore, sustainable leaders place a strong emphasis on skill and resource development, the implementation of long-term changes and innovation, and the achievement of long-term objectives. This approach aligns closely with the UN's SDGs (Khatri, 2023). Notably, sustainable leadership features such as cultivating ethical, social, and environmentally responsible behaviour, valuing the workforce, promoting diversity, ensuring organizational justice, fostering employee welfare and development, maintaining a future-oriented outlook, and supporting work-life balance have a profound impact on a firm's long-term sustainability and profitability (Ahsan & Khawaja, 2024; Lee, 2017; McCann & Holt, 2010). However, sustainable leadership and sustainability performance are highly context-specific and influenced by multiple socio-cultural factors (Paulraj, 2011; Suriyankietkaew & Avery, 2016). Therefore, identifying and measuring the specific factors of sustainable leadership and sustainability performance in a particular context and setting becomes crucial.

Previous studies have made significant advancements, revealing that sustainable leadership positively influences various aspects of an organization. This inspiring influence extends to organizational effectiveness (Lee, 2017), financial performance (Suriyankietkaew & Avery, 2016), organisational resilience and performance (Avery & Bergsteiner, 2011; Baird et al., 2023), corporate and business sustainability

(Suriyankietkaew, 2019, 2023) , employee performance (Xin et al., 2024), and environmental performance (Ahsan & Khawaja, 2024). Despite the progress toward understanding sustainable leadership and its influence on various sustainability parameters, there is still room to investigate this relationship more thoroughly (Piwowar-Sulej & Iqbal, 2023; Suriyankietkaew, 2023).

This study focuses on a specific context, namely the Bangladeshi RMG manufacturing industry, because Bangladesh emerged as the second-largest apparel exporting country worldwide in 2019, capturing 6.8% of the international apparel market (WTO, 2021) and owning the highest number of green clothing factories around the world (BGMEA, 2024a; Sarker et al., 2023). The RMG industry has substantially improved the country's socio-economic structure, employing around 4.1 million employees and generating 84.58% of the nation's total export earnings (BGMEA, 2024b; Habib et al., 2022; Khairul Akter et al., 2022). Moreover, the industry accounts for 36 percent of the manufacturing workforce; nearly 65 per cents are women, and 11.2% of its gross domestic product (BGMEA, 2020). Despite their achievements, RMG factories in Bangladesh are often criticized for issues such as unsafe working conditions, violations of workers' rights, wage discrimination, environmental pollution, and overall poor health and safety of workers (Karanikas & Hasan, 2022; Nabi et al., 2023) . As an export-driven sector, the RMG industry in Bangladesh heavily relies on foreign buyers. At the same time, most buyers, especially the leading apparel brands H&M, Zara, Marks & Spencer, and so forth, underscore the necessity for garment suppliers to adhere to environmental and social compliance (Uddin et al., 2023).

Hence , adopting sustainable practices is critical for the Bangladeshi RMG sector to build resilience and market competitiveness, but it struggles with cost, infrastructure, and resistance to change (Al Amin & Baldacci, 2024).Therefore, developing a holistic framework addressing the garment industry's sustainability performance in Bangladesh is essential. Past research has documented that leadership is a critical determinant of sustainability performance (Aman-Ullah et al., 2024; Wang et al., 2023). Conversely, the traditional leadership approach is insufficient to promote sustainability in the volatile market conditions (Gerard et al., 2017). Sustainable leadership emerges as a promising solution to address environmental, social and economic challenges and achieve sustainable performance (Boeske, 2023). Despite the significance of sustainable leadership (Al-Zawahreh et al., 2019; Etse et al., 2024), little is known about sustainable leadership in apparel industry context, particularly in developing nations like Bangladesh.

While sustainable leadership is a critical predictor of sustainability performance, the mechanisms underlying this relationship remain underexplored. Besides, past empirical research examining the connection between leadership and sustainability performance has not reached a consensus. Several studies have documented leadership can positively and significantly affect sustainability performance (Aman-Ullah et al., 2024; Borah et al., 2022; Esangbedo et al., 2024; Nasir et al., 2022). In contrast, studies of Foo et al. (2021) and Hossain et al. (2024) revealed a non-significant impact of leadership on the manufacturing industry's sustainability performance. Therefore, scholars (Baird et al., 2023; Tian & Wang, 2023) have suggested investigating the mechanisms linking sustainable leadership to sustainability performance. They have argued that sustainability performance of a firm can also be improved not only by employing leadership but also through other driving forces including green dynamic capabilities and digital technology adoption (Borah et al., 2022; Saha et al., 2022).

Several studies have evidence that as an organizational resource, leadership significantly and positively affects building a company's green dynamic capabilities in a changing market condition. Similarly, dynamic capability positively influences sustainability performance, suggesting an indirect effect of green dynamic capability in the linkage between sustainability leadership and sustainable firm performance (Eikelenboom & de Jong, 2019; Wamalwa, 2023). Furthermore, dynamic capabilities refer to organizational capabilities to develop, reconfigure, and integrate resources and competencies to deal with a highly changing environment (Teece et al., 1997). They build capacity of companies by integrating their existing internal and external resources and reconfiguring and redesigning contextual factors sustainably, leading to sustainability peformance (Chaudhuri et al., 2024).

In parallel, Industry 4.0 technology adoption significantly predicts sustainable of manufacturing companies. The implementation of digital tools into the manufacturing operations can enhance work scheduling and execution, resulting in resource conservation and cost efficiency (Saha et al., 2022). Industry 4.0 attempted to make a smart industry using digital means, for instance, Industrial Internet of Things sensors, additive manufacturing, and robotic machines, leading to economic, environmental and socially sustainable manufacturing systems (Beltrami et al., 2021; Huang et al., 2023). Vertical integration of industry 4.0 enhances the capacity of innovative performance while horizontal integration facilitates interorganizational communication , inventory and customer relationship (Pérez-

Lara et al., 2020) . In addition , adopting smart technologies, including machine vision, robotics, IoT, 3D printing, and automation, not only boosts labor productivity and lowers costs and defects but also ensures manufacturing by optimizing forecasting, quality control, and equipment efficiency in manufacturing facilities. A previous study (Jayashree et al., 2022) documented that Industry 4.0 technologies mediate the effects of management leadership in small and medium enterprises (SMEs), and management leadership can enhance triple-bottom-line (TBL) performance in the presence of Industry 4.0 in SMEs.

Although there is abundant research on leadership's effect on organizational performance, the literature needs comprehensive research on sustainable leadership and sustainability performance focusing on the RMG industry (Eikelenboom & de Jong, 2019; Nguyen et al., 2021). In addition , the existing studies have evidenced that green dynamic capabilities and I4.0 adoption can enhance different aspects of sustainability performance, but the combined influence of leadership, green dynamic capablities and Industry 4.0 adoption on the complete sustainability performance still needs to be explored. Hence, this study incorporates green dynamic capability and Industry 4.0 adoption as the mechanisms combinely. Firstly, this research aimed to explore managerial perspectives and experiences regarding sustainable leadership and sustainability performance of the RMGs sector in Bangladesh. Secondly, this research developed a model that examined how sustainable leadership influenced a company's sustainability performance through the combined mediating role of green dynamic capabilities and Industry 4.0 adoption. The principal aim of this study was to provide valuable insights for RMG managers to refine their leadership approach and enhance business performance by examining the relationship among sustainable leadership, green dynamic capabilities, Industry 4.0 adoption and sustainability performance.

1.2 Problem Statement

The central problem addressed in this study was the issue of sustainability performance in the RMG industry. Sustainability performance has become a significant concern in the RMG manufacturing industry as it causes serious environmental and social problems such as wastewater, carbon footprint, pollution, unfair labour treatments, occupational health and safety, and unsafe working conditions (Cai & Choi, 2020; Shumon & Rahman, 2022). As a result, the clothing sector is required by regulatory agency and stakeholders to take a leading role in adopting sustainabilty initiatives into the operations.

Though sustainability practices have a transformative impact on global economies, Bangladesh's ready-made garments (RMG) industry experiences challenges in adopting these practices due to resource deficiency and traditional leadership (Nabi et al., 2023; Hossain et al. 2024). The integration of sustainability into the operations and business decision-making of the RMG industry is still questionable.Therefore, this sector generates adverse outcomes in terms of environmental, social, and economic indicators such as carbon footprint, labour unrest, and downward market competitiveness (Islam, 2021; Kravchenko et al., 2019; Shamsuzzaman et al., 2021; Shaw et al., 2023). However, reducing textiles' negative impacts while generating business opportunities and safe and just employment highlighted the urgent need for sustainable practices and leaders who could foster sustainable practices and enhance sustainability performance (Eikelenboom & de Jong, 2019; Yuan & Cao, 2022). Sustainable leadership has emerged as a potential solution to address sustainability challenges and promote sustainability performance (Ahsan & Khawaja, 2024; Al-Zawahreh et al., 2019; Suriyankietkaew & Kungwanpongpun, 2022). Sustainable leaders can integrate sustainability into organizational environments and enhance stakeholder relationships, thereby promoting sustainable development (Baird et al., 2023) . The extant literature illustrated that sustainable leadership extends beyond financial interests by integrating ethical values, shaping eco-friendly organizational culture, and aligning with sustainable development goals for sustainable firm performance (Ahsan & Khawaja, 2024; Avery & Bergsteiner, 2010).

Although the empirical studies (Iqbal & Ahmad, 2021; Xin et al., 2024) have well-documented the positive impact of sustainable leadership on sustainability performance in different context, existing literature ignored to the unique issues specific industries face, particularly the RMG industry (Nguyen et al., 2021; Hossain et al. 2024). Moreover, to the best of the researcher's knowledge, the research on sustainable leadership's effect on sustainability performance in the RMG industry, especially in emerging economies like Bangladesh, received little attention.

However, the underlying mechanisms through which sustainable leadership enhances sustainability performance still needs to be explored. Dynamic changes in foreign buyers' expectations require refining companies' capabilities through adopting green tools and innovative technologies to survive in the market. Literature supports that green dynamic capabilities and digital technologies in the presence of sustainable leadership can enhance resource optimization, increase competitive advantage, and contribute to achieving

sustainability performance (Kumar Dadsena & Pant, 2023; Saha et al., 2022; Uddin et al., 2023). Empirical research is missing in the extant literature on the function of green dynamic capabilities and Industry 4.0 adoption as joint mediators between sustainability leadership and sustainable firm performance links.

The extant sustainable leadership literature is fragmented and is still evolving, and it needs more theoretical development, especially combining triple bottom lines performance-economic, environmental, and social parameters (Burawat, 2019; Sajjad et al., 2024) . Besides, sustainable leadership and sustainability performance are contextually dependent multidimensional constructs that require contextual validity (Paulraj et al., 2015; Suriyankietkaew & Avery, 2016). Therefore, conducting a qualitative field study is essential to establish the contextual validity of the constructs in the RMG industry. Most of the research on sustainable leadership and sustainability performance has been conducted either using qualitative or quantitative methods, and it implies a need for mixed-method research, which allows for fully exploring and uncovering the meaning and interpretation of sustainable leadership and sustainability performance (Piwowar-Sulej & Iqbal, 2023; Suriyankietkaew, 2023; Tian & Wang, 2023). To the best knowledge of the researcher, no empirical study has yet been conducted to identify and measure sustainable leadership and sustainability performance, as well as investigate their relationship with green dynamic capabilities and Industry 4.0 adoption. This study attempted to address the significant environmental, social, and economic sustainability performance issues identified as a foundation of this research by adopting an exploratory sequential mixed method. Therefore, the researcher first identified the factors and indicators of study variables and the overlooked area of the past studies by reviewing the extant literature and then conducted a qualitative field study with the managerial professionals in the RMG industry in Bangladesh to deeply understand and confirm the contextual validity of sustainable leadership and sustainability performance factors. Finally, after collecting quantitative survey data, the study examined the hypothesized structural relationship in the proposed research model from the perspective of sustainable leadership (SL) theory and dynamic capability view (DCV) theory.

1.3 Research Questions

In the background of research problem, the questions raised in this study are as follows:

RQ1: What are the managerial perspectives and experiences regarding sustainable leadership and sustainability performance in Bangladesh's RMG industry context?

RQ2: How does sustainable leadership influence green dynamic capabilities and Industry 4.0 adoption towards sustainability performance in Bangladesh's RMG industry context?

1.4 Research Objectives

This study identifies the measurement of sustainable leadership and sustainability performance. It also examines the structural relationship between sustainable leadership, green dynamic capabilities, Industry 4.0 adoption and sustainability performance in the context of the clothing sector in Bangladesh. Based on the research question, the principal goal of this research was to develop a model for sustainability performance by developing capabilities and minimizing sustainability challenges in the clothing manufacturing sector in Bangladesh. The specific research objectives are as under:

RO1: To explore the factors influencing sustainable leadership and sustainability performance in Bangladesh's RMG industry context.

RO2: To examine the effect of sustainable leadership on sustainability performance in Bangladesh's RMG industry context.

RO3: To assess the influence of green dynamic capabilities on sustainability performance in Bangladesh's RMG industry context.

RO4: To investigate the influence of Industry 4.0 adoption on sustainability performance in Bangladesh's RMG industry context.

RO5: To determine the role of green dynamic capabilities and Industry 4.0 adoption as mediators in sustainable leadership and sustainability performance links in Bangladesh's RMG industry context.

1.5 Scope of the Study

This study was delimited within a specific context, focused variables, the subjects involved, and a fixed timeframe to facilitate effective management. As the study aimed to develop a sustainability firm performance model in a particular context, the research was conducted in the RMG industry in Bangladesh. The variables of interest in this study were sustainable leadership, sustainability performance, green dynamic capabilities, and Industry 4.0 adoption. Despite the importance of sustainable leadership in enhancing sustainability performance, there are several gaps in the extant literature. The researcher performed a comprehensive review of the study variables. After that review, a qualitative field study was conducted on a limited scale with senior managers in the RMG companies, and a broader

quantitative survey was conducted to obtain managerial-level respondents' perceptions of the RMG firms in Bangladesh.

Additionally, the researcher collected cross-sectional data from the RMG firms in the Dhaka, Chittagong, Narayanganj and Gazipur districts in Bangladesh due to socio-economic significance. The semi-structured interview and questionnaire were completed from February 2024 to September 2024. Consequently, the structural relationship of the variables in the proposed sustainability performance model was tested, and validity was established through advanced statistical analysis.

1.6 Significance of the Study

This study contributes to the leadership literature as the study attempts to bridging inconsistency in the extant literature and reveals the effective leadership approach for sustainability performance in the RMG industry in Bangladesh. Practically, apparel entrepreneurs and policymakers will benefit from this research when running the industry and making their own decisions. The study contributes to several ways which are as follows.

1.6.1 Theoretical significance

This research advances the current knowledge of organizational leadership and sustainability performance in the literature by responding to the demand of additional research on sustainable leadership and sustainability performance (Suriyankietkaew, 2023; Suriyankietkaew & Avery, 2016). In addition, this research addresses the complexity of contextual and cultural nature of leadership and sustainability performance. Furthermore, this study develops a research framework based on sustainable leadership, green dynamic capabilities, Industry 4.0 adoption and sustainability performance variables. The study assumes sustainable leadership is an organization's resource that contributes to gaining a competitive advantage in the market. Therefore, sustainable leadership (SL) theory is undertaken to explain the independent variable and dependent variable. Most of the past empirical research employed SL theory to explain sustainable leadership and organizational sustainability measured in terms of financial and non-financial measures disregarding environmental aspects; hence, environmental aspects must be included in measuring organizational sustainability in the existing literature. This study attempts to fill this limitation and add value to the body of knowledge. Green dynamic capabilities and Industry 4.0 adoption variables have been undertaken from the dynamic capability view (DCV) perspective, where green dynamic capabilities and Industry 4.0 adoption are mediating

variables. Integrating these two variables as mediators in a single study is scarce in the literature; this study gave additional insights into the body of knowledge by employing the joint role of two mediators between sustainable leadership and sustainability performance. Moreover, the simultaneous use of SL theory and DCV theory in a single study received little attention; this research combines mentioned two theories to explore the factors of sustainable leadership and triple-bottom-line performance and develop a model for sustainability performance in the RMG industry in Bangladesh and examine the structural relationship in the model in light of the theories. Therefore, this research will contribute significantly to the intellectual structure of leadership and sustainability performance in the clothing industry.

1.6.2 Practical significance

This study has several practical contributions. First, the study aims to deepen the understanding of sustainable leadership and its influence on sustainability performance in the context of the RMG sector in Bangladesh while the industry is experiencing challenges in implementing sustainability practices. Therefore, the study is expected to have managerial implications in this case. Second, this research will develop a model for sustainable development of the RMG sector by integrating existing research on sustainable leadership and incorporating relevant qualities from conventional leadership theories. Conclusively, this framework will provide a holistic viewpoint to evaluate sustainable performance and explore the correlation between sustainable leadership and firm performance. There are many challenges to implementing sustainability approaches in the clothing supply chain; managers and directors of the RMG companies can address the issues and enhance sustainability by following the proposed sustainability performance model. Third, this study will carefully choose a range from different firms within the RMG industry, including managers, to understand how managers perceive sustainable leadership in practice and its impact on firm performance. Expectedly, results will provide an insight into the practical consequences of sustainable leadership and its ability to promote a contented workforce. Practically, this study will provide practical recommendations to managers to enhance workplace dynamics and promote firm performance, which can positively influence employee engagement, productivity, and overall organizational success. Finally, the study assumes a lot of significance in light of the adoption of diminishing water usage (SDG6), guaranteeing fair labour conditions (SDG8) and Goal 12 sustainable production and

consumption models (SDG12) by revealing the importance of implementing sustainability practices to the attention of the RMG management understanding.

1.7 Definitions of Key Terms

The description of the key terms used in this study is outlined below. The given definitions provide a guideline for analysing the findings of the tested hypotheses and avoid any misunderstandings regarding the concepts used in this research.

Sustainable leadership

Sustainable leadership is an alternative and holistic approach that behaves ethically, socially, and environmentally responsibly, focusing on long-term decision-making, fostering systematic innovation to enhance customer value, developing a skilled, loyal and highly engaged workforce and offering quality products, services and solutions (Avery & Bergsteiner, 2011). The leadership style is also known as "honeybee," or "Rhineland," leadership. The terms "sustainable leadership" and "sustainability leadership" were employed synonymously throughout this research.

Green dynamic capabilities

Green dynamic capabilities represent an organization's environmentally friendly abilities to effectively integrate, strengthen, and reconfigure its internal and external resources and competencies in response to new opportunities and environmental changes (Lin & Chen, 2017; Teece et al., 1997).

Industry 4.0 adoption

Industry 4.0 adoption means integrating various high-end technologies such as automated machines or robots, IoT sensors, additive manufacturing (3D printing), computer vision, Radio-frequency identification (RFID), and digital twin into the manufacturing and logistic system, enhancing operational efficiency, productivity and response time (Kamble et al., 2020; Lee et al. 2015). The terms "Industry 4.0 adoption", "adoption of Industry 4.0", "advanced technology adoption", "smart technology adoption", and "Intelligent technology adoption" were treated as synonymous.

Sustainability performance

Sustainability performance refers to the improvement actions within a business's environmental, social and economic domains. Social performance relates to the initiatives taken for the betterment of society, and ecological performance relates to the steps performed

to improve environmental degradation by reducing emissions and pollution. Economic performance is concerned with the growth in sales, profits and market (Elkington, 2013; Le, 2022). "Sustainability performance", "Sustainable firm performance", and "Sustainable organizational performance" were interchangeably utilized in the present study.

1.8 Dissertation Structure

The dissertation is organized into seven different chapters, as demonstrated in Figure 1. A chapter-wise summary is provided below:

Chapter 1: Introduction

This chapter presents the study background, problem statement, research questions, and research objectives. It also introduces scope of the research, the theoretical and practical significance of the research and finally the overview of the dissertation structure.

Chapter 2: Literature Review

The overview of the RMG industry in the context of world and Bangladesh is firstly presented in this chapter. A critical review of the existing relevant literature is discussed in this chapter, focusing on sustainable leadership, green dynamic capabilities, Industry 4.0 technology adoption, and their influences on sustainability performance. the theories such as sustainable leadership theory and dynamic capability theory, are also discussed here. Finally, the research model hypotheses and the role of control variables are presented.

Chapter 3: Research Methodology

This chapter states research philosophy, research design, qualitative and quantitative methods of research and their justification. The data collection procedure, interview question design, questionnaire development, unit of analysis, population and sampling techniques and the techniques for data interpretation are presented in this chapter.

Chapter 4: Results and discussion

This chapter discuss first qualitative field findings and then quantitative result. It also presents the interpretation of the results in the light of the hypothesis.

Chapter 5: New scientific results

This chapter presents the new scientific findings obtained in the current study.

Chapter 6: Conclusion and future research directions

This chapter discuss conclusion, limitation and future avenues for research. Theoretical, practical and policy implications, connecting to the findings to the extant literature and theories are also presented in the chapter.

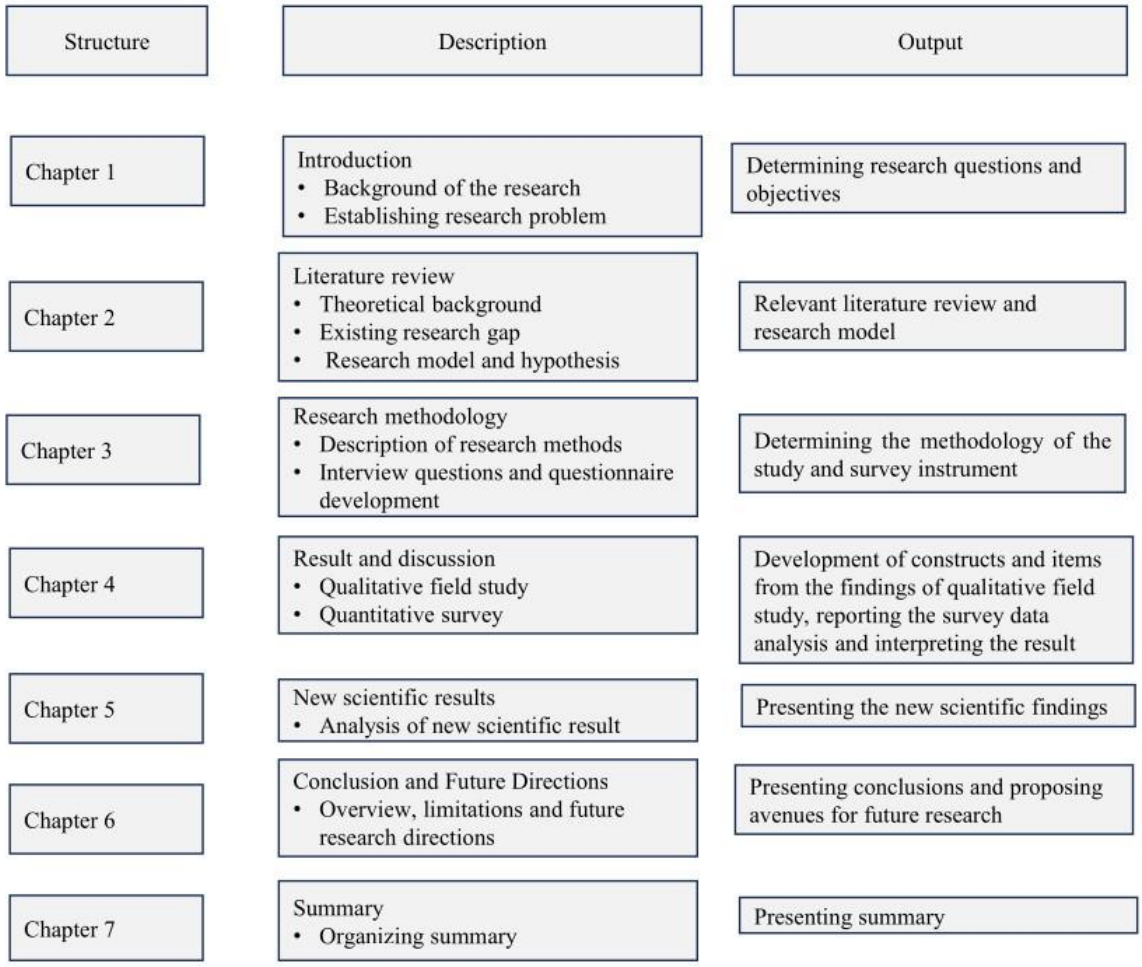

Figure 1. Dissertation structure

Source: Researcher's construction

Chapter 7: Summary

This chapter summarizes the objectives, methods and results of the study. It also suggests avenues for future research.

2 LITERATURE REVIEW

2.1 Global Context of Sustainability in the Ready-made garments (RMG) Industry

The clothing industry is a leading manufacturing sector worldwide, generating $2.4 trillion a year and employing 300 million across its supply chain (Adamkiewicz et al., 2022). While the industry drives socio-economic progress globally, especially in developing nations (Nayak et al., 2020), its unsustainable practices create serious environmental and social issues for instance, increasing carbon footprint, overconsumption of water and energy, pollution, human rights violations (Shen et al., 2021; Wang & Shen, 2017) . Moreover, the fashion supply chain has a significant environmental impact, with 10% of global carbon emissions, 20% of waste generation, $100 billion in wasted resources, and 9% of microplastics polluting oceans yearly (Nasreen et al., 2023; Sarker & Bartok, 2023).

Therefore, some global ecological regulations such Paris agreements, the UN's Fashion Industry Charter for Climate Action (FICCA) were enacted with the aim for zero emissions in the fashion sector by 2050 (Hoque et al., 2022). Consequently, RMG manufacturing firms are transitioning to greener technologies in response to stricter global regulations, government pressure, and rising public awareness about environmental protection (Zheng et al., 2022) . Leading fashion companies, for example, Schoeller Textil AG and Flex Apparel, along with major brands such as H&M, Patagonia, and Louis Vuitton, have embraced green technologies to reduce social and environmental impacts and meet growing stakeholder expectations (Sarker & Bartok, 2023) .

The researcher has published some parts of this chapter in the following journals.

Sarker, M. S. I., Hasan, K. M., & Bartók, I. J. (2023). Green Manufacturing Practices Towards Sustainable Development in the Ready-Made Garments (RMG) Industry of Bangladesh. TÁRSADALOM–GAZDASÁG–TERMÉSZET: SZINERGIÁK A FENNTARTHATÓ FEJLŐDÉSBEN, 241.

Sarker, M. S. I., & Bartok, I. (2024). Global trends of green manufacturing research in the textile industry using bibliometric analysis. Case Studies in Chemical and Environmental Engineering, 9, 100578.

Sarker, M. S. I., & Bartok, I. (2024). A Systematic Review of Green and Digital Transitional Factors in the Fashion Industry. Business Systems Research: International journal of the Society for Advancing Innovation and Research in Economy, 15(1), 1-21.

Sarker, M. S. I., & Bartók, I. J. (2023). A Bibliometric Review of Green Technology-Related Research in the Textile Industry. Textile and Leather Review, 6, 813-836.

Overall, transitioning into sustainability from a traditional manufacturing approach is a lengthy and complex task (Kazancoglu et al., 2020; Lüthje, 2021; Ortega-Gras et al., 2021). However, textile companies can increase competitive advantage, build market image and manufacturing efficiency by adopting green and digital technologies (Casciani et al., 2022; Papahristou & Bilalis, 2017). Green textile practices, for instance, environmentally friendly material resources, cleaner production, green energy, policy and circular principles, can increase resource efficiency and minimize waste and pollution (Ikram, 2022; Zamfir et al., 2022) . Besides, adopting intelligent technologies like sewing robots, IOT sensors, additive manufacturing, blockchain, and machine vision in the clothing supply chain can reduce wastage, increase productivity and minimize manufacturing costs (Bertola & Teunissen, 2018; Sayem, 2022).

Given the circumstances, simultaneously green and digital transformations are key to ensuring a sustainable future for the textile manufacturing sector (Tsai, 2018). The adoption of green and digital technologies can decrease energy and resource use, lower emissions, and reduce waste, providing solutions to the environmental and social challenges of fashion manufacturing. In addition, green and digital practices boost a company's financial performance and improve its CSR, creativity, and public image. Advanced countries are leading, while several emerging markets are beginning to embrace green and digital transformation In addition, green and digital practices boost a company's financial performance and improve its CSR, creativity, and public image (Bianchini et al., 2022; Nyangchak, 2022) . Despite the relatively lower focus on green and digital approaches in developing and underdeveloped countries, India, Bangladesh, Vietnam, and Ethiopia are showing a growing trend toward their adoption in the apparel industry (Khurana, 2022; Nyangchak, 2022). China has launched several initiatives, including environmental regulations, to drive the adoption of green and digital technologies in the manufacturing industry. With the growing urgency to reduce carbon emissions, energy usage, and resource consumption, gaining a deeper understanding of the essential aspects of green and digital transformation in the RMG industry is crucial. The clothing supply chain is simultaneously experiencing both green and digital transitions.

2.2 Sustainability Status in the RMG Industry in Bangladesh

Bangladesh is the world's second-largest apparel exporter, occupying a 6.5 % market share in global RMG trading, just behind China, and competing with India, Vietnam, Sri Lanka, and Pakistan for its global apparel market share (Alam et al., 2023; WTO, 2021).

Bangladesh's economy largely depends on the clothing industry as it offers substantial job opportunities, earns foreign currency, and promotes women's empowerment. The sector accounts for 84.58% of the country's total export earnings in 2022-2023 and contributes 11.2% to the national GDP (BGMEA, 2024b; Islam & Halim, 2022). The RMG sector, with over 4,600 RMG companies, stands as Bangladesh's leading industry, offering 36% of all manufacturing jobs and employing 4.1 million people (BGMEA, 2020). Bangladesh mainly produces three garment products: woven (Shirts, Jackets, and Trousers), knits (undergarments, socks, stockings, T-shirts, Polo Shirts), sweaters, and other casual and soft garments (BGMEA, 2020).

In response to environmental challenges, Bangladesh is pioneering green industrialization in the global clothing industry. The Bangladesh Garment Manufacturers and Exporters Association (BGMEA), a representative body for the RMG industry in Bangladesh, established the RMG Sustainability Council (RSC) in 2019 to drive sustainable development. Despite being one of the lowest contributors to global carbon emissions, Bangladesh is taking proactive steps to address climate change. BGMEA signed the "Fashion Industry Charter for Climate Action (FICCA) " to reduce GHG emissions by 5% by 2030, compared to business-as-usual scenarios (BGMEA, 2020). In recent years, Bangladeshi apparel firms have embraced sustainability initiatives such as the national 3R policy (reduce, reuse, recycle), organic raw materials, renewable energy, and improved water and chemical management to drive sustainability (BGMEA, 2020; Sarker et al., 2023) . Consequently, Bangladesh has the highest number of green RMG factories, including nine of the top 10 globally recognized green garment factories. Out of 79,600 LEED (Leadership in Energy and Environmental Design)-certified projects across 161 countries, Bangladesh boasts 91 LEED-certified green garment factories, the highest globally. Bangladesh leads globally with 24 platinum-rated garment manufacturers, the highest in the world. Twenty-five Bangladeshi manufacturers have received the US Green Building Council's (USGBC) highest certification, including six of the top 10 LEED-certified factories worldwide (Hoque et al., 2022; Sarker et al., 2023). RMG firms in Bangladesh are driving sustainability by implementing green practices, including eco-friendly materials, green innovation, renewable energy, waste management, sustainable buildings, green supply chains, and corporate responsibility efforts (BGMEA, 2020).

However, the extant literature evidenced that despite the significant growth of the apparel business in Bangladesh, the industry faces numerous challenges, such as supply

chain disruptions, labor unrest, workplace safety and security, cargo loading and unloading capability, worker relations, and product development and diversification (Islam & Halim, 2022; Mostafiz et al., 2022). In addition, Bangladesh's RMG manufacturers often use irresponsible business practices such as pollution, misleading buyers, unethical procurement, and unsafe working environment to meet the growing global demand for textiles and gain increased profitability (Khan et al., 2021). The two incidents in the history of the global apparel industry, namely, the tragic Rana Plaza and Tazreen fashion accidents, which caused the loss of hundreds of lives, stemmed from systemic negligence towards sustainability initiatives in the RMG sector in Bangladesh (Sarker et al., 2023). Additionally, untreated or poorly treated textile wastewater contaminates surface and groundwater, worsens water scarcity, and poses serious risks to the climate and human health. Besides, with garment factories being key contributors, industrial pollution makes up 60% of the contamination in the Dhaka (a capital city of Bangladesh), increasing environmental concerns (Islam, 2021; Khan et al., 2015). Therefore, the RMG sector was classified as a "Red Industry," marking it the second-largest environmental degradation contributor. Past research documented that Bangladesh produced 1,000 tons of clothing waste in 2021, representing a billion-dollar opportunity if effectively recycled. Besides, the deficiency of skilled and efficient workforce, absence of recycling initiatives, insufficient use of statistical process tools, and a lack of quality awareness among garment suppliers are key obstacles to sustainability performance in the RMG industry in Bangladesh (Khairul Akter et al., 2022).

The apparel industry in Bangladesh is export-oriented and more focused on the USA and EU markets (BGMEA, 2024b). Bangladesh’s garment sector relies heavily on foreign buyers, including major global brands like Walmart, H&M, Levi’s, Nike, Adidas, M&S, American Eagle, Old Navy, and GAP (Hoque et al., 2022). Due to increasing consumer awareness and sustainability requirements, large garment brands attempt to maintain their reputation by ensuring social and environmental compliance with garment suppliers. Moreover, buyers seek the lowest price, shortest lead time, supply chain transparency and the highest level of compliance (Alam et al., 2023). Additionally, garment manufacturing companies in Bangladesh, as a “Fashion Industry Charter for Climate Action (FICCA)” signatory, are compelled to integrate sustainable approaches into their operations to meet the expectations of western buyers (Hoque et al., 2022). Therefore, attaining sustainable performance for the clothing sector in Bangladesh has become essential to survive and gain a competitive advantage in the global apparel market. In this context, developing green

dynamic capabilities such as an efficient and skilled workforce, energy-efficient equipment, circular tools, and eco-friendly workplaces can help reduce pollution and enhance environmental and social performance and intelligent technology adoption such as sensor-embedded lighting systems, sewing robots, automated fabric defect detection system, can increase productivity and reduce cost leading to sustainability performance in the RMG industry in Bangladesh (Hossain et al., 2024; Uddin et al., 2023). Top management support is a critical predictor of developing green development and digital technology adoption. Previous studies highlighted strategic leadership, incredibly sustainable leadership in place of conventional leadership, to enhance business sustainability performance by adopting Industry 4.0 technologies and developing green dynamic capabilities, which are missing in the current textile and apparel industry literature (Hossain et al., 2024; Saha et al., 2022). As a result, further research is urgently required to enrich understanding and strengthen the sustainability performance of the RMG industry. Despite existing theoretical frameworks examining the impacts of leadership, dynamic capabilities, and I4.0 technologies on sustainability performance, no known empirical study has examined the effect of sustainable leadership and joint mediating influence on sustainability performance (Althnayan et al., 2022; Eikelenboom & de Jong, 2019; Karmaker et al., 2023). The present study aims to bridge this research gap.

2.3 Sustainability and Sustainability Performance

The term "sustainability" traces its roots to the Brundtland Report (Brundtland, 1987), which first presented the concept of sustainable development. It refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). Sustainability is a philosophy or guiding principle that focuses on efficiently using today's resources to meet present needs while preserving them for future generations (Grant, 2010; Ozili, 2022) . Elkington (1997) explained the concept of sustainability by introducing the triple bottom line (TBL), emphasising three key pillars: environmental integrity, social equity, and economic prosperity. The TBL approach is also known as "three Ps" approach representing planet, people, and profit. According to the TBL framework, organizations must reduce their ecological impacts (e.g., through waste reduction, resource efficiency and renewable energy), enhance societal benefits (e.g., supporting employees and communities) and maintain economic impacts (e.g., expanding sales, market share and profitability). A balanced approach to these three dimensions ensures sustainable development (Bebbington & Unerman, 2018). Due to increasing ecological and

social consequences, sustainability is regarded as an effective strategy for development and environmental stewardship. However, the meaning of sustainability varies depending on the context in which it is applied (Brown et al., 1987). Therefore, the conceptual definition of sustainability needs to be aligned with contexts (Qorri et al., 2018). Sustainability is an operational approach for manufacturing companies that prioritises long-term viability in environmental, economic, and social aspects without compromising the opportunities of future generations, while sustainability performance is the achievement of sustainability efforts (Alonso-Martinez et al., 2021) . Sustainability performance involves identifying the direction of a firm towards the success or failure of sustainability initiatives such as carbon footprints, protecting natural resources, upholding ethical labour standards, and supporting the local communities.

Though sustainability and sustainability performance are related, literature evidenced a technical distinction between these concepts. Sustainability is a philosophy or guiding principle that focuses on efficiently using today's resources to meet present needs while preserving them for future generations (Grant, 2010). In contrast, sustainability performance represents the desired outcome achieved through implementing a framework of sustainability. Mousa & Othman (2020) explained sustainable performance as an organization's commitment to achieving long-term success while minimizing environmental, social, and economic impacts. Moreover, sustainability performance encompasses a company's economic, environmental, and social impacts, which are measured and monitored using key performance indicators to gauge progress effectively (Sapta et al., 2021). The main focus of sustainability is to meet the requirement of stakeholders and ensure long-term well-being while sustainability performance helps to determine how effectively a company's operations align with and promote TBL domains.

2.3.1 Measurement of the dimensions of sustainability performance

Though literature revealed various dimensions of sustainability, but majority of scholars interpreted the concepts of sustainability and sustainability performance based on environmental, social and economic pillars propounded by John Elkington. The "triple bottom line" has become the foundation for numerous sustainability standards, such as the Global Reporting Initiative (GRI), United Nations Commission on Sustainable Development Framework, the Dow Jones Sustainability Index, the sustainability metrics of the Institution of Chemical Engineers (IChemE), Wuppertal Sustainability Indicators and International Organization for Standardization (ISO) 14001 standards ISO 14001 standards (Delai &

Takahashi, 2011; Labuschagne et al., 2005). Sustainability performance measures are the key indicators of a firm's sustainability efforts, revealing whether the firm is heading toward success or failure. While the concept of sustainability and sustainability performance are well defined in the literature, manufacturing industries face difficulties in measuring sustainability performance (Kravchenko et al., 2019). Sustainability performance literature lacks a comprehensive and standardized measurement instrument for assessing environmental, social and economic impacts (Slaper & Hall, 2011).

Most previous studies on sustainability performance often focuses on one or two aspects of sustainability performance such as economic and environmental performance (Rao, 2002; Zhu et al., 2007), social performance (Kraus et al., 2017), environmental (Chen et al., 2006), or economic performance (Hofer et al., 2012; Kassinis & Soteriou, 2003; Kravchenko et al., 2019). Few studies integrate all three components (Al Koliby et al., 2024; Nikolaou et al., 2019; Qorri et al., 2018). However, theoretically developed and empirically tested an industry-specific sustainability performance measurement instrument, especially for the RMG industry, is missing in the literature. Therefore, this study incorporates environmental, economic and social dimensions of sustainability performance to explore the relationship between sustainable leadership and sustainability performance in the RMG industry in Bangladesh.

2.3.1.1 Environmental performance

Environmental performance focuses on improving the environment by reducing natural resource consumption, pollution, and emissions. It reflects the ecological impacts of firms' operations. Moreover, environmental performance measures the ability of a company to minimize water, air and soil pollution, energy use, and material consumption while complying with environmental regulations (Al Koliby et al., 2024). Due to increasing environmental implications such as climate change, drought and global warming, institutional and stakeholder pressure compels organizations to perform their operations by adopting environmentally friendly approaches. The RMG industry is resource and energy intensive. Therefore, energy-efficient equipments and eco-friendly approaches in manufacturing tasks such as cutting, sewing, and packaging are essential for addressing environmental challenges. In addition , R-principles such as reduce, reuse and recycle can be addopted to minimise waste generated during garment production (Li & Leonas, 2022; Sarker et al., 2024) . Past studies (Chow & Chen, 2012; Paulraj, 2011; Rao, 2002; Zhu et al., 2007) highlighted several indicators of environmental performance such as reducing

solid / liquid waste, emissions, toxic chemicals, improvement of compliance, environmental accidents and waste management. Table 1 presents the list of indicators reflecting environmental performance.

2.3.1.2 Economic performance

Economic performance evaluates the profitability growth of a company while focusing on reducing material costs (Hofer et al., 2012). Moreover, economic performance reflects an organization's capacity to expand market share, business volume, and sales growth and cut costs related to materials, energy usage, waste disposal, and environmental accident fines (Burki et al., 2018). Table 1 shows the indicators of economic performance. Basically, economic performance is evaluated through operational and financial parameters. The literature (Burki et al., 2018; Carter, 2005; Kassinis & Soteriou, 2003) mentioned several measures for measing financial performance of an organization.

2.3.1.3 Social performance

Social performance assesses the impact of an organization on society. In contrast, social issues of manufacturing companies are concerned with implementing health and safety standards, fostering employee development, and community welfare initiatives. These efforts contribute to lower workplace accidents, enhance job satisfaction and quality of life for employees, and improve relationships with the employees and community (Awan, 2019). Moreover, social performance evaluates the initiatives of an organization towards employees' and communities' well-being, benefits and security (Delai & Takahashi, 2011). The RMG manufacturing companies face many social issues which need be addressed properly because now-a days, social and environmental compliance are the major condition to receive buying orders from brand apparels. Social performance in manufacturing companies can be measured by indicators such as improving employee and community relationships, work environment, workplace safety and security, medical facilities, paying sound salaries and customer satisfaction (Kraus et al., 2017; Paulraj, 2011; Yadegaridehkordi et al., 2023). Table 1 displays the measures of social performance.

Table 1. Measurement of sustainability performance in the literature

Dimensions	Measurement item	Source
Environmental performance (EnP)	Reduction of air emissions	Abdul-Rashid et al (2017) ; Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Paulraj (2011) ; Zhu et al. (2007)
	Reduction of wastewater	Abdul-Rashid et al (2017) ; Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Paulraj (2011) ; Zhu et al. (2007)
	Reduction of solid waste	Abdul-Rashid et al (2017) ; Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Paulraj (2011) ; Zhu et al. (2007)
	Saving energy	Abdul-Rashid et al (2017) ; Abu Seman et al., (2019) ; Shashi et al., (2019)
	Decreasing the use of hazardous/harmful/ toxic materials	Abdul-Rashid et al (2017) ; Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Paulraj (2011) ; Shashi et al., (2019); Zhu et al. (2007)
	Reducing the environmental impacts of products/service/ company activities	Chow & Chen, (2012) ; Shashi et al., (2019)
	Reducing environmental impact by establishing partnerships	Chow & Chen, (2012)
	Decreased the frequency of environmental accidents	Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Paulraj (2011) ; Shashi et al., (2019); Zhu et al. (2007)
	Decrease in material usage	Abdul-Rashid et al (2017)
	Improving compliance with environmental standards	Abdul-Rashid et al (2017)
	Improvement of an enterprise environmental situation	Abu Seman et al., (2019) ; Zhu et al. (2007)
	Reducing the consumption of materials and resources (such as water, electricity, gas, and petrol)	Abu Seman et al., (2019) ;
	Promoting reuse and recycling of raw materials	Abu Seman et al., (2019) ; Shashi et al., (2019);
	Adopting measures for ecological design in products/services.	Shashi et al., (2019)
	Conducting environmental audits regularly	Shashi et al., (2019)
Economic performance (EcP)	Improving market share	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi, (2023)
	Improving company image	Abdul-Rashid et al (2017)
	Improving the company's position in the marketplace	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi, (2023)
	Increasing profitability and sales growth	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi, (2023) ; Paladino, (2007)
	Increasing return on sales (ROS)	Hofer et al. (2012) ; Paladino, (2007)
	Increasing return on asset (ROA)	Hofer et al. (2012) ; Paladino, (2007)
	Increasing return on investment (ROI)	Ijaz Baig & Yadegaridehkordi, (2023) ; Paladino, (2007); Paulraj (2011)
	Lowering operating cost	Paladino, (2007)
	Decrease in cost of materials purchased	Paulraj (2011)
	Decrease in cost of energy consumption	Paulraj (2011)
	Decrease in fee for waste discharge	Paulraj (2011)
	Improvement in earnings per share	Paulraj (2011)

Dimensions	Measurement item	Source
Social performance (SoP)	Improving relationships with the employees and community	Abdul-Rashid et al (2017)
	Improving the work safety of the employees	Abdul-Rashid et al (2017)
	Improving work environment	Abdul-Rashid et al (2017)
	Improving the quality of life for the surrounding community.	Abdul-Rashid et al (2017)
	Improvement in overall stakeholder welfare or betterment	Aftab et al., (2022) ; Paulraj (2011); Yadegaridehkordi et al. (2023)
	Improvement in community health and safety	Aftab et al., (2022) ; Paulraj (2011); Yadegaridehkordi et al. (2023)
	Reduction in environmental impacts and risks to general public	Aftab et al., (2022) ; Paulraj (2011); Yadegaridehkordi et al. (2023)
	Improvement in occupational health and safety of employees	Aftab et al., (2022) ; Paulraj (2011); Yadegaridehkordi et al. (2023)
	Improved awareness and protection of the claims and rights of people in community served	Aftab et al., (2022) ; Paulraj (2011); Yadegaridehkordi et al. (2023)

Source: Literature survey

2.4 Sustainable Leadership

In the present market conditions, attaining sustainability performance has become significant for business enterprises, especially the RMG manufacturing industry, as the industry is responsible for generating sustainability challenges such as carbon footprint, excessive resource consumption, waste generation, unsafe work environment, and unfair labour practices. Therefore, the apparel industry is pressured to integrate sustainability practices into its operations and managerial decision-making by governmental and non-governmental organizations and stakeholders. However, organizational sustainability initiatives mainly depend on effective leadership, as without it, these efforts may yield minimal impact. To effectively pursue a sustainability agenda, organizations must have exemplary leadership. A key approach to tackling sustainability challenges is sustainable leadership (Etse et al., 2024). Though sustainability leadership is critical for sustainable organizational performance, sustainability leadership phenomenon is still evolving and has not been explored comprehensively especially in the context of the RMG industry (Nguyen et al., 2021). Under this circumstance, it is essential to understand the phenomenon of sustainable leadership and investigate how it drives sustainability performance in the clothing industry.

In the leadership literature, sustainable leadership is interchangeably referred to as "sustainability leadership", "leadership for sustainability", "honeybee leadership", "Rhineland leadership", or "SDG leadership", but they all convey almost the same theme (Avery & Bergsteiner, 2011; Bakhshi et al., 2023; Visser & Courtice, 2011). Sustainable

leadership is an alternative approach to leadership, influencing all parties to derive long-term outcomes through ethical, green, and socially responsible behaviour, making long-term decisions, promoting innovation, developing a skilled, loyal, engaged workforce, and creating an inclusive culture in the organization (Avery & Bergsteiner, 2011). It focuses on generating current and future profits while enhancing the well-being of all stakeholders (McCann & Holt, 2010). Unlike other leadership approaches, sustainable leadership bridges gaps in the strategic leadership of an organization by embracing flexibility and diversity without adhering to prescriptive styles or behaviours (Gerard et al., 2017). Hargreaves & Fink (2003) described sustainable leadership as an impactful, enduring, and shared approach. It ensures responsible use of natural resources, preserving human and financial resources, and caring for the well-being of the educational and community environments. Suriyankietkaew and Avery (2016) highlighted the holistic nature of sustainable leadership, balancing people, profits, and the planet. The study supported the idea that sustainable leaders integrate sound business practices with sustainability for both present financial benefits and future growth. Visser & Courtice (2011) conceptualised sustainability leadership as a process that addresses global sustainability challenges through systems thinking, emotional intelligence, and innovative approach. In addition, However, sustainable leadership an idealistic and humanistic management approach that values people and views businesses as contributors to societal well-being to lower costs and enhance brand reputation and customer satisfaction lowering cost and enhancing brand reputation and customer satisfaction lowering cost and enhancing brand reputation and customer satisfaction (Avery & Bergsteiner, 2011). From the support of previous sustainable leadership literature, this study conceptualizes sustainable leadership as a humanistic and stakeholder-focused leadership approach that influences others through fostering ethical, socially and environmentally responsible behaviours, emphasizing long-term thinking, cultivating collaboration, and prioritizing employee-centred attitudes. It aimed at building long-term value for stakeholders and emphasizing the well-being of society, the environment, and future generations.

Hargreaves & Fink (2003) introduced the concept of sustainable leadership for educational institutions, emphasising the ability to promote shared responsibility and minimise the depletion of resources. They proposed seven sustainable leadership principles: depth, endurance, breadth, justice, diversity, resourcefulness, and conservation (Hargreaves & Fink, 2004). Avery (2005) introduced sustainable leadership to enterprise management,

comparing the Anglo/US capitalism and Rhineland capitalism models and outlining 19 essential leadership elements. Building on earlier research, Avery and Bergsteiner (2011) expanded the list of practices to 23 by adding four elements namely trust, innovation, staff engagement and sel-management to the original 19 elements and formed a sustainable leadership framwork. Moreover, traditional shareholder-first or locust approach of leadership is based on the Anglo/US model of capitalism, which emphasises short-run financial outcomes and has less attention to long-term outcomes, while sustainable or honeybee leadership is based on the European Rhineland model of capitalism, which focuses on the humanistic approach and long-term sustainability of firms (Suriyankietkaew, 2019) . Avery & Bergsteiner (2011) developed a new business model based on European Rhineland capitalism and integrating diverse values, principles and theories of sustainability and named sustainable leadership framework that promotes organizational sustainability (Suriyankietkaew, 2019).The framework is structured as a pyramid representing interdependence among the elements.

The sustainable leadership framework has three levels of leadership practices: foundational practices, higher-level practices and key performance drivers. The foundational practices represent the basic leadership attributes or behaviour of an organization, which include 14 elements, namely, developing people, labour relations, retaining staff, succession planning, valuing staff, CEO and top team, ethical behaviour, long- or short-term perspective, organizational change, financial markets orientation, responsibility for the environment, social responsibility (CSR), stakeholders, vision's role in the business. Higher-level practices include five elements: decision-making, self-management, team orientation, culture, knowledge sharing and retention, and trust, while innovation, staff engagement, and quality are the key performance drivers (Avery & Bergsteiner, 2011). These behaviours may also be denoted as principles and attitudes. The foundation practices serve as the basis for the more advanced practices, and the absence of one or more of these foundation activities has a direct influence on the higher-level practices. Management cannot introduce higher-level practices without first establishing the necessary base practices. The third-level practices, which are the main factors that determine performance, arise from a combination of the practices at the first and second levels. The primary performance drivers are contingent upon the existence of the lower-level practices. Ultimately, the 23 practices have a direct influence on the performance results that are crucial for maintaining the long-term viability of the organisation. Avery & Bergsteiner (2011) explained organizational sustainability in

terms of brand and reputation, customer satisfaction, financial performance, long-term shareholder value and long-term stakeholder value, which is at the top of the sustainable leadership framework's pyramid.

Sustainable leadership has been explored from both organizational and individual perspectives in the current literature. Pioneer research works such as Hargreaves & Fink (2004) , Davies (2007) , and Lambert (2011) examined sustainable leadership in the education sector at an organizational level, while Avery & Bergsteiner (2011) investigated multiple sectors, including business, from an organizational perspective. Casserley & Critchley (2010) focused on the individual perspective of sustainable leadership. The individual perspective of sustainable leadership focuses on leaders' particular features and personal behaviours to develop sustainable enterprises. Casserley & Critchley (2010) identified three core processes of sustainable leadership: reflection on action (learning through doing), psychological intelligence, and physiological at the individual level, differentiating sustainable leadership characteristics from traditional ones. In contrast, the organizational perspective of sustainable leadership focuses on sustainable organizational culture and the promotion of sustainable development strategies of organizations (Liao, 2022). However, this study focused on organizational perspective sustainable leadership as the research is more concerned with organizational rather than individual perspective of the RMG industry in Bangladesh.

Empirical studies on the realtionship between leadership and sustainability performance are abundant in the literature (Althnayan et al., 2022; Esangbedo et al., 2024; Sapta et al., 2021; Suriyankietkaew, 2019). Morover, the research on leadership and sustainability performance revealed mixed findings. While some studies found positive influence of leadership on sustainability performance (Aman-Ullah et al., 2024; Borah et al., 2022; Esangbedo et al., 2024; Sahibzada et al., 2024) , others found no significant association between leadership and sustainability performance (Foo et al., 2021; Hossain et al., 2024). The mixed result could be due to different approachs of leadership, different measures of leadership , and data from different contexts and settings. However, the empirical result of sustainable leadership showed positive result (Etse et al., 2024; Lee 2017; Suriyankietkaew, 2019; Suriyankietkaew & Avery, 2016; Xin et al., 2024). For instance, the result of a study by Suriyankietkaew (2023) on 280 business leaders and entrepreneurs of small enterprises across industries in Thailand showed that sustainable leadership enhance sustainability performance outcomes (i.e. financial performance and stakeholder satisfaction). However,

the study was limited to examine economic and social aspects of sustainability performance, thus the study suggested to explore future study in other emmerging economies by incorporating environmental aspects of sustainability performance and analyze empirical data using structural equation modeling. In addition, the study findings of Iqbal et al. (2020) on 369 small medium enterprises in selected ASEAN countries: Malaysia, Indonesia, and Brunei Darussalam revealed that sustainable leadership has indirect positive impact through organizational learning on sustainable performance. The study was conducted from individual perspective using unidimensional measures however, it was recommended for futher study in other industries. In addition, Ahsan & Khawaja (2024) found that sustainable leadership has a positive impact of sustainable leadership on environmental performance in the context of Denmark's information technology sector.They suggested to explore additional variables that may influence the relationship between sustainable leadership and organizational outcomes.

Despite the plethora of studies on sustainable leadership and organizational performance, little is known about the underlying mechanisms by which sustainable leadership influences sustainability performance are largely unexplored (Lin et al., 2022). In addition , a recent systematic review by Piwowar-Sulej & Iqbal (2023) uncovered that leadership and sustainability performance research recieved little attention for adopting mixed method research approach. Therefore , a coprehensive study is missing for measuring susatinble leadership and sustainability performance constructs based on the RMG industry context and exploring the the relationship adopting potential moderators.

2.4.1 Factors that affect sustainable leadership

Sustainable leadership addresses sustainability challenges by adopting a revolutionary managerial approach that creates both present and future profits for the organization and improves long-term relationships with all stakeholders. Therefore, sustainable leadership research has received considerable attention from researchers and professionals. Over the past two decades various theoretical models and components have been developed to explain sustainable leadership (Gerard et al., 2017; Liao, 2022). Scholars focus on various components of sustainable leadership, such as Hargreaves & Fink (2004) proposed seven principles of sustainable leadership in the education sector: depth, length, breadth, justice, diversity, resourcefulness, and conservation. Avery & Bergsteiner (2011) developed a framework of sustainable leadership based on 23 practices which lead to organizational sustainability. Lee (2017) conducted a study in the US federal agencies based on five

dimensions of sustainable leadership: cohesive diversity, organizational justice, employee development, work-life balance, and progress orientation. Lambert (2011) conducted a study in educational organizations proposing a theoretical framework of sustainable leadership considering six dimensions: building the capacity of staff, strategic distribution, consolidating, building long-term objectives from short-term goals, diversity, and conserving. In addition, Visser & Courtice (2011) proposed three components model of sustainability leadership (Cambridge model): leadership context, individual leader and leadership actions and seven key features of sustainability leadership namely systemic understanding, emotional intelligence, values orientation, compelling vision, inclusive style innovative approach; and long-term perspective. Most of the previous studies guided that sustainable leadership is multidimensional and that the characteristics contributing to sustainable leadership factors are contingent upon context.

However, a review conducted by Liao (2022) uncovered that the majority of the empirical studies (Ahsan & Khawaja, 2024; Al-Zawahreh et al., 2019; Xin et al., 2024) in sustainable leadership employed McCann & Holt's (2010) unidimensional measurement scale for measuring sustainable leadership, though several studies (Baird et al., 2023; Suriyankietkaew, 2019, 2023) applied Avery & Bergsteiner's (2011) sustainable leadership model. However, a recent systematic review of sustainable leadership by Ali Mohammad Al-khamaiseh et al. (2024) revealed that sustainable leadership remains an evolving concept which requires more theoretical and empirical research to clarify its multifaceted dimensions.

Due to the fragmented nature of sustainable leadership research, the existing leadership research lacks a theoretically justified and empirically validated multidimensional hierarchical measurement instrument for sustainable leadership, especially in the context of the RMG industry. Moreover, sustainable leadership is a contextually and culturally dependent variable; thus, it is essential to ensure the contextual validity of the sustainable leadership construct in the study context and settings. This study identified the measures relevant for the RMG sectors, which are consistently and often documented in the existing literature and conducted a qualitative field study to justify the contextual validity of the measurement indicators of sustainable leadership. Consequently, the study conducted exploratory factor analysis (EFA) to identify the dimensions and measures of sustainable leadership and then conducted a quantitative survey. Table 2 presents the factors of sustainable leadership in the literature.

Table 2. Factors that affect sustainable leadership in the extant literature

No.	Factors/ determinants	Source
1	Developing people/ Employee development	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lambert (2011) ; Lee (2017)
2	Labor relations	Avery & Bergsteiner (2011)
3	Retaining staff/ conservation	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
4	Succession planning/ Progress-Orientation/ Resourcefulness	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lee (2017)
5	Valuing staff/ Depth	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; McCann & Holt (2010)
6	CEO and top team/ collectivism/breadth	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
7	Ethical behavior/ justice/ Organizational justice/ ethically responsible behabiour	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
8	Long-Term Perspective/ Length	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ;
9	Organizational change fairly	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
10	Financial markets orientation	Avery & Bergsteiner (2011)
11	Valuing Stakeholders	Avery & Bergsteiner (2011)
12	Responsibility for environment/ Environmentally responsible behaviour	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
13	Social responsibility (CSR)/ Sociallly responsible behaviour	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
14	Vision's role in the business	Avery & Bergsteiner (2011)
15	Consensual decision making	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
16	Self-management	Avery & Bergsteiner (2011)
17	Team orientation	Avery & Bergsteiner (2011)
18	Fostering shared culture/ Cohesive diversity	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lee (2017)
19	Knowledge sharing and retention	Avery & Bergsteiner (2011)
20	Developing trust	Avery & Bergsteiner (2011)
21	Fostering innovation	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012)
22	Staff engagement	Avery & Bergsteiner (2011)
23	Embeding quality in the culture	Avery & Bergsteiner (2011)
24	Work/Life Balance	Lee (2017)
25	Strategic distribution	Lambert (2011)
26	Consolidates	Lambert (2011)
27	Recognizing mistakes	McCann & Holt (2010)
28	Correcting mistakes	McCann & Holt (2010)
29	Purpose before profit	McCann & Holt (2010)
30	Wealth through sustainable efforts	McCann & Holt (2010)
31	Balance sustainable social responsibility with profits	McCann & Holt (2010)

Source: Literature survey

2.5 Green Dynamic Capabilities

In today's turbulent environments and under resource constraints, organizations must strategically allocate resources and foster green dynamic capabilities to remain competitive.

A company's green dynamic capability is its capacity to adapt and innovate green organizational approaches in a changing market environment. It integrates environmental protection strategies with external insights into green technology, policies, and demands (Yuan & Cao, 2022).

Furthermore, green dynamic capabilities have three dimensions, namely internal resource integration, external resource integration, and resource building and reconfiguration, which facilitate innovation and employ ecological insights to identify market opportunities or threats (Dangelico et al., 2017). With growing environmental concerns, developing green dynamic capability has become essential for companies. By leveraging green dynamic capabilities, a firm can transform information into innovative products, services, and processes and enhance technological innovation and managerial performance while identifying green opportunities rapidly (Singh et al., 2022; Yuan & Cao, 2022).

According to Dangelico et al., (2017) sustainability-oriented dynamic capabilities enhance market performance of firm's green product development by embedding environmental sustainability. Moreover, they bridge the gap between green training and employees' creativity, highlighting its significance in fostering corporate sustainability (Joshi & Dhar, 2020; Yu et al., 2022). Based on the explanation of existing literature, this study conceptualizes green dynamic capabilities (GDC) as the sustainability oriented dynamic capabilities that encompass the organization's skills, knowledge, and competencies to identify threats and opportunities and mobilize and reconfigure the internal and external resources in an environmentally friendly manner in changing market conditions.

2.5.1 Measurement of dimensions of green dynamic capabilities

Previous studies show that green dynamic capabilities are significant predictors of organizational sustainability as they support green product development and respond to the environmental demand of the market (Joshi & Dhar, 2020; Yuan & Cao, 2022). Dangelico et al. (2017) measured sustainability-oriented dynamic capabilities by three dimensions: external resource integration, internal resource integration, resource building, and reconfiguration. External resource integration is the capability of a firm to integrate and exchange sustainability-oriented knowledge and competencies with external actors. It includes incorporating insights on environmental impacts from customers, suppliers, and channel collaborators to reduce product-related ecological effects. Internal resource

integration involves exchanging and integrating environmental knowledge within the firm through collaborative efforts among specialized environmental units and core departments such as manufacturing, marketing, and design. Resource building and reconfiguration focus on creating environmental knowledge and competencies and restructuring firm resources to address sustainability challenges through environmental training, investment in research and development, and reorganizing supply chain dynamics (Dangelico et al., 2017). The current study adapted a measurement instrument developed by Dangelico (2017) to measure green dynamic capabilities because the instrument is theoretically and empirically verified multidimensional hierarchical measures, and its psychometric properties have been established.

2.6 Industry 4.0 Adoption

Industry 4.0 adoption is the integration of cutting-edge digital innovations, including Internet of Things (IoT) sensors, robotics, blockchain, artificial intelligence, additive manufacturing, computer vision, big data analytics, augmented reality, and cyber-physical systems into manufacturing operations to optimize energy, enhance productivity and resource efficiency (Huang et al., 2023; Tolettini et al., 2023). As the business environment and customer demands are changing rapidly, organizations are being directed towards adopting and implementing advanced technological innovation to meet the need for organizational flexibility and responsiveness (Fatorachian & Kazemi, 2021) . Industry 4.0 revolutionizes production systems by connecting cyber-physical systems with humans in real time, transforming manufacturing and consumer interactions (Jayashree et al., 2022). The study by Costa et al. (2023) revealed that digital technologies such as Internet of Things sensors, Cloud, drones, and Big Data analytics enhance operational improvements and social and environmental sustainability by optimizing operations and resource use. Moreover, recent studies found that Industry 4.0 technologies minimize sustainability challenges like waste generation and poor working conditions in the fashion supply chain (Ijaz Baig & Yadegaridehkordi, 2023; Karmaker et al., 2023).

2.6.1 Measurement of dimensions of industry 4.0 adoption

Industry 4.0 technologies, which are associated with the sustainable development agenda, have great potential for social, economic, and environmental initiatives of sustainable development. Therefore, several researchers conducted empirical research on the adoption of Industry 4.0. However, it is necessary to understand the measurement instrument of

industry 4.0 technologies. Scholars developed both unidimensional and multi-dimensional instruments for measuring Industry 4.0 technologies (Ijaz Baig & Yadegaridehkordi, 2023; Karmaker et al., 2023). Pérez-Lara et al. (2020) developed two-dimension measures of Industry 4.0 adoption: vertical and horizontal integration. Vertical integration involves incorporating digital tools to enhance internal organizational performance. It is measured through employees' innovation performance, managing tools and techniques, creating different products, and capacity to improve product quality. Horizontal integration is concerned with inter-organizational collaboration. It is measured by several factors such as visibility of inventory-related data throughout the supply chain, intelligent product order management system, cloud-based customer database, and assistance for early market entrants (Pérez-Lara et al., 2020). This study employed the measurement scale of Pérez-Lara et al. (2020) for measuring Industry 4.0 adoption because it is theoretically validated and empirically tested in earlier research (Jayashree et al., 2021).

2.7 Overall Research Gap

In today's world, sustainability performance has become a pressing and complex issue worldwide because sustainability represents a paradigmatic shift in the operations and functioning of governments, businesses, and industries (Tjahjadi et al., 2021). Leaders promoting sustainable practices in their communities and organisations are essential for sustainability as they stimulate economic development. Organisational leaders are now under tremendous pressure to envision the sustainability of their organisations and societies considering the SDGs (Borah et al., 2024). In response to the changes in the organisational landscape, new leadership paradigms have evolved, called sustainable leadership (Hallinger & Suriyankietkaew, 2018). Sustainable leaders can integrate sustainability into organisational environments and enhance stakeholder relationships, promoting sustainable development (Avery & Bergsteiner, 2011; Baird et al., 2023).

Extensive research on leadership exists, yet the hierarchical and multidimensional framework of sustainable leadership (SL) (Avery & Bergsteiner, 2011) lacks theoretical and empirical validation in a single study. A robust measurement model for SL is still missing. Therefore, Organizations need a deeper understanding of sustainable leadership to drive sustainable firm performance, highlighting the importance of measuring this construct. Accordingly, this study seeks to measure and validate SL's multidimensional and hierarchical framework in Bangladesh's RMG sector.

While unsustainable practices pose challenges to organizational sustainability, sustainability performance (SP) is essential to survive and gain a competitive advantage (Okai-Mensah et al., 2022; Uddin et al., 2023) . However, a comprehensive measurement for sustainable firm performance using a triple-bottom approach is limited, especially in the context of the RMG industry (Hossan Chowdhury & Quaddus, 2021). To the best of the researcher's knowledge, a validated and empirically tested measurement scale for SP's multidimensional and higher-order construct is lacking. This research aims to contribute to the literature by proposing and validating a comprehensive measurement model for SP in Bangladesh's RMG sector.

The sustainable performance of the RMG industry is essential because the sector is responsible for generating many environmental and social challenges that threaten human life and the world's ecosystem (Uddin et al., 2023). Considering the critical issues of the RMG manufacturing industry, there is a need for empirical study of sustainable leadership and sustainability performance to overcome the existing challenges (Nguyen et al., 2021). Despite the necessity of such studies in Bangladesh's RMG sector, to the best of the researcher's knowledge, no study has yet been conducted to measure sustainable leadership and sustainability performance and to investigate the relationship between sustainable leadership and sustainability performance in the context of the RMG industry in Bangladesh. This gap in the literature has profoundly motivated the researcher to conduct this study.

As unethical labour practices, workplace safety, carbon emissions, water pollution, undesirable waste management, and overconsumption of resources persist in the RMG sector, the issues of sustainable leadership and sustainability are essential because sustainable leadership is a critical predictor for driving sustainability performance in the current turbulent market environment (Eikelenboom & de Jong, 2019; Sarker & Bartok, 2024b). Conceptually, it is established that SL is essential for triple-bottom line performance; however, there is a paucity of empirical studies to test and validate this relationship. Therefore, this study addresses the relationship between SL and sustainability performance.

Past studies suggest that uncovering the underlying mechanisms through sustainable leadership enhances sustainability performance (Suriyankietkaew, 2023). In the present age, stakeholders are pushing organizations to develop eco-friendly activities and technological innovation for a transparent supply chain (Saha et al., 2022; Xiao et al., 2023). Considering the existence of such discrepancies in the literature, this study explores the joint mediating role of green dynamic capabilities and Industry 4.0 adoption in the relationships between

sustainable leadership and sustainability performance in the RMG industry in Bangladesh. A proposed research model was developed based on the gaps identified in the literature and qualitative field study to test the hypothesis for the final sustainable firm performance model in Bangladesh's RMG industry.

2.8 Research Framework

This study developed a preliminary research model based on the gaps identified in the sustainable leadership and sustainability performance literature and conducting qualitative field study in the RMG industry in Bangladesh. Figure 2 outlines the proposed research framework for this study. Sustainable leadership and sustainability performance are the contextually and culturally dependents variables (Hossan Chowdhury & Quaddus, 2021; Paulraj et al., 2015; Suriyankietkaew & Avery, 2016). Therefore, it was necessary to contextualize the factors and variables identified through reviewing the literture on sustainable leadership and sustainability performance. Aligned with Kovilage et al., (2024) the study conducted a qualitative field study in the RMG industry in Bangladesh for confirming contextal validity for the variables of the study . After that the researcher developed a resesrch model for sustainability performance in the context of the RMG industry in Bangladesh.

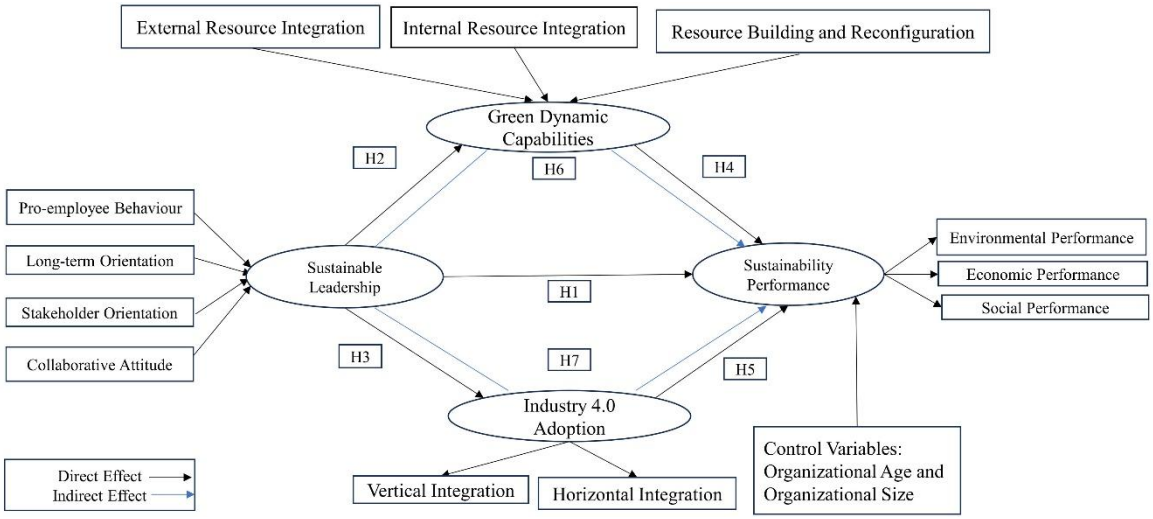

Figure 2. Proposed research model

Source: Researcher's construction

Based on the existing studies, the dimensions and variables of green dynamic capabilities (Dangelico et al., 2017) and Industry 4.0 adoption (Jayashree et al., 2021; Pérez-Lara et al., 2020) were identified. Sustainability performance dimensions were explored based on

Elkington's (2013) triple-bottom-line approach, and the variables were extracted from various studies, qualitative field surveys and exploratory factor analysis (EFA). However, due to emerging concepts and the lack of harmony among scholars regarding the dimensions of sustainable leadership, the study followed Richards and Gladwin's (1999) criteria of relevance, practicability, and appropriateness to include the indicators and dimensions in the sustainable leadership construct. Additionally, the researcher conducted a qualitative field study guided by Avery and Bergsteiner's (2011) sustainable leadership framework and EFA to identify the dimensions and variables of sustainable leadership.

2.9 Underpinning Theories and Justification

A theory is a systematic and structured collection of concepts that elucidates and forecasts phenomena. Researchers can use it to understand the relationships between variables, which aids in hypothesis formation, research design, and result interpretation. Theoretical justification is necessary to define, present and show the relationship between variables in any studies, otherwise, the study result will be questionable. This study employed two theories namely sustainable leadership (SL) theory and dynamic capability view (DCV) theory as a basis of theoretical foundation of this research shown in Figure 3.

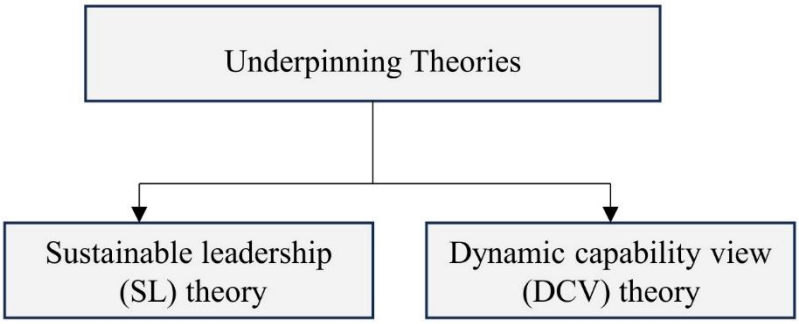

Figure 3. Underpinning theories

Source: Researcher's construction

The research model of this study was conceptualized based on the sustainable leadership (SL) theory and dynamic capability view (DCV). In leadership literature, the majority of the studies (Ahsan & Khawaja, 2024; Baird et al., 2023; Suriyankietkaew, 2023; Suriyankietkaew & Kungwanpongpun, 2022) use the SL theory for explaining sustainable leadership while Eikelenboom & de Jong, (2019) , Hossan Chowdhury & Quaddus, (2021) and others use dynamic capability view (DCV) theory to explain sustainability performance. The justification for employing SL theory and DCV theory is given below:

The SL theory argues that sustainable leaders act as the catalysts for organizational sustainability by creating long-term stakeholder values encompassing the environment, society and future generations (Avery & Bergsteiner, 2011; Hargreaves & Fink, 2012). Sustainable leadership focuses on long-term vision, ethical values and societal well-being in the organization, thereby implementing sustainable performance (Muff et al., 2020). Sustainable leaders drive green initiatives by cultivating an organizational culture aligned with environmental values and collaborating with multiple stakeholders to address sustainability challenges and achieve sustainability goals (Al-Zawahreh et al., 2019; Kantabutra & Avery, 2013; McCann & Holt, 2010).

Empirical evidence has shown that sustainable leadership is significant for increasing organizational resilience and achieving sustainable firm performance (Ahsan & Khawaja, 2024; Baird et al., 2023; Garcia-Blandon et al., 2023) . Lewandowska et al. (2023) found positive and significant impact of sustainable leadership on developing social sustainability in the healthcare industry. Researchers of sustainable leadership theory advocate the leaders' role to enhance economic and environmental performance through teamwork and innovative and inclusive attitudes of leaders (Iqbal et al., 2021; Iqbal & Piwowar-Sulej, 2023b; Suriyankietkaew & Avery, 2016). This study presumes that an effective leadership is necessary for enhancing sustainability performance along with developing eco-friendly capabilities and digital innovation in the RMG sector. Thus, the core principles of sustainable leadership theory underpin the relationship between sustainable leadership and sustainability performance.

Dynamic capabilities theory is the extension of resource-based view theory assuming that only resources are not sufficient to gain competitive advantages because static resources fail to reap advantage from market. Therefore, firms must sense, seize and reconfigure their existing resources to deal with changing market environment. In addition, dynamic capability refers to the organizational capacities to integrate, develop, reconfigure internal and external resources, knowledge to effectively respond to dynamics of the market (Teece et al., 1997). This theory states that how companies can adjust and reconfigure their knowledge, resources and capabilities to achieve a sustained competitive advantage in a constantly changing business environment. Bag & Rahman (2023) integrated resource-based view theory and absorptive capacity theory to investigate the influence of innovative capabilities on organizational performance.

This study also integrates SL theory and DCV theory to examine the relationship between sustainable leadership and sustainability performance. Sustainable leaders enable organizations by developing green and innovative capabilities of organization which help to respond changing market reactions (Mai et al., 2022; Tian & Wang, 2023). In addition, sustainability performance, green dynamic capabilities and Industry 4.0 adoption are dynamic capabilities of a firm which cultivate long-term customer values in responding to market changes. Literature on SL theory suggests that firms driven by sustainable leadership can outperform and drive sustainability. Empirical research highlighted that sustainability performance, green dynamic capabilities and Industry 4.0 adoption are dynamic capabilities of a company and the sources of sustainable competitive advantage, companies may use sustainable leadership as a prime driver to enhance them (Hossan Chowdhury & Quaddus, 2021). The current market is changing rapidly, and stakeholders are increasingly pressing manufacturing companies to adopt environmentally friendly approaches and establish transparency in the supply chain. Thus, manufacturing companies must develop green capabilities and innovation to survive in the market and overcome sustainability challenges. However, more than one theory was needed in the present research because sustainable leadership theory focuses more on the leadership approach. In contrast, the organizational sustainability aspect of this theory pays less attention to environmental parameters. On the other hand, dynamic capability theory focuses little on leadership characteristics. Consequently, it can be concluded through the lens of SL theory and DCV theory that companies need sustainable leadership, green dynamic capabilities, and adopting Industry 4.0 technology to enhance sustainability performance in manufacturing companies in a changing, complex environment.

2.10 Hypothesis Development

2.10.1 Sustainable leadership and sustainability performance

Leadership can be defined as a person's ability to influence others toward attaining organizational objectives. Leaders influence individuals and mobilize organizations to achieve their targeted goals. Therefore, leadership is commonly recognized as a critical predictor of firm performance, organizational change, and integration of values and norms. However, numerous perspectives on leadership have been developed, and each leadership style, such as transformational, transactional, servant, and sustainable leadership, has a unique approach and focus to influence and attain goals. For instance, green leadership emphasizes addressing environmental concerns and promoting eco-friendly behaviours

within organizations and among employees (Robertson & Carleton, 2017). Leadership literature illustrates that diverse leadership have direct and indirect effect on sustainability performance. Althnayan et al. (2022) empirically uncovered a positive relationship between environmental transformational leadership (ETL) and organizational sustainability performance (SP). Conversely, the study conducted by Shoaib et al. (2022) found non-significant relationship between ETL and sustainable performance in Pakistani dairy manufacturing organizations. In addition, However, sustainable leadership is an alternative leadership approach that focuses on long-term organizational success by establishing an ethical code of conduct, environmental stewardship, and social equality (Avery & Bergsteiner, 2011). The existing empirical studies found indirect positive relationship between sustainable leadership and sustainable leadership in different context from individual level of analysis (Iqbal & Ahmad, 2021; Lin et al., 2022). However, the direct effect of sustainable leadership on sustainable firm performance has not been studied in previous research, some researchers have examined the direct impact of sustainable leadership on aspects of sustainable performance, such as environmental performance (Ahsan & Khawaja, 2024) and some researchers have looked at different factors of sustainable leadership on financial and non-financial performance outcomes (Suriyankietkaew & Avery, 2016; Suriyankietkaew & Kungwanpongpun, 2022). The findings of these studies confirmed that sustainable leadership is a critical factor that influence sustainable performance because they supported to enhance financial, environmental and social performance. However, the relationship between sustainable leadership and triple-bottom-line firm performance, whilst none of the studies have been found in the clothing sector context, this study hypothesized the relationship between sustainable leadership and sustainable firm performance as:

H_1: Sustainable leadership positively affects sustainability performance

2.10.2 Sustainable leadership and green dynamic capabilities

The notion of green dynamic capabilities (GDC) is basically rooted from the original concept of dynamic capabilities (Teece et al., 1997). According to Chen and Chang (2013) GDC refers to an organization's capacity to leverage current resources and skills to innovate and cultivate new green capabilities in response to shifts in the external environment. Green dynamic capabilities have become indispensable for organisational growth and market adaptability, ensuring resilience and competitiveness amidst changing conditions. Leadership plays a pivotal role in shaping an organization's green ability. Rasheed et al.

(2024) suggest that leadership behaviour is one of the most effective means of fostering organizational green development. Due to environmental, social and stakeholder-oriented features, sustainable leadership has been identified as an efficient approach to enhancing green capabilities of a company (Iqbal & Piwowar-Sulej, 2022; Wolfgramm et al., 2015). Ahsan & Khawaja (2024) uncovered a causal association between sustainable leadership and environmental performance. Sustainable leaders integrate environmentally responsible technologies into organizational operations and foster a culture of environmental responsibility among employees (Cavazotte et al., 2021). Though the relationship between sustainable leadership and green dynamic capabilities in the existing literature, Lopez-Cabrales et al. (2017) revealed that both transformational leadership and transactional leadership are positively related to dynamic capabilities in Spanish industrial firms. In addition, the impact of digital leadership on dynamic capability in the Indonesian telecommunication industry was found significant (Mihardjo et al., 2019). Grounded in the above discussion of existing literature, the following hypothesis was proposed in this study:

H_2: Sustainable leadership positively affects green dynamic capabilities.

2.10.3 Sustainable leadership and industry 4.0 adoption

Industry 4.0 adoption represents a paradigm shift in the production process, characterized by the implementation of smart manufacturing technologies such as robotics, Internet of Things (IoT), machine vision, additive manufacturing, augmented reality and so on (Huang et al., 2023). As industry 4.0 is concerned with transformation process, it requires top management support. Therefore, leadership is a vital factor for implementing industry 4.0 technologies in the company while some studies used Industry 4.0 adoption as the organizatinal innovation in the literature (Koloszár et al., 2024; Mihardjo et al., 2019; Saha et al., 2022) . Past empirical research has evidenced that leadership is a major predictor of creativity and innovation toward firm performance (Shafique et al., 2020). In todays business environment , a company can not survive without embracing technology while industry 4.0 brings radical change in the organizational operations along with related disruptions , which is challenging for traditional leaders to accept. Several studies suggested digital, innovative and transformational leadeship for implementing Industry 4.0 technologies because these leadership accept organizational change and drive innovation in the organization for saving cost and achieving operational efficiency , transparency and productivity towards long-run firm performance (Nasir et al., 2022; Schneider, 2018) . However, cultivating systematic innovation and developed organizational change are the integral features of sustainable

leadership, which support digital transition of a company (Armani et al., 2020; Iqbal & Piwowar-Sulej, 2023a) . Moreover, sustainable leaders inspire individuals to embrace change and fosters innovation in the company for implementing sustainablity (Xin et al., 2024). The study conducted by Jayashree et al. (2022) revealed a positive relationship between management leadership and Industry 4.0 adoption. Empirical evidence on the impact of sustainable leadership on Industry 4.0 adoption is scare in the literature. Therefore, relying on SL and DCV theories and the mentioned discussion from the literature, this study proposed the following hypothesis:

H_3: Sustainable leadership positively affects Industry 4.0 adoption.

2.10.4 Green dynamic capabilities and sustainability performance

Dynamic capability theory suggests that businesses must proactively respond to market dynamics, restructure their resource base, and develop capabilities to effectively navigate a changing environment (Teece, 2007, 2014; Teece et al., 1997). Companies with well-developed dynamic capabilities can efficiently extract insights from key market players such as customers, competitors, and suppliers in response to market changes, enabling them to proactively identify opportunities, reconfigure product structures, refine technologies and services, and adapt business model and structures (Yuan & Cao, 2022). Empirical studies on the impact of dynamic capabilities on sustainability performance are abundant in the literature (Eikelenboom & de Jong, 2019; Mathivathanan et al., 2017; Wu et al., 2013). Due to increasing environmental challenges, professionals, policy makers, and researchers are currently paying more attention on green dynamic capabilities. Though green dynamic capabilities are closely related to dynamic capabilities, the research on the impact of green dynamic capability on sustainability performance is limited in the literature. Several researchers examined the association between green dynamic capability and different aspects of sustainability such as green innovation (Xiao et al., 2023; Yuan & Cao, 2022), green product development (Chen & Chang, 2013) , green innovation (Dangelico et al., 2017; Singh et al., 2022; Yousaf, 2021) and financial performance (Xing et al., 2020). Green dynamic capabilities support to save energy and fuel, waste minimisation and pollution prevention and adopt environmentally friendly technologies toward superior firm performance (Qiu et al., 2020). Based on this literature support this study proposed the following hypothesis:

H_4: Green dynamic capabilities positively affect sustainability performance

2.10.5 Industry 4.0 adoption and sustainability performance

Industry 4.0 adoption is a dynamic capability of a firm which drives sustainability performance by reducing social issues and environmental risks and enhancing operational efficiency and productivity (Jayashree et al., 2022). Industry 4.0 improves workplace safety and employee well-being by introducing automatic repetitive tasks through smart production systems (Brenner & Hartl, 2021). In addition, several studies have documented that Industry 4.0 technologies enhance on environmental capability and sustainability of businesses by minimizing energy consumption, reducing CO_2 emissions, and integrating energy-efficient systems. It also facilitates the recycling, remanufacturing, and reuse of product components, promoting circular economy approaches (Bai et al., 2020; Dantas et al., 2021; Nascimento et al., 2019). Concerning economic performance, researchers illustrated that industry 4.0 technologies such as RFID, computer vision, IOT sensors and digital twin enhances economic performance by reducing manufacturing errors, streamlining supply chains, and improving inventory accuracy. They also support product customization, reduces waste, cuts costs, shorten lead time, and extends product lifespans (Braccini & Margherita, 2018; Jayashree et al., 2022; Sariyer et al., 2021). In spite of abundant of studies on Industry 4.0 and sustainability in the literature, organizational level study received less attention. For instance, a recent study by Karmaker et al., (2023) focused on Industry 4.0 technologies and sustainable performance based on RBV. However, this study also analysed from individual level. Therefore, taking into account the limitations of the current literature and based on DCV theory, this study proposed the hypothesis as:

H_5: Industry 4.0 adoption positively affects sustainability performance

2.10.6 Sustainable leadership and sustainability performance: Mediating role of green dynamic capabilities

Due to increasing ecological issues and frequent changes in market conditions, businesses face pressure to adopt environmental approaches. In this circumstance, green dynamic capabilities help firms adapt to market changes and address ecological impacts while driving economic performance (Li et al., 2024). According to Forliano et al. (2022), firms must adapt and innovate their capabilities to survive in the market because more than existing resources are needed for market competitiveness. Green dynamic capabilities equip firms with ecological skills and competencies, enabling them to enhance their firm performance. These capabilities can help companies transform from traditional operations to eco-friendly

practices (Ahmad et al., 2024). However, questions about how firms develop these green capabilities still need to be answered.

According to past studies, effective leadership is instrumental in cultivating organizational green dynamic capabilities (Foo et al., 2021; Xu & Wang, 2019). Sustainable leaders promote eco-friendly practices by integrating ethical values and long-term goals. They engage employees in a shared environmental vision, inspiring them to support sustainability efforts and enhancing the organization's sustainability performance (Ahsan & Khawaja, 2024). Empirical evidence supports that green dynamic capabilities mediate the relationship between green transformational leadership and green product development (Ahmad et al., 2024). In addition, several studies highlighted that sustainable leadership develops green organizational capabilities by integrating green and lean practices into company operations in response to stakeholders' requirements for sustainability performance (Foo et al., 2021). However, the underlying mechanisms through which sustainable leadership indirectly influences RMG manfacturing companies towards sustainability performance are yet to be examined thoroughly. Therefore, drawing on the SL and the DCV theories and aligning with the literature support, this study proposed the following hypothesis.

H_6: Green dynamic capabilities positively affect the relationship between sustainable leadership and sustainability performance

2.10.7 Sustainable leadership and sustainability performance: mediating role of industry 4.0 adoption

In the recent years, transforming conventional manufacturing into smart manufacturing through the integration of Industry 4.0 technologies has become critical to reduce the negative consequences of manufacturing industry (Tiwari et al., 2022). Empirical studies in different context have documented that Industry 4.0 technology adoption can enhance environmental, social and economic sustainability (Ghobakhloo et al., 2021; Sarker & Bartok, 2024a). Concerning economic performance, as tools of smart technologies, robotics enables 24/7 operations, boosts productivity by speeding up tasks, and reduces supervision time (Ferreira et al., 2023). In addition, autonomous production enhances environmental sustainability by reducing energy use, carbon emissions, and waste as the operations are more efficient. Furthermore, blockchain technology enhances social sustainability by improving working conditions, promoting human rights, and boosting transparency because

it helps track and monitor companies' health and safety certificates, workers' work activity and human rights (Enyoghasi & Badurdeen, 2021; Ferreira et al., 2023). Despite many benefits Industry 4.0 technologies can several negative consequences such as job displacement, rising unemployment, privacy loss, and increased inequality. Besides, these technologies consume excessive energy, generate substantial CO_2 emissions, and require large-scale infrastructure, threatening natural resources and contributing to deforestation (Parmentola et al., 2022). Nevertheless, effective implementation of Industry 4.0 technologies can ensure sustainability performance. Thus, top management has become one of the key resources for implementing smart technologies towards sustainability (Jayashree et al., 2022). Adopting Industry 4.0 often calls for transformational leadership that motivates people to prioritize organizational goals over personal interests towards enhancing sustainability performance (de Sousa Jabbour et al., 2018). Mittal et al. (2018) highlighted for innovative leadership for implementing smart manufacturing. Though empirical studies illustrated the direct impact of Industry 4.0 technologies on sustainable performance, but innovative features of leadership are more significant for effective implementation of smart manufacturing because Industry 4.0 make several new challenges for human resource, supply chain, business operations, and sustainability. Few studies examined Industry 4.0 as an underlying mediating mechanism through which leadership promotes sustainability (Jayashree et al., 2022; Nasir et al., 2022). However, the mediating effect of Industry 4.0 on specific leadership and sustainability performance is still under-researched. Drawing upon SL theory, sustainable leadership is viewed as opportunity for innovation and change in the organisation which make an environment for implementing cutting-age technologies toward long-term firm performance. This study argue that firms should leverage Industry 4.0 adoption to enhance sustainability performance in the changing business environment while sustainable leaders foster innovation in the company to gain competitive advantage though technological implementation. Grounded in SL theory and DCV theory, this study investigated the mechanism between sustainable leadership and sustainability performance through Industry 4.0 adoption as a mediator. The research speculated that sustainable leadership causes firms to integrate smart technologies as their dynamic capabilities for enhancing sustainability performance. Consequently, this study proposed the hypothesis as follows:

H_7: Industry 4.0 adoption positively affects the relationship between sustainable leadership and sustainability performance

2.11 Role of Control Variables on Sustainability Performance

This study considered two control variables on the influence of sustainability performance in light of the earlier studies (Awwad et al., 2022; Hossan Chowdhury & Quaddus, 2021; Wang et al., 2022). As the study's unit of analysis was organizational, the researcher focused on organizational level variables. The selected control variables were organizational size and organizational age. Organizational size was measured by number of employees employed in the company while organizational age was measured by number of years the company in the operations. This study did not consider industry type as control variable as the data was collected from only single sector.

3 RESEARCH METHODOLOGY

3.1 Research Paradigm

Conventionally, paradigm refers to beliefs or basic assumptions guiding any activity. A research paradigm is a framework for research that provides philosophical presumptions when conducting the whole research process. This paradigm is also known as a philosophical worldview (Creswell & Creswell, 2018). The philosophical worldview comprises ontology, the researchers' beliefs about what constitutes reality, and epistemology, the researcher's beliefs about what constitutes knowledge (Leavy, 2022). In the literature, scholars revealed different research paradigms, such as Onwuegbuzie and Lewis (2005) broadly categorized the philosophical stance as positivism and interpretivism, while Leavy (2022) introduced six paradigms for social research: postpositivism, interpretive, critical, transformative, pragmatic, and arts-based intersubjective. Additionally, Creswell & Creswell (2018) explained four major philosophical worldviews in the literature where: postpositivism, which focuses on causes-effects/outcomes and verifying theory by assuming that reality is objective and measurable; constructivism, which focuses on theory generation by positing that truth is subjective and socially constructed, transformative emphasizes on driving social change by assuming that reality is socially constructed and inequitable; pragmatism focuses on solving real-world problems through "what works" in place of adhering strictly to a specific philosophy, assuming the presence of multiple realities and perspectives. However, the researcher determined this study's research paradigm by considering the research's purpose, nature, and context. The research objective was to develop a model of sustainable leadership and sustainability performance in Bangladesh's context of the RMG industry. For this, this study conducted semi-structured interviews to enrich the understanding of sustainable leadership and sustainability performance from the perspectives and experiences of senior managers in the RMG industry in Bangladesh. The researcher explored several factors of sustainable leadership and sustainability performance based on the qualitative field study. This qualitative field study directs this research toward the constructivism philosophy due to industry-specific factors and respondents' perceptions and experiences (Abid, 2024; Willis, 2007). Apart from the constructivism paradigm, this research aimed to assess the influence of sustainability leadership on sustainable organizational performance. Thus, the researcher developed hypotheses, having quantifiable as well as measurable variables, tested the hypotheses, and made statistical analysis. As a result, adopting the postpositivism paradigm was deemed relevant and suitable for this

research. However, consistent with recent research (Kovilage et al., 2024), this study employed pragmatism as a research paradigm, which is where the combination of postpositivism and constructivism because the research problem requires a methodological plurality, and it is one of the focuses of the pragmatism paradigm. Moreover, existing literature (Kelly & Cordeiro, 2020; Morgan, 2014) suggests using a pragmatic research philosophy when more than one research method and theory are required for a study in a different context.

3.2 Research Design

A research design outlines the comprehensive plan to effectively explore and answer the research questions. It covers all the activities for completing a research project. According to Creswell & Creswell (2018) research designs represent frameworks for qualitative, quantitative, and mixed methods inquiries, offering clear guidance for research. Quantitative research designs focus on numeric data collected through closed-ended responses in numeric form, and qualitative research designs are concerned with non-numeric data collected through open-ended responses in textual form. In contrast, mixed method research designs combine both numeric and non-numeric data to answer the research question. Table 3 shows different research designs.

Table 3. Research designs

Quantitative designs	Qualitative designs	Mixed method designs
Experimental	Narrative	Convergent mixed methods
Non-experimental	Phenomenological	Explanatory sequential
Longitudinal	Grounded theory	Exploratory sequential
	Ethnography	Complex designs with embedded core designs
	Case studies	

Source: Adapted from Creswell & Creswell (2018)

This study adopted an exploratory sequential mixed methods approach, starting with qualitative design followed by quantitative design to address their respective weakness (Creswell, 2014; Onwuegbuzie & Leech 2005). Moreover, this study's two main variables, sustainable leadership, and sustainability performance, are still emerging constructs, calling for more theoretical studies to enrich the literature (Sajjad et al., 2024). In addition, earlier studies (Hossan Chowdhury & Quaddus, 2021; Suriyankietkaew, 2023) evidenced that sustainable leadership and sustainability performance are culturally and contextually dependent variables that justify conducting a qualitative field study and quantitative survey research. Therefore, in line with the suggestions of Creswell & Creswell (2018) and

Schoonenboom & Johnson (2017), a sequential exploratory mixed-method research design was applied. Hence, the researcher primarily conducted interviews with a few apparel professionals to identify the factors and variables of sustainable leadership and sustainable organizational performance in Bangladesh's RMG industry. Finally, quantitative study was conducted on a large-scale sample with the result of a qualitative field interviews to test the structural relationship in the research framework of this study.

3.3 Research Process

Research process involves chronological steps to complete the study. The researcher applied qualitative methods for exploration and quantitative methods for confirmation, aligning with a sequential exploratory research design. represents the flow chart of the study.

Figure 4 illustrates the activities involved in different stages of this study, starting with a review of the literature to understand research gaps and uncover the study's initial dimensions and variables. In addition, the researcher developed a research model for the RMG industry in Bangladesh. The second phase was concerned with conducting the qualitative field study employing semi-structured interviews and thematic analysis of the interview transcripts to ensure the contextual validity of the research model. The factors and variables were refined by comparing interviews and the findings of the literature survey. The final stage involved developing a questionnaire, conducting a pilot study, performing a final survey and analysing and interpreting the survey data to examine the research model.

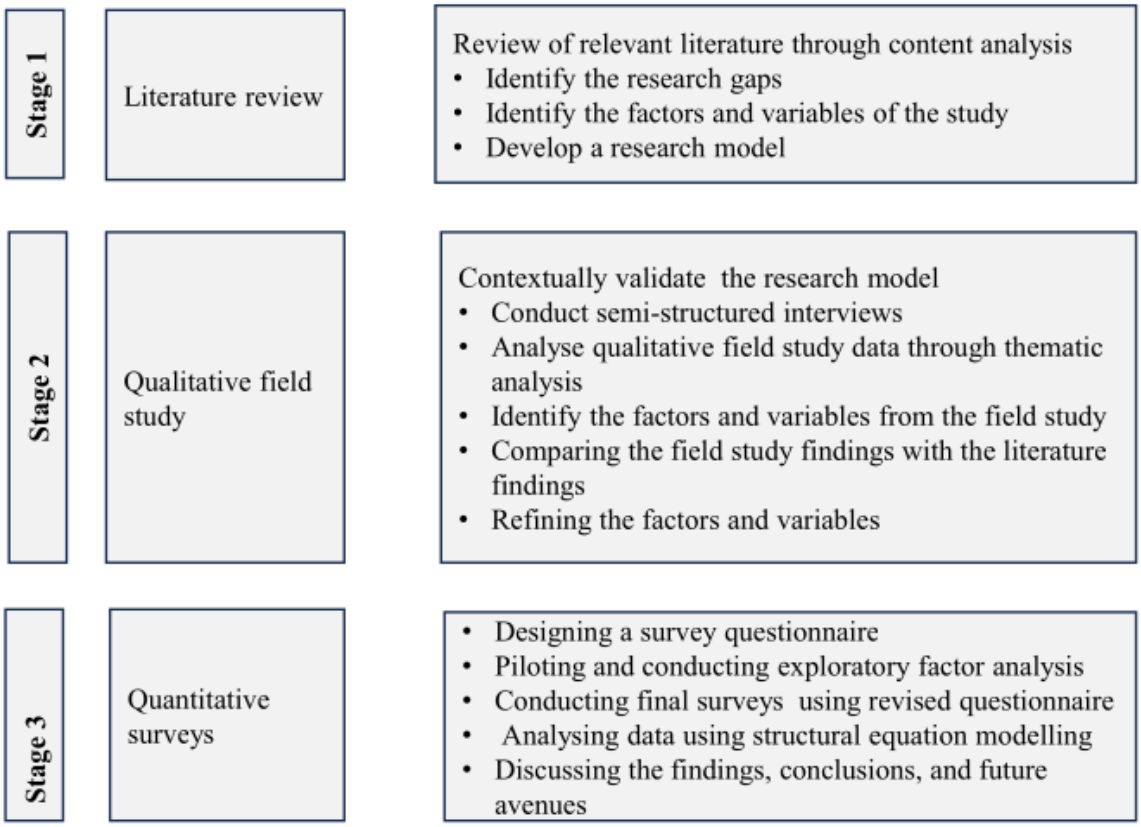

Figure 4. Research flow chart

Source: Researcher's construction

3.4 Qualitative Field Study

In line with the suggestions of Creswell (2014), this research undertook interviews during the exploratory phase to validate the dimensions and indicators of research constructs in the proposed research framework. Confirming the contextual validity of the research framework was also the aim of conducting qualitative interviews.

3.4.1 Data collection techniques for qualitative field study

According to Malhotra (2020) interviewing is an effective technique for qualitative data. Considering the nature of the study, interview technique was adopted to identify the factors and variables from the perspectives of the respondents in the study area. Structured interviews are designed with predetermined questions, which lead to no exploration, and unstructured interviews are developed without pre-planned questions, which require a huge amount of time. In contrast, semi-structured interviews follow a moderately structured path where researchers have a chance to use both structured questions to support the interview process and unstructured questions for in-depth data. Consequently, semi-structured

interviews are an appropriate technique for qualitative study (McIntosh & Morse, 2015). Therefore, the researcher applied semi-structured interviews and refined the factors and variables in the proposed research model based on the findings of the qualitative field study.

3.4.2 Sampling for qualitative field study

Determining sampling technique and sample size is significant in the case of qualitative study. Considering the research purpose, this study employed non-probability purposive sampling techniques because under these techniques, only those respondents can be selected who have enough knowledge on the subject of the study, and thereby, in-depth data can be obtained to address the research questions. On the other hand, data can be collected easily by using convenience sampling, which allows to collection of data at the convenience of the researcher, but obtaining deeper insights is difficult to apply this technique for collecting qualitative data (Myers, 2019). Hence, the researcher of this study chose a purposive sampling technique for a qualitative study to obtain in-depth data and to collect data from all sizes (Small, medium, and large) of RMG companies in Bangladesh to represent the whole industry.

The target population of this study was the RMG companies in Bangladesh; therefore, each respondent represents an individual company for qualitative field study. Respondents were those who were in senior management positions and possessed adequate knowledge of the company management and sustainability issues of the company. Respondents were approached through electronic means (such as email, telephone number, and WhatsApp) using contact details from the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) directory. It is noted that sample size determination for qualitative study varies from quantitative research. Therefore, the researcher selected the sample of this study, keeping in mind the focus of the study. Conventionally, a 5-50 sample size is adequate in qualitative research (Dworkin, 2012). However, the sample size varies depending on the study context and research paradigms in the qualitative study (Boddy, 2016) . The theoretical saturation can be used for determining sample size in qualitative research. According to Boddy (2016), data saturation can be observed with 12 cases in a relatively homogenous population. The study collected data from 13 in-depth interviews; no additional interviews were conducted as the data reached saturation.

3.4.3 Qualitative research data analysis

This study used content analysis techniques for the factors and variables collected through surveying the literature and hybrid thematic analysis techniques with the support of the NVivo 14 program for factors and variables derived through in-depth interviews. Inductive and deductive approaches are used in thematic analysis. Following the guidelines of Proudfoot (2023), this study employed inductive/deductive hybrid thematic analysis where the researcher primarily employed the inductive technique, which is involved with open coding of data and then grouping the newly identified codes into broader themes, and finally, the deductive technique, which is involved with coding data and identifying categories that align with the existing literature to fulfil the research objective.

3.5 Quantitative Study

Following the refinement of sustainable leadership and sustainability performance factors and variables supported by the literature review and qualitative field study, the assessment of the relevance of the measurement items by an expert committee was necessary before applying quantitative analysis. The researcher developed an expert committee consisting of two active researchers and three apparel professionals to assess the relevance of sustainable leadership and sustainability performance measurement items in Bangladeshi RMG companies. The experts were invited individually to judge the most relevant items and classify the items into first-order constructs to measure the second-order sustainable leadership and sustainability performance constructs. This process led to the retention of items matching more than 80% of classification cases, while three items of sustainable leadership (SO7: Organizational change sensitively , SO8: Protecting human rights, CA9: Self-management, and five items of sustainability performance (EnP6: Decreasing environmental accidents , EnP8: Increasing efficiency of material usage, EcP6: Decreasing penalties for environmental damage, EcP7: Reducing waste treatment charges, SoP7: Funding to local community initiatives) were deleted. After that, the researcher proceeded to develop a questionnaire for the confirmation and validation of the measurement items of this study.

3.5.1 Questionnaire Development

The researcher developed a structured questionnaire using a five-point Likert scale in the context of the literature survey, theoretical support, and qualitative field study findings to collect survey data for testing the hypothesis. The questionnaire consisted of the following

constructs: sustainable leadership (SL), sustainability performance (SP), green dynamic capabilities (GDC), and Industry 4.0 adoption (I4.0A). This study followed Churchill's (1979) scale development process for two primary constructs: sustainable leadership and sustainability performance. In addition, the researcher adapted the earlier standardized scales for two other constructs: green dynamic capabilities and Industry 4.0 adoption in the study. In designing scales, the critical steps in this process include (1) specifying the domain of constructs', (2) generating a pool of items, (3) gathering initial data to refine the items, (4) refining the measure, 5) conducting further data collection, (6) assessing reliability, (7) validating the measure, and (8) establishing norms. The researcher conceptualized both sustainable leadership and sustainability performance constructs in light of the existing literature for specifying the domain of the constructs (step 1). The study employed the extant literature review and conducted semi-structured interviews to contextualize the findings of the literature on sustainable leadership and sustainability performance to generate a pool of the items (step 2) of the scales. It took expert advice to sort and purify the measurement items. Mentioned that the expert team was a combination of apparel professionals and academics who judged the measurement indicators summarized through literature review and interviews. In this phase, expert members judged the indicators of sustainable leadership and sustainability performance from the perspective of Bangladesh's clothing sector and classified the measurement indicators. The researcher retained the most common indicators, and some items were dropped due to merging with other items and less relevance in the study context and settings (SO7: Organizational change sensitively , SO8: Protecting human rights, CA9: Self-management, EnP6: Decreasing environmental accidents , EnP8: Increasing efficiency of material usage, EcP6: Decreasing penalties for environmental damage, EcP7: Reducing waste treatment charges, SoP7: Funding to local community initiatives) on the recommendation of an expert team. After determining the relevance of the measurement items of this study by an expert committee, the researcher developed a draft questionnaire using a five-point Likert scale to purify the measures. The primary version of the questionnaire was pre-tested with six RMG managers sampled from the study's target population to ensure the questionnaire's content validity. In this phase, the researcher asked the respondents to give feedback on the clarity of the instructions, the questions' wording, the questionnaire's layout, and the time required to complete it. Though the respondents in the pre-testing phase commonly reported that the questionnaire was straightforward and clear, they recommended translating the questionnaire into Bengali in the final survey as

most of the measurement indicators were adapted from the existing literature, which was initially designed in English.

In contrast, the survey was conducted in Bangladesh's RMG industry, where the native language is Bengali. Therefore, the researcher first developed the final version of the English questionnaire. Then, based on the recommendation from pre-testing and following the guidelines of Brislin (1986), the questionnaire was translated into Bengali. Moreover, the researcher employed a back-translation approach between English and Bengali by bilingual Bengali professors and researchers to ensure conceptual similarity. After that, aligned with the recommendation of Hensley (1999), the researcher proceeded with pilot testing of the Bengali version questionnaire with a small number of garment companies in Bangladesh and conducted the exploratory factor analysis (EFA) to purify the measures and ensure the understandability and reliability of the measurement indicators using pilot testing data (Step 3 and 4). After purifying and ensuring the applicability of the questionnaire using an EFA in the pilot study, the researcher again collected data from the final survey and ran confirmatory factor analysis (CFA) to assess the refined questionnaire to justify further the validity of the questionnaire instrument (Step 5, 6, 7 and 8).

3.5.2 Operationalization and measurement of the constructs

This study has four primary constructs, and each construct has some sub-constructs. Thus, the researcher considered multiple items for each sub-construct to ensure the validity and reliability of the items. The researcher developed a construct measurement instrument for this study based on surveying relevant literature and qualitative field study, which has 63 items without demographic items. This measurement instrument was initially used in the pre-testing of the survey to confirm the applicability and reliability of the measurement indicators. After conducting the pilot study, the revised measurement instrument was applied for the final survey of this research. All constructs' items of this study used a uniform five-point Likert scale, scored from 1 = "strongly disagree" to 5 = "strongly agree", aligned with prior studies (Huang et al., 2024; Wang et al., 2022) . The instrument has five sections: demographic variables, sustainable leadership, green dynamic capabilities, Industry 4.0 adoption, and sustainability performance, which are explained below.

3.5.3 Questionnaire section 1: Demographic variables

The first part of the questionnaire was demographic variables. The demographic variables of this study included managerial position, gender, age, educational level, working

experience, organizational size, organizational age, sale revenue, and Industry 4.0 adoption level, which were measured by the nominal scale. The demographic data was used to check whether there were any significant demographic differences between the respondent companies and to employ them as control variables. The demographic variables utilised in this research are presented below (Table 4)

Table 4. Demographic variables

Item	Variable	Measure
Q1.	Managerial position	Managerial hierarchy
Q2.	Gender	Gender of respondent
Q3.	Age	Age range of the respondent
Q4.	Education level	Range of educational status of respondent
Q5.	Working experience	Range of working experience of respondents
Q6	Organisational size	Range of number of employees working in the company
Q7.	Organizational age	Range of number of years the company running in the business operations
Q8.	Sales revenue	Company's annual sales volume level in Bangladeshi currency
Q9.	Industry 4.0 adoption level	Full, partial and development phase of Industry 4.0 adoption

Source: Researcher's construction

3.5.4 Questionnaire section 2: Sustainable leadership (SL) factors

This section aimed to identify and measure the sustainable leadership factors: pro-employee behaviour, long-term orientation, stakeholder orientation, and collaborative behaviour. This study surveyed relevant literature and conducted a qualitative field study to explore the measures of sustainable leadership. After confirming empirical validity and theoretical justification, the researcher identified four dimensions of sustainable leadership construct and their measurement items. Table 5 presents the measurement items related to the four dimensions of sustainable leadership and their sources.

Table 5. Measurement items and related statements of SL

Dimensions	Measurement item	Source
Pro-employee behaviour (PEB)	Our company's leadership cares for the welfare of its employees (PEB1)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; McCann & Holt (2010) ; Field study
	Our company's leadership develops all employees' knowledge and skills through continuous training (PEB2)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lambert (2011) ; Lee (2017) ; Field study
	Our company's leadership values the cooperation of employee representatives to foster amicable labour relations (PEB3)	Avery & Bergsteiner (2011) ; Field study
	Our company's leadership promotes employees wherever possible (PEB4)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lee (2017) ; Field study
	Our company's leadership strives to retain employees across all levels (PEB5)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Field study

Dimensions	Measurement item	Source
Long-term orientation (LTO)	Our company's leadership emphasizes long-term plans and strategies for investment and resource management. (LTO1)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Dou et al. (2019) ; Diallo et al.,(2021) ; Visser & Courtice (2011) ; Field study
	Our company's leadership considers its vision as an indispensable strategic tool to drive business (LTO2)	Avery & Bergsteiner (2011) ; Visser & Courtice (2011) ; Field study
	Our company encourages innovative activities across the company (LTO3)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Visser & Courtice (2011) ; Field study
	Our company's leadership emphasizes producing high-quality products to gain a competitive advantage. (LTO4)	Avery & Bergsteiner (2011) ; Field study
	Our company's leadership values emotionally committed employees for future benefits (LTO5)	Avery & Bergsteiner (2011) ; Visser & Courtice (2011) ; Field study
Stakeholder orientation (SO)	Our company's leadership acts in an environmentally responsible manner (SO1)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Our company's leadership acts in a socially responsible manner (SO2)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Our company's leadership behaves in an ethically responsible manner (SO3)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; McCann & Holt (2010) ; Field study
	Our company's leadership builds a trusting atmosphere through relationships and goodwill (SO4)	Avery & Bergsteiner (2011) ; Field study
	Our company's leadership strives to ensure fairness in the company (SO5)	Field study
	Our company's leadership values the interests of all stakeholders. (SO6)	Avery & Bergsteiner (2011) ; Field study
Collaborative attitude (CA)	Our company's leadership cultivates a widely shared culture in the workplace (CA1)	Avery & Bergsteiner (2011) ; ; Lee (2017) ; McCann & Holt (2010) ; Visser & Courtice (2011) ; Field study
	Our company's leadership encourages knowledge and skill sharing throughout the company (CA2)	Avery & Bergsteiner (2011) ; Field study
	The top management team, not just our CEO, makes crucial strategic decisions in our company (CA3)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Our company's leadership emphasizes building a team-based work culture across the company (CA4)	Avery & Bergsteiner (2011) ; Field study
	Our company's leadership strives to correct mistakes that affect sustainability (CA5)	McCann & Holt (2010) ; Field study
	Our company's leadership strives to maintain open communication with diverse stakeholders. (CA6)	Field study
	Our company's leadership demonstrates support for Work/Life Programs (CA7)	Lee (2017) ; Field study
	Our company's leadership supports employees to adapt in the workplace (CA8)	Field study

Source: Field study interviews 2024

3.5.5 Questionnaire section 3: Green dynamic capabilities (GDC) factors

This section included three dimensions of green dynamic capabilities and their measurement items. Green dynamic capabilities were measured by adapting established measurement scales in the literature. The researcher slightly modified the measurement items to match the current study. Table 6 presents the coded measurement items statement of green dynamic capabilities (GDC) and their sources.

Table 6. Measurement item statements of GDC

Dimensions	Measurement item	Source
External resource integration (ERI)	Our company integrates buyers' environmental requirements in products (ERI 1)	Dangelico et al., (2017)
	Our company integrates knowledge of the environmental impact of products during customers' use (ERI 2)	Dangelico et al., (2017)
	Our company integrates suppliers' knowledge and competencies on the environmental impact of components or materials (ERI 3)	Dangelico et al., (2017)
	Our company integrates suppliers' knowledge and competencies on the environmental impact of production processes (ERI 4)	Dangelico et al., (2017)
Internal resource integration (IRI)	Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental sustainability unit) and design function/department within the company (IRI 1)	Dangelico et al., (2017)
	Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental sustainability unit) and production function/ department within the company (IRI 2)	Dangelico et al., (2017)
	Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental sustainability unit) and marketing function/ department within the company (IRI 3)	Dangelico et al., (2017)
Resource building and reconfiguration (RBR)	Our company hires environmental specialists (e.g. experts on Life Cycle Assessment (LCA) and Design for Environment (DfE)) (RBR 1)	Dangelico et al., (2017)
	Our company organizes training (e.g. through attendance to conferences, workshops, and courses) for product development teams' members to upgrade their environmental knowledge and competencies (RBR 2)	Dangelico et al., (2017)
	Our company organizes training (e.g. through attendance to conferences, workshops, and courses) for R&D staff to upgrade their environmental knowledge and competencies upgrading environmental knowledge and competencies (RBR 3)	Dangelico et al., (2017)
	Our company strengthens environmental R&D (e.g. increasing the scope, increasing investments) (RBR 4)	Dangelico et al., (2017)
	Our company reconfigures organizational structure to focus on environmental sustainability (e.g. creating a new division, reconfiguring product lines) (RBR 5)	Dangelico et al., (2017)
	Our company reconfigures product development teams to include environmental specialists (RBR6)	Dangelico et al., (2017)

Source: Researcher's construction

3.5.6 Questionnaire section 4: Industry 4.0 technologies adoption factors

This section measures the factors of Industry 4. 0 adoption in the RMG industry in Bangladesh. Industry 4. 0 adoption was measured by two dimensions: vertical integration, which reflects a company-level technological integration in innovation and efficiency, and horizontal integration, which reflects a company's degree of technological integration in inventory, product-order management, customer service management, and inter-company communication. This study adapted Industry 4.0 adoption measurement items from the established scale in the literature. Table 7 presents the coded measurement items statement of Industry 4.0 adoption (I4.0A) and their sources.

Table 7. Measurement item statements of I4.0A

Dimensions	Measurement item	Source
Vertical integration (VI)	While Industry 4.0 adoption, our company's technological integration enhances employees' innovation performance (VI1)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration helps employees manage the tools and techniques (VI2)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration enables the creation of various products (VI3)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration allows for improving product quality (VI4)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
Horizontal integration (HI)	While Industry 4.0 adoption, our company's technological integration makes inventory-related information visible throughout the supply chain (HI1)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration helps to maintain a smart product order management system (HI2)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration allows for building cloud-based customer service data management (HI3)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)
	While Industry 4.0 adoption, our company's technological integration assists early market entrants (HI4)	Jayashree et al., (2021) ; Pérez-Lara et al. (2020)

Source: Researcher's construction

3.5.7 Questionnaire section 5: Sustainability performance factors

This section comprised measurement items concerning sustainability performance. Consistent with previous studies (Li et al., 2020), sustainability performance of the RMG industry in Bangladesh was assessed using the perception of the respondents concerning their company's performance in comparison to the primary competitors of their company in the last three years. The researcher measured sustainability performance using three

dimensions and their measurement indicators. These measurements were reviewed in the literature, contextual validity was confirmed by conducting a qualitative field study, and theoretical justification was ensured with the help of previous studies. EcP4, SoP5 and SoP6 were identified as new sustainability performance measures and confirmed through an expert committee's advice. The coded measurement item's statements of sustainability performance and their sources are illustrated below Table 8.

Table 8. Measurement item statements of sustainability performance

Dimensions	Measurement item	Source
Environmental performance (EnP)	Our company has reduced air emissions (EnP1)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our company has reduced wastewater (EnP2)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our company has reduced solid waste (EnP3)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our company has reduced energy consumption (EnP4)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our company has decreased the use of hazardous/harmful/ toxic materials (EnP5)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our company has improved environmental compliance (EnP6)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Our firm have increased the usage of eco-friendly materials (EnP7)	Abdul-Rashid et al (2017) ; Shashi et al., (2019) ; Field study
Economic performance (EcP)	Our company's market share has been improved (EcP1)	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Our company's image has been improved (EcP2)	Abdul-Rashid et al (2017) ; Field study
	Our company's position in the marketplace has been improved (EcP3)	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Our company has received increased orders from buyers (EcP4)	Field study
	Our company's profitability has increased (EcP5)	Abdul-Rashid et al (2017) ; Hofer et al. (2012) ; Paladino, (2007) ; Field study
Social performance (SoP)	Our company has improved relationships with the employees and community (SoP1)	Abdul-Rashid et al (2017) ; Aftab et al., (2022) ; Field study
	Our company has improved workplace safety measures (SoP2)	Abdul-Rashid et al (2017) ; Aftab et al., (2022) ; Field study
	Our company has improved the work environment (SoP3)	Abdul-Rashid et al (2017) ; Aftab et al., (2022) ; Field study
	Our company has improved the living standard of the surrounding community (SoP4)	Abdul-Rashid et al (2017) ; Aftab et al., (2022) ; Field study
	Our company has improved the wage structure of employees (SoP5)	Field study
	Our company has improved employees' health security measures (SoP6)	Field study

Source: Field study interviews 2024

3.5.8 Control variables

The unit of analysis of this study is organizational, and the data was collected from only one responsible person of each sampled company. Therefore, in line with the previous studies, this study considered two control variables, namely organizational size and organizational age, to examine whether these variables have a significant influence on the sustainability performance of the RMG companies in Bangladesh.

3.5.9 Population of the study and unit of analysis

The focus of this study is on the RMG manufacturing firms in Bangladesh. The target population comprises the RMG companies registered in the BGMEA. Consistent with the similar nature of studies (Chan et al., 2016; Huang et al., 2024), the unit of analysis was set as organizational, which means individual RMG manufacturing companies, whereas the targeted respondents were managers who can provide data on leadership, dynamic capabilities, Industry 4.0 adoption and sustainability performance of the company. Besides, only different hierarchical managers were targeted to collect data because they know more about the company than operating-level employees. Consequently, managers' responses can reflect a company's appropriate perception (Jayashree et al., 2021). A single respondent in this study represents each RMG company. The survey data were collected from all RMG companies listed in BGMEA irrespective of size: small, medium, and large.

3.5.10 Sampling techniques and justification

Both probability and non-probability sampling techniques were used in the study on the basis of the nature, objective, and study context. Compared to non-probability sampling, probability sampling has more generalizability because each item of the population has an equal and independent chance of being included in the sample. However, probability sampling takes more time and money. Aligned with the previous studies (Al-Hakimi et al., 2022; Nasir et al., 2022), this study employed a simple random sampling technique to minimize the sampling bias and to ensure the generalizability of the study findings.

3.5.11 Determination of sample size

The study used the directory of BGMEA (https://www.bgmea.com.bd/page/member-list), which has a complete list of registered RMG companies in Bangladesh, including the contact details of the company (name of the company and contact person, address, phone number, email). The researcher found 3810 RMG companies listed in the BGMEA on 03.01.2024.

According to the BGMEA directory, RMG companies are located in 13 districts in Bangladesh (BGMEA, 2023c). The researcher focused on four districts: Dhaka, Chittagong, Gazipur, and Narayanganj because most of the garment companies (3695 out of 3810) are in these districts and their economic importance. The minimum sample size of 351 RMG companies was determined to represent the study population following the sample size determination table developed by Krejcie & Morgan (1970) . The study targeted 400 companies for data collection, considering the low response rate of firm-level data. An additional 60% of companies were considered for data collection for accurate statistical purposes. Subsequently, an online random number generator (https://www.random.org/integers/) was used to generate random numbers, which helped select the participating companies randomly from the sample frame. The contact persons of garment companies were approached via in-person and online communication using contact details from the BGMEA directory. They were requested to allow their one manager with knowledge of the subject matter of the study to participate in the survey by informing the study's academic purpose and ensuring the anonymity and confidentiality of the respondents and the companies.

3.5.12 Data analysis technique and justification

This study employed both descriptive and inferential statistical techniques for analysing quantitative data of this study. Descriptive statistics (such as average, standard deviation, percentage, and frequency) were employed to describe the survey data. In contrast, inferential statistical tools helped make decisions on the proposed research model of this study. This study applied IBM SPSS version 25 for data preparation, missing value, outlier, and exploratory factor analysis (EFA) for descriptive data analysis. On the other hand, this study employed a structural equation model (SEM) using the SmartPLS version 4.0.9.6 software, which is a non-parametric and multivariate technique widely used to test the hypothesized relationship in the proposed research model by assessing path co-efficient and effect size (Hair et al., 2019). When both the values are in the scale measure, or one is in scale, and the other is in the ratio scale data, it is recommended to employ SEM instead of simple regression (Maruyama, 1997). In addition, the primary assumption of simple regression is multicollinearity, while SEM emerges to overcome multicollinearity. Therefore, following the guidelines of Hair & Alamer (2022) , this study applied PLS-SEM (partial least square-based SEM) to determine the structural relationship between the constructs in the research model.

Moreover, when the research framework is more complex and includes mediating or moderating variables with higher-order formative constructs, employing PLS-SEM is more appropriate than CB-SEM (covariance-based SEM) (Hair et al., 2019). Furthermore, data normality is the pre-condition to using CB-SEM, whereas PLS-SEM can be applied to either the normal distribution of data or non-normal data (Hair et al., 2017). In addition, this study has higher-order and lower-order reflective and formative constructs and two mediating variables that justify employing PLS-SEM.

3.5.13 Partial least squares (PLS) assumptions

Literature suggested two sequential stages for applying PLS-based SEM: first, the measurement model assessment, and second, the structural model assessment (Hair et al., 2022; Henseler et al., 2009). According to Jarvis et al. (2003), determining the causal relationship between manifest and latent variables is necessary to evaluate the measurement model. The measurement model is of two types: reflective and formative, and it is determined by the causal relationship between the latent variable and its indicators (Hair et al., 2019; Jarvis et al., 2003). Assessing the reflective measurement model is different from the formative measurement model. The proposed research model has both reflective and formative measurements. However, all the lower-order constructs of this study are reflective. Therefore, following the guidelines of Hair et al. (2022), the researcher assessed the lower-order measurement using indicator reliability, internal consistency, average variance extracted (AVE), and discriminant validity. After that, the higher-order reflective measurement model was assessed similarly to the lower-order reflective model assessment, but higher-order formative measurement was assessed using indicator weight and significance, multi-collinearity, and convergent validity. Finally, the researcher assessed the structural model using the endogenous constructs' path coefficient, R^2, f^2, Q^2, and explanatory power.

4 RESULTS AND DISCUSSIONS

4.1 Qualitative Study

The present study initially employed qualitative research tools which started with reviewing the literature. It progressed through interviews to identify sustainability leadership and sustainable organizational performance factors and variables. The researcher conducted interviews with Bangladesh's clothing industry professionals to contextualize the outcomes from the literature. Since all interviewees hold higher managerial positions in their companies, their inclusion is justified. The interview was conducted in Bengali, and the interviewee felt comfortable there. Thirteen respondents from large and medium-sized RMG companies were interviewed. The candidates for the interviews were chosen purposively.

4.1.1 Development of interview guide

Following Yin's (2009) recommendations, an interview protocol was designed based on reviews of literature. More specifically, the questions for the interview were drawn on Avery & Bergsteiner's (2011) for sustainable leadership and Elkington's (2013) for sustainability performance. The interview guide focused on exploring managerial perceptions and experiences about sustainable leadership and sustainability performance in Bangladesh's RMG industry. The open-ended interview questions used in the study encouraged the interviewee to express their opinions freely. Two experienced academics and active research scholars from the University of Sopron, Hungary, and the University of Rajshahi, Bangladesh, validated the interview guide. The reliability of the research was ensured by keeping records of the respondents' interviews. The guide was piloted on two senior managers in the Bangladesh RMG industry; these pilot interviews were excluded from the final analysis. The researcher modified the interview guide based on the suggestions of a pilot study of qualitative interviews. The researcher developed 10 main questions to cover this study's two main topics (sustainable leadership and sustainability performance). In addition, some follow-up questions were also designed, the interview questions have been attached in the appendix. A comprehensive understanding was gained on the dimensions and indicators associated with sustainability leadership and sustainable firm performance in Bangladesh's RMG industry from the interviews.

4.1.2 Interview participant's demographics

The researcher conducted thirteen (13) interviews via Google Meet, and each interview session spanned approximately 25 to 60 minutes. It is mentioned that the researcher took the interviewees' permission to record the interview session. The thirteen interviewees included a managing director, three general managers, three deputy general managers, three departmental heads of HR and QC, one senior manager compliance, and two managers from the HR and production departments. Interviewees' work experience ranges from 5 to 35 years. As the interview was conducted in Bengali, the interviewees' mother tongue, the transcription was followed by immediate translation. Table 9 outlines the interview participant's profiles.

Table 9. Profile of In-depth interview respondents

Respondents	Position	Respondents' work experience	Company age (No. of year in business)	Company size (No. of employees employed)
A	General manager, Production	20	More than 20	3000-3500
B	Head , HR	25	More than 20	2500-3000
C	Managing director	22	5-10	Less than 500
D	Head, QC	15	More than 20	More than 4000
E	Senior manager, Compliance	7	10-15	2000-2500
F	Deputy general manager, HR	13	More than 20	2000-2500
G	Head, Sampling department	15	15-20	More than 4000
H	General manager, Production	25	More than 20	2500-3000
I	Managing director	20	10-15	500- 1000
J	Manager, HR and compliance	5	15-20	2500-3000
K	Deputy general manager, HR	15	More than 20	2000-2500
L	General manager, Production	14	10-15	1500-2000
M	Deputy general manager, QC	20	More than 20	2000-2500

Source: Field study interviews 2024

4.1.3 Code analysis

The study used NVivo 14 to code the transcribed interviews, ensuring that coding involved thoughtful analysis. Content analysis was used for data obtained in the literature review, while the thematic analysis approach was employed for interview data. This process enabled the researcher to identify and organize themes and sub-themes. Moreover, Following the studies (Fereday & Muir-Cochrane, 2006; Kovilage et al., 2024; Proudfoot, 2023) , a hybrid inductive-deductive approach was employed to identify and validate themes and sub-themes derived from the field study interviews. The themes and sub-themes were identified in the inductive phase using open coding and axial coding. Each sub-theme was considered a variable or initial item, and each theme was thus considered a prospective dimension to measure sustainable leadership and sustainable organizational performance as higher-order

constructs. In the deductive phase, these variables and dimensions derived from the field study were compared and assessed in light of the existing literature to justify the findings of the interviews.

4.1.4 Findings from qualitative field interviews: Sustainable leadership factors and measures (Inductive analysis)

In the qualitative field study, interview participants primarily identified 27 variables that affect sustainable leadership behaviour. Based on thematic analysis, the interview transcripts were analysed to derive various dimensions (themes) and variables (sub-themes) of sustainable leadership. The analysis showed that the sustainable leadership dimensions are employee-related (e.g., “our company values the well-being of all employees irrespective of the position”), long-term oriented factors (e.g., "Our company focuses on balancing long and short-term goals and strategies and continuous improvement to gain a future competitive advantage "), stakeholder-oriented (e.g., "Our company protects the interest of all not just for shareholders and shows ethical, social and environmentally responsible behaviours") and collaboration related factors (e.g., " Our company supports all the employees and fosters an environment for all ") which reflected the multi-dimensional nature of sustainable leadership. Table 4.3 concisely overviews the dimensions and variables contributing to sustainable leadership. The dimensions of sustainable leadership are explained below.

Pro-employee behaviour

All participants in the qualitative field interviews highlighted the significance of almost all indicators, such as caring for employees (N= 13), training and development (N= 13), building amicable relations (N=12), advancement of employees (N=8), and employee retention (N=8) to build a dynamic workforce toward enhancing organizational performance and ensuring future competitiveness in the global apparel market. In the literature, these measures are considered people-oriented behaviour. Concerning valuing employees, Participant **I** stated, *"...Our company is always careful about the well-being of the labour force because they are the basis of success in this labour-intensive RMG company. Therefore, we try to ensure all the basic amenities and build a safe and supportive work environment where every employee feels honoured and valued. Besides, Our management grants maternity leave with pay to a female worker when she goes on maternity and provides baby care facilities when she comes back after maternity leave."* Similarly, Participant **M** expressed his company's commitment to human resources development, stating, *"... our*

management focuses on enhancing employee skills through regular training that can be on the job or off the job training. However, it should be for each employee after recruitment. Even if our company is experiencing a budget crisis, our company management strives to continue employee development programs because our management believes training and development as the key to unlocking the potential that helps our employees grow professionally, which eventually leads to our company productivity." In addition, participant **E** stated that *"Our company management is committed to employee advancement, offering clear career paths and opportunities for growth to ensure that our company members thrive. We aim to cultivate a team that feels supported, motivated, and empowered to achieve success."*

Long-term orientation

From the analysis of the transcript, it was observed that most of the participants stressed different parameters of long-term orientation, such as long-term goals and strategies (N=11), sharing the vision to drive (N=9), encouraging innovation (N=8), cultivating quality (N=7), employee engagement (N=6). Participant **A,** For instance, mentioned, *"... Our company management believes that long-term strategy instead of ad hoc-basis plan for investment in technologies and resource allocation is the foundation of sustainable growth of the company. Therefore, we strive to integrate eco-friendly approaches into our manufacturing process, such as sourcing sustainable raw materials and application of green technologies ..."* Participant **K** stated *"... Our company designed a vision driven by a focus on innovation, facilitating to remain competitive in the changing landscape of the world. We share our vision among all which helps to expand our business operations.... "* Corresponding to long-term orientation, participant **B**, for example, reported that: *"Our company has a policy for promotion where we use 360-degree appraisal and indoor viva if anyone qualified for the upper-level position, this process stimulates employees to work long-time. "*

Stakeholder-orientation

Stakeholder orientation helps a garment company's long-term success and increases the company's brand image in the global apparel market. In the qualitative field study, participants expressed their opinions concerning stakeholder issues such as caring about the environment (N=13), supporting the community (N=13), valuing stakeholders (N=12), building a trusting atmosphere (N=11), organizational change sensitively (N=10), protecting

human rights (N=9), ensuring fairness (N=9), fostering ethical workplaces (N=8). concerning ecological awareness of the company, Participant **E** stated, *"Though it is expensive, our company have some measures to save the environment such as installing ETP, minimum use of chemical and water reuse, and recycling; the company management believes that these initiatives will increase the competitiveness."* Participant **B** mentioned about social attitude of the company in the way that is: *"... Our company plants 100 trees every year, and our factory management established a high school in the district of Manikganj, which is the best in the district. All the facilities for students such as study material tiffin, school drees, housing for teachers are being funded by our company and the company is donating 102 Madrasha every year .... "*

Collaborative behaviour

The field study findings also indicated that many of the participants expressed different collaborative attitudes toward the company. Some of the variables such as fostering inclusive culture(N= 10) , Sharing knowledge and skills (N=8), building teamwork (N=8), participatory decision making (N=7), maintaining open communication (N=7), facilitating adaptation(N=7), building teamwork (N=7), Work/Life Balance (N=5), correcting mistakes and maintaining open communication (N=5). In reference to inclusive work culture, Participant **L** stated, *"Our company attempts to foster an inclusive culture, where all employees, regardless of position in the company, feel valued. For example, our company regularly host meetings and workshops to raise awareness and promote inclusivity."* Besides, participant **F** opined that *"Our company focuses on building effective teams for completing a shipment because when a buying order is received from a foreign buyer concern the company management encourages teamwork by promoting collaboration across departments, which ensures smooth production flow. For instance, our production department works closely with the quality control and design departments to ensure buyer's standards and requirements."* Table 10 presents the full list of dimensions and variables derived from the field study, which contextualises sustainable leadership factors for the RMG industry in Bangladesh.

Table 10. Factors and variables of sustainable leadership derived from qualitative field study

Sustainable leadership factors	Variables	Respondents												
		A	B	C	D	E	F	G	H	I	J	K	L	M
Pro-employee behaviour (PEB)	Caring for employees (PEB1)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Training and development (PEB2)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Building amicable relations (PEB3)	/	/	/	/	/	/	/	/	/	/	/	/	
	Advancement of employees (PEB4)				/	/	/	/			/	/	/	/
	Employee retention (PEB5)				/	/	/	/		/			/	/
Long-term orientation (LTO)	Long-term goals and strategies (LTO1)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Formulating vision to drive (LTO2)	/	/	/	/	/	/	/		/	/	/	/	/
	Encouraging innovation (LTO3)	/	/	/	/	/	/	/	/	/	/	/	/	
	Cultivating quality (LTO4)	/	/	/	/				/	/	/	/		
	Employee engagement (LTO5)	/	/				/	/		/	/	/		
Stakeholder orientation (SO)	Caring about the environment (SO1)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Supporting community (SO2)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Fostering ethical workplaces (SO3)	/	/	/	/	/	/	/	/		/	/	/	/
	Building trusting atmosphere (SO4)	/	/	/	/		/		/		/	/	/	/
	Ensuring fairness (SO5)	/		/	/	/	/	/	/	/	/	/		
	Valuing stakeholders (SO6)			/	/	/	/	/	/			/	/	/
	Organizational change sensitively (SO7)	/	/	/	/	/	/	/			/	/		
	Protecting human rights (SO8)	/	/	/				/		/	/	/		/
Collaborative attitude (CA)	Cultivating inclusive culture (CA1)	/			/	/	/	/	/		/	/	/	/
	Sharing knowledge and skills (CA2)					/	/	/	/	/	/	/	/	
	Participatory decision making (CA3)	/	/			/	/				/	/	/	/
	Building teamwork (CA4)					/	/			/	/	/	/	/
	Correcting mistakes (CA5)		/		/	/	/	/			/	/	/	
	Maintaining open communication (CA6)	/					/	/	/		/		/	
	Work/Life Balance (PEB6)	/					/	/	/		/		/	
	Facilitating adaptation (CA8)						/	/		/			/	/
	Self-management (CA9)	/				/	/					/	/	

Source: Field study interviews 2024

4.1.5 Qualitative field study findings: Sustainability performance (Inductive analysis)

The RMG industry in Bangladesh is basically dependent on foreign buying orders. In recent decades, buyers' requirements, global regulations, national law and stakeholder pressures have forced RMG companies to take sustainability initiatives. Therefore, only profit-seeking companies, without considering ethical, social and environmental issues, a company cannot survive in the marketplace. The researcher of this study explored sustainability performance metrics in the qualitative field study. Three dimensions and several measurement items of sustainability performance were identified through extensive thematic analysis procedures. Initially, respondents identified 23 variables influencing sustainable organizational performance in Bangladesh's RMG industry. After grouping these variables according to their commonality, three dimensions were revealed. These are: "environmental

performance", "economic performance", and "social performance". The explanation of the dimensions is as follows.

Environmental performance

Environmental performance is concerned with the advancement of companies' efforts in terms of ecological issues in the past few years. Participants who attended the qualitative interview mentioned several indicators of the environmental performance of a company. These indicators are reducing air emissions (N=13), reducing wastewater (N=13), reducing solid waste (N=13), saving energy (N=12), decreasing toxic materials usage (N=12), decreasing environmental accidents(N=12), improving environmental compliance (N=12), increasing efficiency of material usage(N=9), increasing the usage of eco-friendly materials (N=8). For example, participant **K** stated that *"..... on one floor, it was required for our company to use at least 200-250 lights. We would use normal Tube lights, each consuming 40 watts of power in the past, whereas now we use LED light that takes only 18 watts each, therefore saving energy costs. In addition, our company is using a servo motor in place of a clutch motor for reducing energy consumption ...."* Participant **A** also mentioned about environmental performance of the company: *"Our company have employed energy-efficient machinery, recycling systems, and effective waste management approach to minimize negative environmental complexity. Our company also source raw materials responsibly".*

Economic performance

Economic performance is more important for any organization to survive in the marketplace. Without sound finances, no organization, especially private-owned companies, can implement any steps. Therefore, the study asked to interview participants about the economic performance of the RMG companies in Bangladesh. The findings uncovered different measures of economic performance, such as increasing the market share (N=13), improving the company's image (N=13), improving the company's position in the marketplace (N=12), increasing sales revenue (N=11), increasing the profitability (N=11), decreasing penalties for environmental demage (N=10), reducing waste treatment charges (N=9). In relation to economic performance, Participant **G**, for example, stated that *"Our buying order has increased due to adopting sustainable manufacturing approaches and the growing demand for eco-friendly products around the world."*

In contrast, Participant **J** commented that *"Our company is committed to using energy-efficient lighting that helps to achieve cost efficiency and leads to the profitability of our*

company." In addition, Participant **I** stated, *"We started with 34 machines in this garment sector. Now it has been 340 within 14 years of our business operations, now we sell our products in many countries of EU and the USA. It has been possible due to our company image in the global apparel market."*

Social performance

Social performance focuses on the ability of a company to improve the well-being of employees, communities and stakeholders. Foreign buyers impose different parameters to improve social issues such as workplace safety, occupational health and fair wages in Bangladesh's RMG industry. The interview outcomes revealed several measures of social performance in the RMG industry. For instance, participants mentioned improving relationships with the employees and community (N=11), improving workplace safety measures (N=11), improving the work environment (N=10), improving the living quality of the surrounding community (N=10), improving the wage structure of employees (N=10), improving employees' health security measures (N=10), and funding to local community initiatives (N=8).). Concerning these indicators, participant **B**, for example, mentioned that *"…. even though it cost a lot in the initial stage, now the safety and security of our garment factory is 100% better than before. For example, a few days ago there was a fire accident in a warehouse of TCB. People from the fire brigade came and put out the fire. When their water ran out, they used our factory reservoir to put out the fire and commented that your factory is radically now improved…."* Moreover, participant **E** mentioned that *"…. complying with the worker code of conduct, buyers code of conduct, Bangladesh Govt. labour law, and ILO rules, our company management ensures workers' well-being for long-term gains of our company…."* In addition, concerning workplace safety, participant **J** stated, "*Nowadays in the garment business, ensuring safety is the priority to get buying orders. Therefore, our company follows the RSC approval process, which involves three types of safety: Building safety, fire safety and electrical safety, which ensure the overall security of our company; thus, foreign buyers do not have any complaints about our operations for safety in the workplace.*" Table 11 presents the full list of dimensions and variables derived from the field study, which contextualises sustainability performance factors in Bangladesh's RMG industry.

Table 11. Factors and variables of sustainability performance derived from field study

Factors	Variables	Respondents												
		A	B	C	D	E	F	G	H	I	J	K	L	M
Environmental performance (EnP)	Reducing air emissions (EnP1)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Reducing wastewater (EnP2)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Reducing solid waste (EnP3)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Saving energy (EnP4)	/	/	/	/	/	/	/	/	/	/	/	/	
	Decreasing toxic materials usage (EnP5)	/	/	/	/	/		/	/	/	/	/	/	/
	Decreasing environmental accidents (EnP6)	/	/	/	/	/	/		/	/	/	/	/	/
	Improving environmental compliance (EnP7)	/	/	/	/	/	/	/	/		/	/	/	/
	Increasing efficiency of material usage (EnP8)	/	/			/	/	/		/	/		/	/
	Increasing the usage of eco-friendly materials (EnP9)	/		/				/	/			/	/	
Economic performance (EcP)	Increasing the market share (EcP1)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Improving company's image (EcP2)	/	/	/	/	/	/	/	/	/	/	/	/	/
	Improving company's position in the marketplace (EcP3)	/	/		/	/	/	/	/	/	/	/	/	/
	Increasing growth in buyer's order (EcP4)	/	/	/		/	/	/	/	/	/		/	/
	Increasing profitability (EcP5)			/	/	/	/	/	/	/	/	/	/	/
	Decreasing penalties for environmental damage (EcP6)	/	/		/			/	/	/	/	/	/	/
	Reducing waste treatment charges (EcP7)	/	/	/		/	/	/		/		/	/	
Social performance (SoP)	Improving relationships with the employees and community (SoP1)	/	/	/	/	/	/			/	/	/	/	/
	Improved workplace safety measures (SoP2)	/	/	/	/	/	/	/	/		/	/	/	
	Improving work environment (SoP3)	/	/	/		/	/	/		/	/	/		/
	Improving living standard of the surrounding community (SoP4)			/	/	/	/	/	/	/		/	/	/
	Improving the wage structure of employees (SoP5)		/	/		/	/	/	/	/		/	/	/
	Improving employees' health security measures (SoP6)	/	/	/	/	/	/		/		/	/		/
	Funding to local community initiatives (SoP7)	/	/	/	/			/				/	/	/

Source : Field study interviews 2024

4.1.6 Deductive analysis

The four dimensions and several variables of sustainable leadership and three dimensions and various variables of sustainability performance were identified using inductive analysis of the study. These dimensions and variables were then categorized through deductive analysis in the context of the existing literature (Abdul-Rashid et al., 2017; Avery & Bergsteiner, 2011; Brenner & Hartl, 2021; Elkington, 2013; Hargreaves & Fink, 2012; Lee, 2017; McCann & Holt, 2010; Paulraj, 2011; Suriyankietkaew, 2023; Suriyankietkaew & Avery, 2016; Visser & Courtice, 2011; Zhu et al., 2008) . The deductive analysis justified

choosing factors and variables of sustainable leadership and sustainability performance, supported by relevant literature. Most dimensions and measurement indicators derived from the interviews align with the prior study's findings. Therefore, the justification for each factor and variable in the present study was established by the existing theories and empirical findings. It is also mentioned that during the research, some items identified in the literature were excluded due to limited contextual relevance. The field study highlighted a few new items for measuring sustainable leadership and sustainability performance that were subsequently incorporated. Table 12 shows the justification of the dimensions and variables of sustainable leadership.

Table 12. Dimensions and variables of sustainable leadership with relevant literature

Dimensions	**Variables**	**References**
Pro-employee behaviour (PEB)	Caring for employees (PEB1)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; McCann & Holt (2010) ; Field study
	Employee development (PEB2)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lambert (2011) ; Lee (2017) ; Field study
	Building amicable relations (PEB3)	Avery & Bergsteiner (2011) ; Field study
	Advancement of employees (PEB4)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Lee (2017) ; Field study
	Staff retention (PEB5)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Field study
Long-term orientation (LTO)	Long-term goals and strategies (LTO1)	Avery & Bergsteiner (2011) ; Hargreaves and Fink (2012) ; Dou et al. (2019) ; Diallo et al.,(2021) ; Visser & Courtice (2011) ; Field study
	Long-run vision to drive (LTO2)	Avery & Bergsteiner (2011) ; Visser & Courtice (2011) ; Field study
	Encouraging innovation (LTO3)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Visser & Courtice (2011) ; Field study
	Cultivating quality (LTO4)	Avery & Bergsteiner (2011) ; Field study
	Employee engagement (LTO5)	Avery & Bergsteiner (2011) ; Visser & Courtice (2011) ; Field study
Stakeholder orientation (SO)	Eco-friendly behaviour (SO1)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Supporting community (SO2)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Building ethical workplaces (SO3)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Hargreaves and Fink (2012) ; Field study
	Building trusting atmosphere (SO4)	Avery & Bergsteiner (2011) ; Field study
	Ensuring fairness (SO5)	Field study
	Valuing stakeholders (SO6)	Avery & Bergsteiner (2011) ; Field study
	Organizational change sensitively (SO7)	Avery & Bergsteiner (2011) ; Field study
	Protecting human rights (SO8)	Field study

Dimensions	Variables	References
Collaborative attitude (CA)	Fostering inclusive culture (CA1)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Lee (2017) ; Visser & Courtice (2011) ;Field study
	Sharing knowledge and skills (CA2)	Avery & Bergsteiner (2011) ; Field study
	Participatory decision making (CA3)	Avery & Bergsteiner (2011) ; McCann & Holt (2010) ; Field study
	Building teamwork (CA4)	Avery & Bergsteiner (2011) ; Field study
	Correcting mistakes (CA5)	McCann & Holt (2010) ; Field study
	Maintaining open communication (CA6)	Avery & Bergsteiner (2011) ; Field study
	Work/Life Balance (CA7)	Lee (2017) ; Field study
	Facilitating adaptation (CA8)	Field study
	Self-management (CA9)	Avery & Bergsteiner (2011) ; Field study

Source: Field study interviews 2024

All the dimensions and variables of sustainable leadership were assessed and labelled based on common themes from the field interviews and the existing studies. More specifically, the researcher labelled the pro-employee behaviour dimension in line with the previous research (De Hoogh & Den Hartog, 2008; Kalshoven et al., 2011; Suriyankietkaew et al., 2022), long-term orientation dimension (Cantele et al., 2024; Dou et al., 2019), stakeholders orientation dimension (Brulhart et al., 2019; Vurro et al., 2022) and collaborative attitude dimension (Chedid et al., 2019; Liu et al., 2023). These dimensions and variables were also validated using exploratory factor analysis in this study. Notably, prior studies supported most of the variables mentioned by interview participants (Avery & Bergsteiner, 2011; Hargreaves & Fink, 2012; Lee, 2017; McCann & Holt, 2010). Table 13 provides the justification for each variable under three dimensions of sustainability performance.

Table 13. Dimensions and variables of sustainability performance with relevant literature

Dimensions	Variables	References
Environmental performance (EnP)	Reducing air emissions (EnP1)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Reducing wastewater (EnP2)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Reducing solid waste (EnP3)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Saving energy (EnP4)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Decreasing toxic materials usage (EnP5)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Zhu et al. (2008) ; Field study
	Decreasing environmental accidents (EnP6)	Abu Seman et al., (2019) ; Chow & Chen, (2012) ; Field study
	Improving environmental compliance (EnP7)	Abdul-Rashid et al (2017) ; Field study

Dimensions	Variables	References
	Increasing efficiency of material usage (EnP8)	Field study
	Increasing the usage of eco-friendly materials (EnP9)	Field study
Economic performance (EcP)	Increasing the market share (EcP1)	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Improving company's image (EcP2)	Abdul-Rashid et al (2017) ; Field study
	Improving company's position in the marketplace (EcP3)	Abdul-Rashid et al (2017) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Increasing growth in buyer's order (EcP4)	Field study
	Increasing profitability (EcP5)	Abdul-Rashid et al (2017) ; Paladino, (2007) ; Field study
	Decreasing penalties for environmental damage (EcP6)	Paladino, (2007) ; Field study
	Reducing waste treatment charges (EcP7)	Paulraj (2011) ; Field study
Social performance (SoP)	Improving relationships with the employees and community (SoP1)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Improved workplace safety measures (SoP2)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Improving work environment (SoP3)	Abdul-Rashid et al (2017) ; Field study
	Improving living standard of the surrounding community (SoP4)	Abdul-Rashid et al (2017) ; Paulraj (2011) ; Ijaz Baig & Yadegaridehkordi (2023); Field study
	Improving the wage structure of employees (SoP5)	Field study
	Improving employees' health security measures (SoP6)	Field study
	Funding to local community initiatives (SoP7)	Field study

Source: Field study interviews 2024

Sustainable organizational performance was categorized into environmental, economic, and social dimensions, validated by previous research and interview analysis of the present study. This study's findings align with earlier literature (Abdul-Rashid et al., 2017; Chow & Chen, 2012; Gimenez et al., 2012).

New findings from the interviews that were validated in alignment with the literature are illustrated in Table 14.

Table 14. New findings from field study

Dimensions	Pro-employee behaviour
	Long-term orientation
	Stakeholder orientation
	Collaborative attitude
Variables	Ensuring fairness
	Protecting human rights
	Facilitating adaptation
	Maintaining open communication
	Increasing efficiency of material usage
	Increasing the usage of eco-friendly materials
	Increasing growth in buyer's order
	Improving the wage structure of employees
	Improving employees' health security measures
	Funding to local community initiatives

Source: Field study interviews 2024

4.2 Quantitative Survey and Data Analysis Results

4.2.1 Pilot survey

Before starting the main survey, the researcher conducted a pilot study following the recommendation of Lewis et al. (2005) to develop a refined survey instrument for the final survey and to check the reliability of the constructs of this study. Both Google Forms and printed questionnaires were distributed to a similar target sample of the final survey to ensure the data's appropriateness and the instrument's applicability. The pilot study was completed within one month from the start of data collection in May 2024. A five-point Likert scale was used to collect the data. During the pilot study, 92 responses were received from RMG manufacturing companies in Bangladesh. These 92 responses were not included in the final survey to avoid double approaches to the same respondent companies.

4.2.2 Exploratory factor analysis (EFA)

This study developed a measurement scale for sustainable leadership and sustainability performance through surveying literature, conducting semi-structured interviews with senior managers of garment companies and consulting with academics. Measurement scales for green dynamic capabilities and industry 4.0 adoption were adapted from the previously validated scale. Therefore, following suggestions of Netemeyer et al. (2003) and consistent with earlier studies e.g., Kovilage et al. (2024) ; Hossan Chowdhury & Quaddus (2021) , this study performed an exploratory factor analysis (hereafter EFA) based on the pilot survey data to purify the initial measurement scales and to understand the latent structure of sustainable leadership and sustainability performance constructs. In this context, the

researcher applied the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and Bartlett's Test of Sphericity (BTS) tests for identifying the appropriateness of the data for factor analysis. The results of the KMO and BTS tests (Table 15) of this study confirmed the requirements of EFA for both sustainable leadership and sustainability performance constructs.

Table 15. Kaiser- Meyer-Olkin and Bartlett's test results

		Sustainable leadership	Sustainability performance
KMO		.786	.780
BTS	Chi-Square ($\chi 2$)	1319.350	1091.271
	df	190	136
	Sig. (p)	.000	.000

Source: Field study 2024 and SPSS output

Following the guidelines of Carpenter (2018) and Conway & Huffcutt (2003), the latent structure of the sustainable leadership and sustainability performance scales was examined using Principal Axis Factoring (PAF) with Promax rotation. The minimum factor loading criteria was set to 0.50. The factor analysis extracted four latent factors for sustainable leadership with Eigenvalues over 1, explaining 26.372 %, 20.966 %, 9.874 %, and 9.551 % of the variance, respectively and three latent factors for sustainability performance with Eigenvalues over 1, explaining 30.337%, 23.566 %, and 7.749 % of the variance, respectively. The best practices, as suggested by Clark & Watson (2015) for item retention, were followed to evaluate the factor analysis result. Finally, 20 items (out of 24) for the sustainable leadership scale were retained, and 17 items (Out of 18) for the sustainability performance scale were retained for further analysis. Table 16 below shows the EFA results for the sustainable leadership scale.

Table 16. EFA result of the refined sustainable leadership scale in the pilot study

Factors	Items	Communality	Loadings	Eigenvalue	Cumulative variance %	Corrected Item-total correlation
Pro-employee behaviour	PEB1	.674	.836	5.604	26.372	.354
	PEB2	.612	.786			.409
	PEB3	.625	.783			.370
	PEB4	.520	.676			.333
Long-term orientation	LTO1	.612	.756	4.496	47.337	.437
	LTO2	.680	.832			.317
	LTO3	.577	.742			.430
	LTO4	.606	.771			.409

Factors	Items	Communality	Loadings	Eigenvalue	Cumulative variance %	Corrected Item-total correlation
	LTO5	.657	.830			.429
Stakeholder orientation	SO1	.841	.900	2.314	57.212	.313
	SO2	.841	.863			.488
	SO3	.676	.838			.403
	SO4	.704	.862			.320
Collaborative attitude	CA1	.760	.898	2.239	66.762	.557
	CA2	.687	.839			.549
	CA3	.553	.739			.529
	CA4	.697	.760			.538
	CA5	.768	.857			.566
	CA6	.723	.869			.467
	CA7	.538	.688			.431

Source: Field study 2024 and SPSS output

In the analysis, it was observed that four items for sustainable leadership scale and one item for sustainability performance scale were dropped due to low communality (CA8), low item loading score (SO4, SO5 and EcP5) and low inter-item -total corrected correlation (POB5). Table 16 shows the four distinct factors of sustainable leadership. Factor 1 represents pro-employee behaviour, factor 2 is related to long-term orientation, factor 3 reflects stakeholder orientation and factor 4 is concerned with collaborative attitude. Table 17 below displays the EFA results for the sustainability performance scale where factor 1 represents environmental performance, factor 2 expresses economic performance, and factor 3 is related to social performance. In this process, factor analysis empirically validated the dimensions and measurement items of sustainable leadership and sustainability performance that were primarily derived from the literature (theoretically supported) and in the field study.

Table 17. EFA results of the refined sustainability performance scale in the pilot survey

Factors	Items	Communality	Loadings	Eigenvalue	Cumulative variance %	Corrected Item-total correlation
Environmental performance	EnP1	.381	.671	5.551	30.337	.361
	EnP2	.410	.720			.377
	EnP3	.650	.808			.555
	EnP4	.488	.656			.490
	EnP5	.667	.785			.517
	EnP6	.539	.628			.578
	EnP7	.516	.661			.541

Factors	Items	Communality	Loadings	Eigenvalue	Cumulative variance %	Corrected Item-total correlation
Economic performance	EcP1	.612	.849	4.328	53.903	.371
	EcP2	.774	.908			.470
	EcP3	.724	.812			.506
	EcP4	.647	.657			.504
Social performance	SoP1	.571	.752	1.702	61.652	.385
	SoP2	.670	.809			.408
	Sop3	.671	.814			.336
	SoP4	.746	.859			.354
	SoP5	.790	.890			.435
	SoP6	.623	.787			.343

Source: Field study 2024 and SPSS output

4.2.3 Reliability analysis

The pilot survey was performed to assess response consistency and understanding of the questionnaire content. The researcher performed a reliability analysis of the responses received in pilot surveys using the Cronbach alpha coefficient in SPSS. Reliability is the first and foremost measure in assessing the quality of a questionnaire instrument (Churchill, 1979). The result of the reliability coefficient of this study is shown in Table 18. Normally, the minimum acceptance limit of Cronbach's alpha is 0.60 to 0.70. The reliability of all the constructs in this pilot study was internally consistent with values between 00.694 to 0.927, which met the criteria suggested by Sekaran (2016). Therefore, it can be concluded that this questionnaire can be used for final data collection and analysis.

Table 18. Reliability coefficients in the pilot survey

Second order constructs	First order constructs	No. of Test Items	α – value
Sustainable leadership	Pro-employee Behaviour	4	0.828
	Long-term orientation	5	0.887
	Stakeholder orientation	4	0.886
	Collaborative attitude	7	0.927
Green dynamic capabilities	External resource integration	4	0.796
	Internal resource integration	3	0.835
	Resource building and reconfiguration	6	0.694
Industry 4.0 adoption	Vertical integration	4	0.911
	Horizontal integration	4	0.776
Sustainability performance	Environmental performance	7	0.889
	Economic performance	4	0.890
	Social performance	6	0.882

Source: Field study 2024 and SPSS output

4.3 Final Survey

After refining the measurement items and confirming the reliability of the constructs, a final version of the questionnaire, composed of purified items of sustainable leadership (20 items), sustainability performance (17 items), adapted items of green dynamic capabilities (13 items) and Industry 4.0 adoption scale (eight items) was sent to the randomly selected garments companies in Bangladesh. The final data collection of this study was completed in two phases: first wave and second wave. Data collected in the first contact was considered the first wave of data collection or early response. In contrast, responses received after sending a reminder were treated as the second wave of data collection or late response. The researcher used both online and in-person data collection modes to ensure the sampling adequacy of the study. The final survey was carried out from June 2024 to September 2024. This study collected data from the firm level, where a single respondent represented each RMG company. Four hundred companies were targeted for accurate statistical analysis of the complex model of this study and considering the lower response rate in firm-level data collection than individual level, the researcher took steps to approach 60% additional companies of the targeted sample using the email addresses and contact details obtained from the BGMEA directory. In this phase, the researcher and four research assistants (surveyors) first contacted companies via phone calls, email and in-person visits and informed them about the aim and relevance of the study, invited their participation and identified the person knowing the study subject. After that communication, a printed questionnaire and an online Google survey link were distributed to 626 apparel companies depending on the preference of the respondent companies to fill up the questionnaire by 30th August 2024, and the data collection team did a follow-up after the scheduled time. The researcher received 276 completed responses within 10 weeks of starting data collection. A total of 96 responses were received after the reminder was sent to the companies that did not respond in the earlier phase. The data collection process was ended by 25th September 2024.

4.3.1 Preliminary data Analysis

4.3.1.1 Data coding

After collecting the final survey data from the field, data entry was made with the help of coding. According to De Vaus (2002), coding involves converting answers to numbers and categorising answers. With the help of a codebook, the researchers can identify variable descriptions, code names, and fields (Zikmund, 1994). The researcher developed a codebook

to specify all survey questions. Therefore, after collecting responses from the questionnaire, raw data was first entered into Microsoft Excel and then into Statistical Package for Social Sciences (SPSS) version 25 using the codebook.

4.3.1.2 Data screening and cleaning

Before statistical analysis, it is necessary to examine whether the data were correctly entered into a computer database, complete and valid, and free from missing values, outliers and normality of distribution (Malhotra, 2020) . This study minimised the data entry error by collecting questionnaire responses via Google form and the researchers and two research assistants independently checked the data for the printed questionnaire. There were no missing values or incomplete responses in the online survey because the online questionnaire was designed in a way that responding to all questions was compulsory; without responding to all questions, the respondent was not allowed to submit the questionnaire form. Therefore, the compulsory requirement for all survey questions to be answered has eliminated the problem of missing values and incomplete questionnaires in this study. However, the researcher found nine incomplete responses for an offline survey, and these were removed from the data set. This study received a total of three hundred seventy-two (372) responses, and the researchers further screened all the cases of data files in the SPSS and Microsoft Excel and found that five respondents answered the same responses for all questions. These five cases were removed from the data file as this kind of response could affect the reliability of the study result. In addition to that, a frequency analysis was performed in SPSS for each variable to assess for out-of-range values. The study found no out-of-range values in the data file. Moreover, this study used a boxplot to identify extreme outliers in the data file. Three extreme outliers were detected, shown in Figure 5, and they were removed from the data set. After screening and cleaning the data set, a total sample of 355 valid responses was found for statistical analysis.

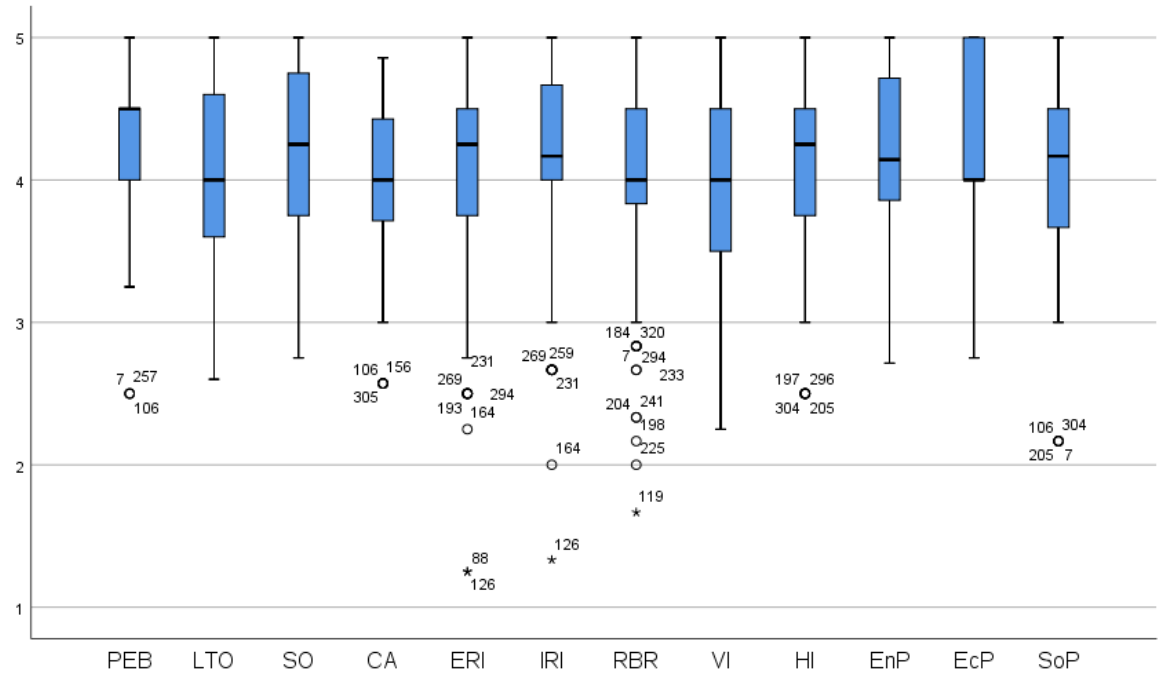

Figure 5. Box plot analysis

Source: Field study 2024 and SPSS output

4.3.1.3 Response rate

Respondent companies of this study were approached via online and offline modes to receive an adequate response rate. In-person data collection is more effective than web surveys. On the other hand, the online survey method offers benefits to saving time and money by removing geographical barriers (Huang et al., 2023). Therefore, this study adopted a mixed data collection method. Table 19 summarizes the response rate. in the first wave, the study received 276 responses, while 96 responses were received in the second phase. Due to incomplete responses and outlier issues, 17 responses were removed for accurate data analysis. The overall response rate of this study was 56.70%, which is acceptable because the response rate of a recent survey in Bangladesh's RMG industry was 45.6% (Rubel et al., 2021) .

Table 19. Response rate of survey

Respondents	Number of questionnaires	Percent (%)
Questionnaire distributed	626	100
First wave response received	276	44.00
Second wave response received	96	15.33
Total response received	372	59.42
Unusable responses	17	2.21
Useable responses	355	56.70

Source: Field study 2024

4.3.1.4 Data normality

The nature of the data determines the types of statistical tests for data analysis. In line with previous studies by Akoglu & Özbek (2022) and Khan et al. (2021), this study used a web-based calculator "https://webpower.psychstat.org/models/kurtosis" suggested by Cain et al. (2017) to check the data for multivariate normality applying Mardia's (1970) test. Multivariate normality was evaluated as it is one of the conditions for perfect model prediction (Akoglu & Özbek, 2022). The outcome of the multivariate normality analysis shows that Mardia's multivariate skewness (β 786.3571, $p < 0.05$) and multivariate kurtosis (β 3630.8638, $p < 0.05$) suggest multivariate non-normality. Table 20 presents the results of Mardia's multivariate skewness and kurtosis.

Table 20. Mardia's multivariate skewness and kurtosis

	β	z	p-value
Skewness	786.3571	46526.12982	0
Kurtosis	3630.8638	17.03588	0

Source: Field study 2024 and SPSS output

Data normality was also checked through the Shapiro–Wilk and Kolmogorov–Smirnov tests, with findings summarized below (Table 21)

Table 21. Normality test results

	Kolmogorov-Smirnova		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
PEB	.346	.000	.790	.000
LTO	.174	.000	.940	.000
SA	.143	.000	.930	.000
CA	.130	.000	.952	.000
ERI	.197	.000	.914	.000
IRI	.145	.000	.927	.000
RBR	.147	.000	.950	.000
VI	.136	.000	.961	.000
HI	.154	.000	.940	.000
EnP	.109	.000	.947	.000
EcP	.155	.000	.902	.000
SoC	.111	.000	.958	.000

Source: Field study 2024 and SPSS output

revealed that all constructs were significant at $p < 0.05$, confirming the sample data were not normally distributed, presenting the necessity of a non-parametric test.

4.3.1.5 Non-response bias

Non-response bias is a serious issue in survey research because its existence can lead to unreliable results and affect the generalizability of the study results. The survey data for this study was received in two phases: early wave and late wave. Therefore, this study checked the non-response bias in the data set following the opinion of Armstrong & Overton (1977). As the data for this study was not normally distributed, the Mann-Whitney U test, a non-parametric test, was used to determine the difference between the responses from the early and late respondents (Malhotra, 2020). This test confirms that the sample data hardly deviates from the population (Groves, 2006). The responses of early (n = 259) and late respondents (n = 96) were compared to assess any differences in their answers to the measurement items. The study hypothesized differences in the early and late respondents' responses. The difference between samples was examined based on the first-order constructs items of this study. The result of the test is presented in Table 22.

Table 22. Measuring non-response bias

First order-constructs	Z-Value	Sig. (2-tailed) (P)
Pro-employee behaviour (PeB)	-.095	.925
Long-term orientation (LtO)	-1.938	.053
Stakeholder orientation (SO)	-.347	.729
Collaborative attitude (CA)	-.937	.349
External resource integration (ERI)	-.230	.818
Internal resource integration (IRI)	-.478	.633
Resource building and reconfiguration (RBR)	-.180	.857
Vertical integration (VI)	-3.725	.000
Horizontal integration (HI)	-.048	.962
Environmental performance (EnP)	-.908	.364
Economic performance (EcP)	-.191	.848
Social performance (SoP)	-.755	.450

Source: Field study 2024 and Mann–Whitney U test result

4.3.1.6 Common method bias

Common method bias (CMB) can occur when survey data on both endogenous and exogenous constructs are collected using a cross-sectional design and it can cause a disturbance in the study results. Since this study also collected cross-sectional data, checking CMB is recommended (Aftab et al., 2023) . Therefore, this study undertook several ex-ante

(preventive techniques) remedies to avoid possible common method variance by following the suggestions of Podsakoff et al. (2003). First, data was collected from top, mid and junior managers who possessed relevant knowledge in the subject area. Second, the measurement items were designed to be simple and specific and translated into Bengali language (the mother tongue of the respondent) using a backward translation approach to avoid ambiguity. Third, questions related to dependent and independent variables were placed separately and in distinct sections for each construct. Fourth, the respondents were assured about the anonymity and confidentiality of their responses. These procedural measures ensured that respondents could answer the questions precisely and honestly. The study also adopted ex-post (statistical techniques) measures to minimise common method bias. The Harman one-factor test was applied to check the possible CMB issues, and the variance should be less than 50% (Podsakoff & Organ, 1986). The study used an unrotated factor solution using principal axis factoring and found that the first factor explains 18.578 % of the total variance, which is below the 50% threshold. Hence, CMB was not an issue for this study. Aligned with previous studies such as Bag et al. (2021) and Ortiz-Martínez et al., (2023) , this study also assessed common method bias through the Variance Inflation Factor value of the inner model of this research. In the current study, all the VIF values are lower than 3.33, so the model can be considered free from common method bias (Kock, 2015) . Therefore, common method variance (CMV) is not a likely threat to the validity of this study's results.

4.4 Descriptive Statistics of Respondents

Respondents' descriptive statistics provide demographic data of the participants. In the final survey, participants responded to nine questions on demographic variables. Table 23 presents the demographic data of the respondents and the RMG companies surveyed.

Managerial hierarchy

Data were collected from Bangladesh's RMG companies. The respondents were asked to identify managerial positions in the company. The distribution of respondents at different managerial levels in the companies that participated in the final survey is illustrated in It was found that 47.6% of the respondents were mid-level managers in the surveyed companies. A further 42% of respondents were junior managers, while the remaining 10.4% were top-level managers. This distribution was logical as upper-level managers such as Managing Director/General Managers of RMG companies are more engaged with different operations of companies than mid-level managers like deputy general managers. On the

other hand, mid-level managers can give more reliable data than junior managers like assistant managers. Almost 60% of the respondents were top and mid-level managers, implying they had a high level of familiarity with the questionnaire's subject matter.

Respondents' gender

Survey participants were asked to select their gender by choosing between 'male' or 'female.' The gender distribution of this study revealed 92.1 % male respondents, while female respondents were 7.9%. The findings indicated an imbalanced gender distribution in managerial positions in Bangladesh's RMG companies, though most workers in the garment company are female. This study's finding aligns with the recent research work in the same context by Hossain et al. (2022).

Table 23. Demographics of respondents

Variables	Category	Frequency (n=355)	Percentage
Managerial hierarchy	Top management	37	10.4
	Middle management	169	47.6
	Junior management	149	42.0
Gender	Male	327	92.1
	Female	28	7.9
Respondents' age	18-25 years	4	1.1
	26-35 years	112	31.5
	36–45 years	152	42.8
	more than 45 years	87	24.5
Education level	Secondary	7	2.0
	Higher-secondary	106	29.9
	Bachelor	146	41.1
	Master	96	27.0
Working experience of respondents in the RMG industry	less than 5 years	32	9.0
	5 to 10 years	80	22.5
	11 to 15 years	89	25.1
	16 to 20 years	78	22.0
	More than 20 years	76	21.4
Organisational size (Total employees working)	Less than 1000 employees	167	47.0
	1001-2000 employees	98	27.6
	2001-3000 employees	30	8.5
	3001-4000 employees	22	6.2
	More than 4000 employees	38	10.7
	Less than 5 years	42	11.8

Variables	Category	Frequency (n=355)	Percentage
Organizational age (Number of years in business operation)	5- 10 years	43	12.1
	11-15 years	74	20.8
	16-20 years	93	26.2
	More than 20 years	103	29.0
Company's annual sales in BDT	Less than 10 million	114	32.1
	10-20 million	161	45.4
	More than 20 million	80	22.5
Industry 4.0 adoption level	Fully implemented	0	0
	Partially implemented	162	45.6
	Development phase	193	54.4

Source: Field study 2024

Age of respondents

The age of managerial employees in a company can help to attain organizational goals (Darmadi, 2013) . Moreover, age is an indicator of the maturity of the respondents and the accuracy of the information provided. Respondents were asked to mark the age group appropriate to them. The study findings revealed that 42.8% of those who responded were aged between 36 and 45 years, constituting the greater part of the sample. One hundred and twelve (112) of the 355 respondents (31.5%) were in the 26–35-year age range, while 87 respondents (24.5%) were more than 45 years old. Four respondents, accounting for 1.1% of the 355 participants, were in the 18–25-year age range. These findings imply that the relatively young workforce is running the garment sector in Bangladesh.

Educational qualification of respondents

In this survey, respondents' educational data were obtained. Survey results revealed that 41.1% of the respondents had received the qualification of a bachelor's degree. In comparison, 29.9% of the respondents held higher secondary certificates, and 27% possessed master's degrees among the participants who took part. The study's outcomes are in line with the earlier study in this sector (Rubel et al., 2021).

Experience of respondents

Long-experienced employees can contribute more than newly appointed employees in the organization. During this study, the data concerning respondents' work experience were collected. The study findings showed that eighty-nine (89) people (25.1%) among 355 respondents reported 11 – 15-year working experience, 80 participants (22.5%) reported 5-

10-year experience, and 78 respondents (22.7%) reported 16–20-year experience in the apparel industry. Seventy-six respondents, representing 21.4% of the 355 respondents, reported that they possessed over 20 years of experience, and 32 people (9%) reported that they possessed less than 5- years of working experience.

Organizational size

Organizational size is expressed in terms of the total staff and workers employed. The total workforce in the sample RMG companies in Bangladesh is depicted in It was revealed that the majority of RMG companies in Bangladesh (47%) have less than 1000 employees, 27.6% of the companies have between 1001-2000 employees, and 10.7% have employees over 4000. The study also found that 8.5% of participating companies employed employees between 2001 -3000 while 6.2% had 3001 - 4000 employees. This result of the RMG company size distribution in Bangladesh is justified because most of the garment companies in Bangladesh are small and medium-sized.

Organizational age

Organizational age means the duration of a company's existence in the business. Respondents were asked to specify the company age category appropriate to them. The survey result reveals that 29 % of the surveyed 355 companies have been running business for over 20 years, while 26.2% of the sampled companies have been in operation for between 16-20 years. Companies that existed between 11 and 20 years were 20.8%, those between 5 and 10 years were 12.1%, and those that existed for less than 5 years constituted 11.8%. These findings are rational because the growth of the RMG industry has been noticeable since 1990.

Sales revenues

The survey also obtained data on the sales revenue range of the companies participating in the study. It was found that most of the sampled companies (45.4%) reported annual sales revenue between 10-20 million BDT, which is almost equivalent to 170000 USD. It is mentioned that these companies' upper limit of sales revenue is 20 million BDT while the lower limit is 10 million BDT. It was also noticed that one hundred and fourteen (114) companies, comprising 32.1 % of the 355 companies, had sales revenue of less than 10 million BDT. In comparison, eighty (80) companies, representing 22.5 %, had sales revenue of more than 20 million BDT. This result implies the income pattern of Bangladeshi RMG

companies as most of the companies are small and medium-sized; therefore, sales revenue is relatively low.

Industry 4.0 adoption level

Table 23 also presents the industry 4.0 adoption level of the RMG sector in Bangladesh. It was found that more than half of the sampled companies (54.4%) are in the development phase of adopting industry 4.0 technologies, while 162 companies, representing 45.6%, are adopting digital technologies partially. It was also found that no company had adopted advanced technologies fully. The study result implies that RMG companies are gradually adopting intelligent technologies in line with the global demand. The findings obtained from this study are in alignment with the research work in the RMG sector in Bangladesh by Karmaker et al. (2023).

4.5 Descriptive Statistics for Constructs

This study has 12 sub-constructs with four higher-order constructs measured by 58 indicators. The researcher used SPSS version 25 to assess the average, standard deviation, variance, and range for all indicators, as presented in Table 24.

Table 24. Descriptive statistics for research instrument

Construct	Indicator	n	Minimum	Maximum	Mean	SD
Pro-employee behaviour (PEB)	PEB1	355	2	5	4.63	.627
	PEB2	355	2	5	4.61	.648
	PEB3	355	2	5	3.90	.625
	PEB4	355	2	5	3.81	.581
Long-term orientation (LTO)	LO1	355	2	5	4.54	.647
	LO2	355	2	5	4.46	.655
	LO3	355	3	5	4.13	.601
	LO4	355	2	5	3.75	.759
	LO5	355	2	5	3.66	.684
Stakeholder orientation (SO)	SO1	355	2	5	4.23	.742
	SO2	355	3	5	4.29	.694
	SO3	355	2	5	3.95	.865
	SO4	355	2	5	4.33	.752
Collaborative attitude (CA)	CA1	355	3	5	4.65	.530
	CA2	355	3	5	4.62	.541
	CA3	355	3	5	4.35	.626
	CA4	355	3	5	4.14	.575
	CA5	355	2	5	3.84	.622
	CA6	355	2	5	3.49	.661
	CA7	355	2	5	3.44	.600
External resource integration (ERI)	ERI1	355	1	5	4.10	.707
	ERI2	355	1	5	4.05	.813
	ERI3	355	1	5	4.02	.761
	ERI4	355	2	5	4.11	.724
Internal resource integration (IRI)	IRI1	355	2	5	4.20	.658
	IRI2	355	1	5	4.17	.695
	IRI3	355	1	5	4.14	.771

Construct	Indicator	n	Minimum	Maximum	Mean	SD
Resource building and reconfiguration (RBR)	RBR1	355	2	5	4.17	.731
	RBR2	355	1	5	4.13	.729
	RBR3	355	1	5	4.06	.709
	RBR4	355	1	5	4.07	.719
	RBR5	355	1	5	4.00	.727
	RBR6	355	2	5	3.92	.744
Vertical integration (VI)	VI1	355	2	5	4.10	.800
	VI2	355	2	5	4.01	.770
	VI3	355	1	5	3.80	.761
	VI4	355	2	5	3.77	.720
Horizontal integration (HI)	HI1	355	2	5	4.20	.800
	HI2	355	2	5	4.16	.739
	HI3	355	2	5	4.30	.749
	HI4	355	2	5	4.07	.763
Environmental performance (EnP)	EnP1	355	2	5	3.94	.845
	EnP2	355	2	5	4.11	.863
	EnP3	355	1	5	4.29	.794
	EnP4	355	3	5	4.30	.661
	EnP5	355	2	5	4.20	.743
	EnP6	355	3	5	4.27	.694
	EnP7	355	3	5	4.26	.688
Economic performance (EcP)	EcP1	355	3	5	4.32	.663
	EcP2	355	3	5	4.32	.680
	EcP3	355	3	5	4.10	.702
	EcP4	355	2	5	4.00	.811
Social performance (SoP)	SoP1	355	2	5	4.25	.781
	SoP2	355	2	5	3.80	.829
	SoP3	355	2	5	4.18	.740
	SoP4	355	1	5	4.03	.911
	SoP5	355	1	5	3.97	.843
	SoP6	355	1	5	4.09	.820

Source: Field study 2024 and SPSS output

Research guidelines state that while using a five-point Likert scale, mean scores are ≤2.99 as low, 3–3.99 as moderate, and >4 as high (Sekaran, 2016) . Table 24 shows that mean values for all indicators range between 3.44 to 4.65, suggesting the presence of these items in Bangladeshi garment companies.

4.6 Inferential Statistics

The researcher applied partial least squares structural equation modeling (PLS-SEM) to meet the research objectives. PLS-SEM is robust in examining exploratory and complicated research frameworks with the presence of higher-order-construct (HOC) and formative construct and performs well with data that do not meet the normality and multivariate assumptions (Hair & Alamer, 2022). In PLS-SEM, the proposed research framework was evaluated in two phases: measurement model assessment and structural model assessment. Table 25 illustrates these steps, ensuring construct reliability, validity, and finalizing relationships.

Table 25. Sequential research model assessments

Stage	Assessment	Construct	Assessment
1	Measurement model assessment	Reflective	i. Internal consistency ii. Convergent validity iii. Discriminant validity
		Formative	i. Collinearity issues ii. Weight and significance
2	Structural model Assessment	For both reflective and formative	i. Collinearity issues ii. Path coefficient (β) iii. Amount of variance explained (R^2) iv. Effect size (f^2) v. Predictive relevance (Q^2)

Source: Adapted from Hair & Alamer (2022)

4.6.1 Measurement model assessment

This study's research framework consisted of four higherarchical constructs: sustainable leadership (an independent variable which is considered in PLS-SEM as an exogenous construct), sustainability performance (a dependent variable which is considered an endogenous construct), green dynamic capabilities (mediating construct), Industry 4.0 adoption (mediating construct). These four variables are hierarchical and multidimensional. To be more specific, sustainable leadership (SL) is a higher-order formative construct measured by four reflective-type lower-order-components (LOCs): pro-employee behaviour (PEB), long-term orientation (LTO), stakeholder orientation (SO), collaborative attitude (CA). Reflective indicators measured each LOC of sustainable leadership in the measurement model. Green dynamic capability is also a higher-order formative construct measured by three reflective-type LOCs: external resource integration (ERI), internal resource integration(IRI), and resource building and reconfiguration. Reflective indicators measured all LOCs of green dynamic capability. Industry 4.0 adoption is a higher-order reflective construct and was measured by two reflective lower-order components: vertical integration (VI) and horizontal integration (HI). Reflective indicators measured LOCs of Industry 4.0 adoption. Finally, the higher-order reflective construct sustainability performance (SP) was measured by three reflective lower-order components, namely, environmental performance (EnP), economic performance (EcP), and social performance (SoP) and these LOCs were measured by reflective indicators. The complete research framework is presented in Figure 6 .

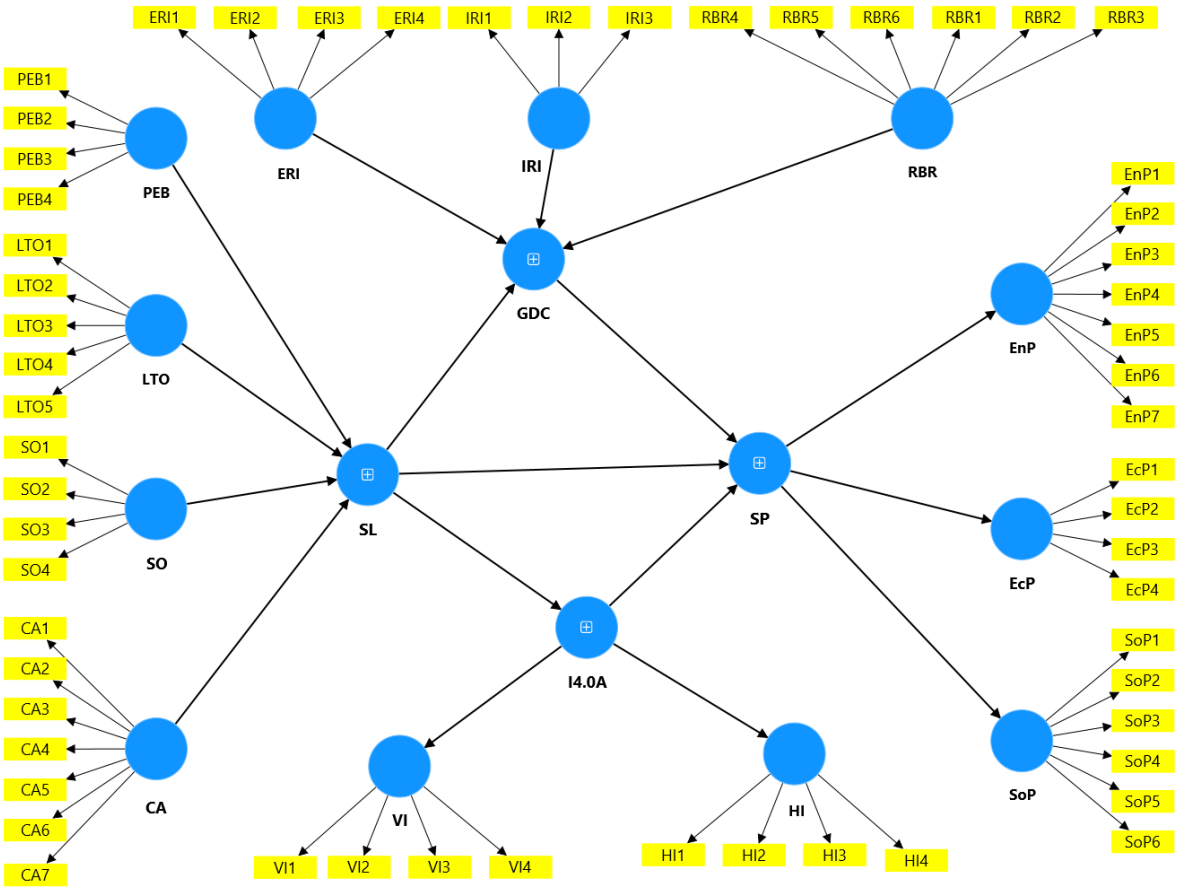

Figure 6. Complete model

Source: Field study 2024 and PLS 4 output

According to Anderson & Gerbing (1988), construct reliability, convergent validity and discriminant validity are the key components of the measurement model. This study followed a disjoint two-stage technique for measurement model assessment. In the disjoint two-stage approach, convergent validity, discriminant validity, and reliability of the lower-order constructs are evaluated first, then in the second phase, the reliability and validity of the higher-order constructs are evaluated based on the latent variable scores obtained from the first phase (Sarstedt et al., 2019).

4.6.2 Lower -order measurement model

In this research framwork, all lower-order constructs are reflective-type. Therefore, following the guidelines of Hair & Alamer (2022), the researcher first evaluated the quality of the lower-order constructs on the basis of the measurement properties: item reliability (outer loadings), construct reliability (Cronbach's alpha coefficient and composite reliability) and convergent validity (average variance extracted) and discriminant validity

(Fornell-Larcker criteria , HTMT ratios and cross-loadings). Table 26 shows the outcome obtained based on running the PLS algorithm in PLS version 4.0.9.6.

Table 26. Assessing reliability, CR, AVE for lower-order constructs

Lower-order constructs	**Items**	**FL**	**α**	**CR**	**AVE**
Pro-employee behaviour (PEB)	PEB1	0.677	0.707	0.714	0.528
	PEB2	0.690			
	PEB3	0.772			
	PEB4	0.763			
Long-term orientation (LTO)	LTO1	0.707	0.751	0.754	0.502
	LTO2	0.639			
	LTO3	0.700			
	LTO4	0.721			
	LTO5	0.770			
Stakeholder orientation (SO)	SO1	0.868	0.804	0.814	0.631
	SO2	0.817			
	SO3	0.707			
	SO4	0.778			
Collaborative attitude (CA)	CA1	0.697	0.896	0.902	0.618
	CA2	0.708			
	CA3	0.814			
	CA4	0.786			
	CA5	0.77			
	CA6	0.856			
	CA7	0.854			
External resource integration (ERI)	ERI1	0.661	0.815	0.871	0.591
	ERI2	0.731			
	ERI3	0.791			
	ERI4	0.876			
Internal resource integration (IRI)	IRI1	0.846	0.758	0.802	0.664
	IRI2	0.795			
	IRI3	0.803			
Resource building and reconfiguration (RBR)	RBR1	0.734	0.894	0.923	0.645
	RBR2	0.729			
	RBR3	0.823			
	RBR4	0.897			
	RBR5	0.865			
	RBR6	0.752			
Vertical integration (VI)	VI1	0.741	0.707	0.689	0.517
	VI2	0.755			
	VI3	0.768			
	VI4	0.597			
Horizontal integration (HI)	HI1	0.840	0.683	0.742	0.534
	HI2	0.787			
	HI3	0.867			
	HI4	**0.249**			
Environmental performance (EnP)	EnP1	0.676	0.874	0.874	0.572
	EnP2	0.698			
	EnP3	0.810			
	EnP4	0.751			
	EnP5	0.835			
	EnP6	0.750			
	EnP7	0.760			
Economic performance (EcP)	EcP1	0.898	0.906	0.907	0.781
	EcP2	0.903			
	EcP3	0.869			
	EcP4	0.863			

Lower-order constructs	Items	FL	α	CR	AVE
Social performance (SoP)	SoP1	0.781	0.826	0.832	0.542
	SoP2	0.573			
	SoP3	0.801			
	SoP4	0.774			
	SoP5	0.658			
	SoP6	0.800			

Source: Field study 2024 and PLS 4 output

Please note: FL: Factor loading; α: Cronbach's alpha; CR: Composite reliability; AVE: Average variance extracted. FL score for bolded item (**HI4**) is below threshold value.

Reliability analysis

Indicator reliability and construct reliability are the two common categories of reliability measured in SEM to confirm the reliability of measurement instruments. Indicator reliability is assessed through outer loading, while Cronbach's alpha and composite reliability evaluate construct reliability. As per the guidelines of Hair & Alamer (2022), Fornell & Larcker (1981) and Henseler et al., (2009), all the measures of reliability must meet a minimum value of 0.7. However, values in the range of .40 to .70 for reliability can also be considered suitable if other indicators meet acceptable standards (Hair et al., 2019; Hair & Alamer, 2022). Table 26 reveals that one indicator (HI4) has loadings lower than the threshold value. Therefore, this low-loading item was deleted, and the PLS algorithm was run again to confirm the scale's reliability and validity following the recommendation of Hair & Alamer (2022). The result of the refined model (after deleting one item) is shown in Table 27.

Table 27. Assessment of reliability, CR and AVE after deleting item

Lower-order constructs	Items	FL	α	CR	AVE
Pro-employee behaviour (PEB)	PEB1	0.679	0.707	0.714	0.528
	PEB2	0.692			
	PEB3	0.770			
	PEB4	0.761			
Long-term orientation (LTO)	LTO1	0.703	0.7510	0.754	0.502
	LTO2	0.634			
	LTO3	0.701			
	LTO4	0.725			
	LTO5	0.773			
Stakeholder orientation (SO)	SO1	0.867	0.804	0.813	0.631
	SO2	0.816			
	SO3	0.709			
	SO4	0.778			
Collaborative attitude (CA)	CA1	0.698	0.896	0.902	0.618
	CA2	0.709			
	CA3	0.814			
	CA4	0.786			
	CA5	0.77			
	CA6	0.856			
	CA7	0.854			

Lower-order constructs	Items	FL	α	CR	AVE
External resource integration (ERI)	ERI1	0.659	0.815	0.871	0.590
	ERI2	0.729			
	ERI3	0.789			
	ERI4	0.878			
Internal resource integration	IRI1	0.846	0.758	0.802	0.664
	IRI2	0.795			
	IRI3	0.803			
Resource building and reconfiguration (RBR)	RBR1	0.734	0.894	0.923	0.645
	RBR2	0.729			
	RBR3	0.823			
	RBR4	0.897			
	RBR5	0.865			
	RBR6	0.752			
Vertical integration (VI)	VI1	0.741	0.683	0.689	0.517
	VI2	0.755			
	VI3	0.768			
	VI4	0.597			
Horizontal integration (HI)	HI1	0.852	0.806	0.813	0.720
	HI2	0.812			
	HI3	0.88			
Environmental performance (EnP)	EnP1	0.68	0.874	0.874	0.572
	EnP2	0.697			
	EnP3	0.809			
	EnP4	0.751			
	EnP5	0.833			
	EnP6	0.75			
	EnP7	0.759			
Economic performance (EcP)	EcP1	0.899	0.906	0.907	0.781
	EcP2	0.903			
	EcP3	0.869			
	EcP4	0.863			
Social performance (SoP)	SoP1	0.779	0.826	0.832	0.542
	SoP2	0.575			
	SoP3	0.802			
	SoP4	0.774			
	SoP5	0.658			
	SoP6	0.799			

Source: Field study 2024 and PLS 4 output

From Table 27, it was revealed that outer loading scores for all items meet the recommended threshold values, which implies that indicator reliability was not a concern for this study. After that, the researcher checked the results of internal consistency assessed by alpha coefficient and composite reliability in Table 27. which shows that all the constructs fulfilled the recommended minimum score for ensuring the reliability of first-order components in this study. The refined measurement model with lower-order constructs is visualized in Figure 7 .

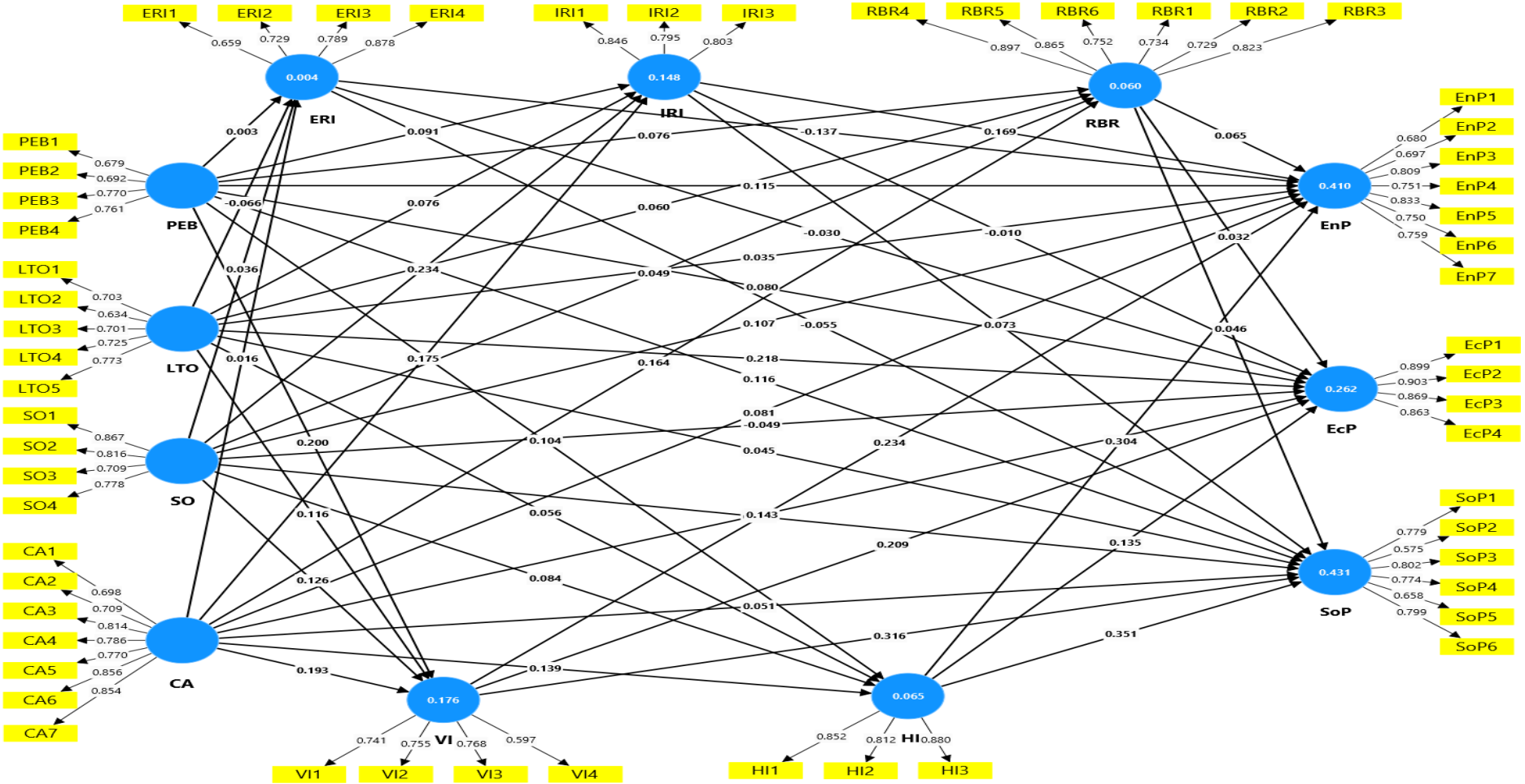

Figure 7. Stage one-Refined measurement model with lower-order constructs

Source: Field study 2024 and PLS 4 output

Convergent validity

Convergent validity describes how the constructs in the research framework relate to each other. The average variance extracted (AVE) was used to establish the convergent validity of the construct. shows that the AVE values for all the constructs in this research surpassed the recommended minimum value of 0.5, as Hair & Alamer (2022) and Fornell & Larcker (1981) suggested. Therefore, the convergent validity of lower-order constructs was satisfactorily established.

Discriminant validity

Discriminant validity reflects how well each construct in the proposed research model is conceptually different from others. In structural equation modelling, the commonly used measures of discriminant validity are the Fornell-Larcker criteria, and cross-loadings and heterotrait-monotrait (HTMT) ratios. This study verified discriminant validity with both the traditional Fornell-Larcker criterion and the modern HTMT criterion. Fornell & Larcker (1981) suggested that the diagonal values (square roots of the AVE) be higher than the other values in the same row and column. For the modern approach, as per the recommendation of Benitez et al. (2020) and Hair & Alamer (2022) stated that the cut-off point for the HTMT is less than 0.85, but a liberal cut-off value < .90 can also be accepted. The results in Table 28 for Fornell & Larcker and Table 29 for HTMT confirm the discriminant validity of lower-order constructs in the model.

Table 28. Fornell-Larker criteria

Constructs	PEB	LTO	SO	CA	ERI	IRI	RBR	VI	HI	EnP	SoP	EcP
PEB	**0.727**											
LTO	0.208	**0.708**										
SO	0.138	0.246	**0.794**									
CA	0.238	0.447	0.141	**0.786**								
ERI	-0.002	-0.049	0.022	-0.008	**0.769**							
IRI	0.181	0.231	0.29	0.263	0.47	**0.815**						
RBR	0.134	0.161	0.097	0.216	-0.074	0.185	**0.803**					
VI	0.287	0.276	0.21	0.31	0.003	0.224	0.161	**0.719**				
HI	0.181	0.182	0.112	0.216	-0.021	0.05	0.131	0.269	**0.731**			
EnP	0.311	0.29	0.285	0.332	-0.066	0.266	0.229	0.45	0.456	**0.756**		
SoP	0.237	0.371	0.097	0.349	-0.051	0.124	0.155	0.364	0.314	0.437	**0.884**	
EcP	0.311	0.275	0.224	0.304	-0.03	0.204	0.196	0.502	0.488	0.696	0.37	**0.736**

Source: Field study 2024 and PLS 4 output

Table 28 shows that all the constructs meet the requirements of the Fornell-Larcker criterion. Therefore, it can be inferred that Fornell-Larcker established discriminant validity in the study. The researcher calculated Heterotrait-Monotrait (HTMT) ratios for this research which is shown in Table 29.

Table 29. Heterotrait-Monotrait (HTMT) ratios

Constructs	PEB	LTO	SO	CA	ERI	IRI	RBR	VI	HI	EnP	SoP	EcP
PEB												
LTO	**0.28**											
SO	0.172	**0.314**										
CA	0.297	0.542	**0.173**									
ERI	0.05	0.083	0.061	**0.051**								
IRI	0.238	0.303	0.344	0.31	**0.751**							
RBR	0.165	0.193	0.114	0.226	0.119	**0.202**						
VI	0.405	0.386	0.28	0.393	0.081	0.311	**0.209**					
HI	0.268	0.277	0.204	0.291	0.059	0.077	0.168	**0.401**				
EnP	0.39	0.355	0.336	0.373	0.083	0.309	0.241	0.584	**0.613**			
SoP	0.294	0.447	0.116	0.387	0.054	0.138	0.162	0.465	0.458	**0.497**		
EcP	0.394	0.34	0.276	0.35	0.066	0.24	0.207	0.667	0.641	0.812	**0.419**	

Source: Field study 2024 and PLS 4 output

From Table 29, it was concluded that the current study confirmed the discriminant validity of lower-order constructs through HTMT ratios. All the values shown in Table 29 fall within the range of recommended thresholds.

In addition to that this study applied cross loading for establishing discriminant validity. For cross-loading, an item's loading with its corresponding construct should be higher than its loading with other constructs (Henseler et al., 2009). Here is the result of cross loading in Table 30.

Table 30. Cross loading for refined measurement model of lower-order constructs

Constructs	**PEB**	**LTO**	**SO**	**CA**	**ERI**	**IRI**	**RBR**	**VI**	**HI**	**EnP**	**SoP**	**EcP**
PEB1	**0.679**	0.142	0.062	0.191	-0.013	0.122	0.141	0.185	0.072	0.197	0.173	0.187
PEB2	**0.692**	0.143	0.05	0.189	-0.019	0.14	0.11	0.187	0.029	0.207	0.158	0.171
PEB3	**0.77**	0.176	0.152	0.171	0.025	0.16	0.087	0.252	0.161	0.25	0.189	0.269
PEB4	**0.761**	0.141	0.119	0.151	-0.007	0.105	0.063	0.203	0.178	0.245	0.167	0.261
LTO1	0.132	**0.703**	0.133	0.276	-0.017	0.161	0.065	0.201	0.121	0.147	0.255	0.149
LTO2	0.078	**0.634**	0.064	0.291	-0.004	0.148	0.115	0.206	0.129	0.199	0.25	0.205
LTO3	0.227	**0.701**	0.226	0.413	-0.05	0.186	0.182	0.219	0.091	0.207	0.291	0.209
LTO4	0.159	**0.725**	0.202	0.291	-0.043	0.133	0.062	0.171	0.075	0.198	0.236	0.164
LTO5	0.134	**0.773**	0.234	0.296	-0.058	0.18	0.125	0.174	0.148	0.263	0.272	0.233
SO1	0.112	0.187	**0.867**	0.126	0.025	0.284	0.049	0.199	0.098	0.233	0.103	0.176
SO2	0.107	0.206	**0.816**	0.081	0.024	0.241	0.067	0.171	0.108	0.254	0.104	0.196
SO3	0.147	0.194	**0.709**	0.099	0.055	0.185	0.149	0.138	0.148	0.209	0.075	0.191
SO4	0.066	0.197	**0.778**	0.15	-0.044	0.2	0.046	0.153	0.059	0.203	0.012	0.146
CA1	0.134	0.348	0.159	**0.698**	0.03	0.209	0.174	0.233	0.168	0.202	0.194	0.188
CA2	0.116	0.348	0.118	**0.709**	0.028	0.2	0.164	0.192	0.198	0.229	0.243	0.184
CA3	0.127	0.38	0.074	**0.814**	0.003	0.225	0.191	0.232	0.153	0.265	0.307	0.249
CA4	0.165	0.333	0.148	**0.786**	-0.032	0.195	0.141	0.201	0.151	0.228	0.282	0.243

Constructs	PEB	LTO	SO	CA	ERI	IRI	RBR	VI	HI	EnP	SoP	EcP
CA5	0.208	0.316	0.055	**0.77**	-0.035	0.159	0.196	0.231	0.144	0.282	0.304	0.258
CA6	0.264	0.371	0.124	**0.856**	-0.027	0.222	0.157	0.311	0.149	0.312	0.287	0.281
CA7	0.271	0.366	0.112	**0.854**	-0.003	0.238	0.165	0.292	0.154	0.292	0.293	0.256
ERI1	-0.007	-0.009	-0.037	-0.019	**0.659**	0.508	-0.02	-0.048	0	-0.032	-0.036	-0.018
ERI2	0.045	0.056	0.007	0.015	**0.729**	0.563	0.002	0.012	-0.028	-0.032	-0.032	-0.007
ERI3	0.009	-0.065	-0.021	-0.021	**0.789**	0.352	-0.041	0.036	0.029	-0.056	-0.019	-0.03
ERI4	-0.011	-0.039	0.061	0.005	**0.878**	0.354	-0.089	-0.008	-0.04	-0.059	-0.06	-0.023
IRI1	0.174	0.188	0.312	0.252	0.272	**0.846**	0.165	0.196	0.085	0.274	0.145	0.216
IRI2	0.122	0.192	0.198	0.188	0.441	**0.795**	0.151	0.162	0.033	0.194	0.08	0.146
IRI3	0.137	0.188	0.158	0.188	0.507	**0.803**	0.129	0.189	-0.023	0.151	0.054	0.109
RBR1	0.029	0.072	0.002	0.104	-0.144	0.077	**0.734**	0.121	0.1	0.144	0.105	0.122
RBR2	0.1	0.023	-0.008	0.121	-0.164	0.065	**0.729**	0.124	0.08	0.123	0.075	0.096
RBR3	0.12	0.074	0.062	0.138	-0.095	0.149	**0.823**	0.098	0.042	0.11	0.099	0.086
RBR4	0.08	0.139	0.102	0.203	-0.079	0.162	**0.897**	0.184	0.08	0.223	0.167	0.169
RBR5	0.145	0.185	0.128	0.223	-0.016	0.192	**0.865**	0.14	0.145	0.198	0.118	0.192
RBR6	0.144	0.187	0.106	0.188	0.032	0.181	**0.752**	0.097	0.115	0.237	0.145	0.21
VI1	0.239	0.181	0.18	0.227	0.033	0.131	0.146	**0.741**	0.254	0.331	0.237	0.418
VI2	0.249	0.183	0.119	0.199	-0.018	0.159	0.078	**0.755**	0.202	0.298	0.231	0.398
VI3	0.209	0.22	0.182	0.28	-0.049	0.188	0.159	**0.768**	0.14	0.347	0.299	0.313
VI4	0.12	0.209	0.117	0.18	0.048	0.169	0.071	**0.597**	0.134	0.317	0.28	0.309
HI1	0.12	0.124	0.117	0.16	-0.016	0.07	0.125	0.267	**0.852**	0.416	0.16	0.478
HI2	0.082	0.169	0.117	0.164	0.013	0.011	0.09	0.152	**0.812**	0.32	0.325	0.303
HI3	0.2	0.121	0.102	0.188	-0.027	0.042	0.095	0.224	**0.880**	0.369	0.201	0.438
EnP1	0.266	0.156	0.206	0.222	0.024	0.185	0.215	0.309	0.502	**0.68**	0.23	0.522
EnP2	0.159	0.111	0.195	0.224	-0.06	0.15	0.16	0.286	0.446	**0.697**	0.182	0.436
EnP3	0.282	0.263	0.2	0.283	-0.047	0.245	0.159	0.383	0.275	**0.809**	0.355	0.513
EnP4	0.256	0.251	0.137	0.247	-0.046	0.19	0.213	0.346	0.261	**0.751**	0.386	0.541
EnP5	0.25	0.213	0.253	0.249	-0.102	0.224	0.187	0.36	0.236	**0.833**	0.399	0.569
EnP6	0.22	0.298	0.277	0.246	-0.06	0.201	0.123	0.362	0.322	**0.750**	0.394	0.566
EnP7	0.205	0.249	0.228	0.285	-0.065	0.208	0.153	0.33	0.225	**0.759**	0.377	0.525
EcP1	0.24	0.31	0.049	0.309	-0.038	0.092	0.131	0.329	0.249	0.346	**0.899**	0.334
EcP2	0.189	0.35	0.037	0.283	-0.035	0.091	0.155	0.303	0.301	0.308	**0.903**	0.279
EcP3	0.206	0.32	0.113	0.297	-0.043	0.116	0.119	0.354	0.206	0.439	**0.869**	0.392
EcP4	0.202	0.329	0.151	0.349	-0.067	0.142	0.141	0.298	0.166	0.46	**0.863**	0.304
SoP1	0.255	0.157	0.115	0.228	-0.072	0.144	0.126	0.37	0.353	0.531	0.267	**0.779**
SoP2	0.213	0.171	0.161	0.156	0.038	0.144	0.088	0.364	0.396	0.323	0.251	**0.575**
SoP3	0.239	0.255	0.186	0.265	-0.035	0.2	0.159	0.379	0.37	0.615	0.261	**0.802**
SoP4	0.264	0.241	0.197	0.262	-0.032	0.125	0.182	0.402	0.381	0.581	0.391	**0.774**
SoP5	0.14	0.135	0.193	0.192	-0.018	0.108	0.103	0.296	0.298	0.389	0.113	**0.658**
SoP6	0.24	0.236	0.141	0.226	-0.01	0.17	0.196	0.388	0.327	0.596	0.308	**0.799**

Source: Field study 2024 and PLS 4 outputTable 30.

Table 30 shows that all the constructs satisfy the requirement of discriminant validity. Therefore, this study has established discriminant validity for lower-order constructs. Since the lower-order constructs fulfilled all the reliability and validity conditions, it was necessary for the researcher in the next phase to assess the reliability and validity of the higher-order constructs.

4.6.3 Assessment of higher-order constructs

This study has four higher-order constructs in the research framework. Among these four constructs, two constructs are reflective higher-order constructs namely sustainability performance and Industry 4.0 adoption. On the other hand, sustainable leadership and green dynamic capabilities are formative higher-order constructs. It is noted that whether a construct is reflective, or formative is determined based on prior literature and theoretical explanations of the construct. This study adopted a disjoint two-stage approach for analyzing the research model. In the second stage of the disjoint two-stage approach, the lower-order constructs become the indicators of the higher-order constructs (Sarstedt et al., 2019). Therefore, the latent variable scores of the lower-order constructs: pro-employee behaviour, long-term orientation, stakeholder orientation, collaborative attitude, external resource integration, internal resource integration, resource building and reconfiguration, vertical integration, horizontal integration, environmental performance, economic performance, and social performance from stage one was used to create and estimate the second stage model of research. Figure 8 illustrates the hierarchical relationships of sustainable leadership, green dynamic capabilities, Industry 4.0 adoption and sustainability performance.

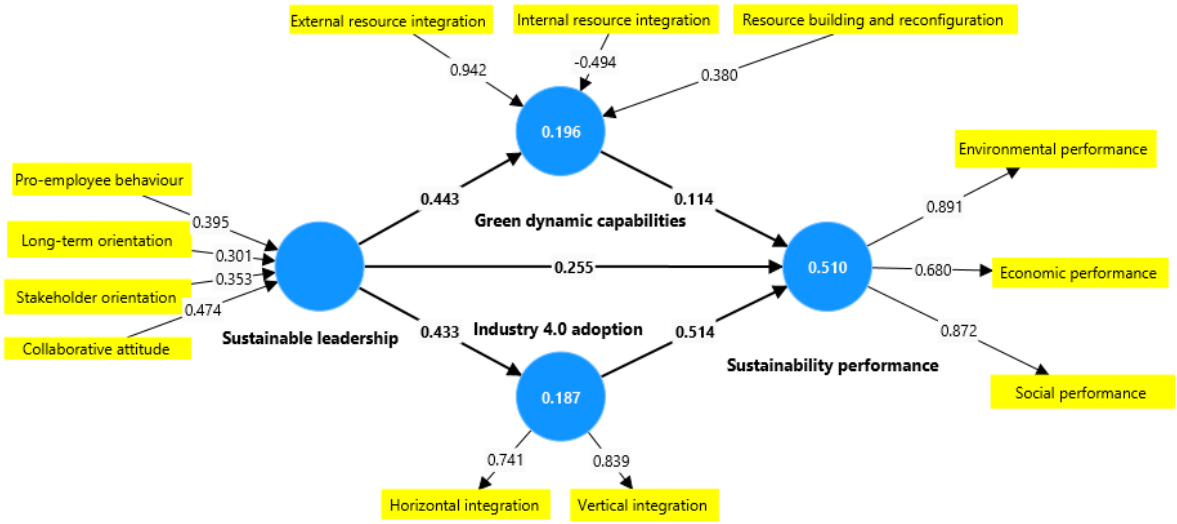

Figure 8. Stage two- measurement model with higher-order constructs

Source: Field study 2024 and PLS 4 output

4.6.3.1 Higher-order reflective measurement model

In the research model, sustainability performance is a reflective higher-order construct consisting of three lower-order constructs: environmental performance, economic performance, and social performance. Similarly, Industry 4.0 adoption is also a higher-order

construct, composed of two lower-order constructs: vertical integration and horizontal integration. In reflective higher-order constructs, the connections between second order and first-order constructs are viewed as loadings. They are evaluated for quality through factor loading (>0.7), internal consistency (Cronbach's alpha >0.7, composite reliability >0.7), convergent validity (AVE >0.5), and discriminant validity (Fornell-Larcker criterion, cross-loadings, HTMT ratios) (Sarstedt et al., 2019). This study assessed the measurement properties of higher-order reflection as per the suggestion of researchers. Reliability and validity were estimated to verify the reflective constructs' measurement properties. The result is presented in Table 31.

Table 31. Assessment of reliability and AVE of higher-order reflective constructs

Higher-order constructs	Lower-order constructs	FL	α	CR	AVE
Sustainability performance (SL)	Environmental performance (EnP)	0.891	0.751	0.782	0.672
	Economic performance (EcP)	0.680			
	Social performance (SoP)	0.872			
Industry 4.0 adoption (I4.0A)	Vertical integration (VI)	0.839	0.408	0.419	0.627
	Horizontal integration (HI)	0.741			

Source: Field study 2024 and PLS 4 output

As Table 31 shows, factor loadings for EnP, SoP, VI, and HI are far above the threshold value (>0.7), and the score for EcP is close to the cut-off value. Therefore, the study has established the indicator reliability for higher-order reflective constructs of this research. Table 4.24 also indicates that Cronbach's alpha (0.751), composite reliability (0.782), and AVE (0.672) for SL surpass the threshold, validating internal consistency and convergent validity of the sustainable leadership construct. Though Cronbach's alpha (0.408) and composite reliability (0.419) for I4.0A are lower than the threshold value (>0.7), AVE (0.627) is over the threshold (>0.5).

Therefore, scores for internal consistency of I4.0A are acceptable. Besides, the guidelines for assessing reliability state that scores between .40 and .70 for reliability are acceptable when other indices fulfil the threshold values (Hair et al., 2019; Hair & Alamer, 2022). Thus, the reliability and convergent validity of Industry 4.0 adoption of the higher-order reflective construct has been established. Since the study has only two higher-order reflective constructs, the researcher assessed the discriminant validity of higher-order reflective constructs using the Fornell-Larcker criterion and cross-loading. Table 32 shows the result of Fornell-Larcker.

Table 32. Fornell-Larcker criterion of higher-order reflective constructs

	I4.0A	SP
I4.0A	**0.792**	
SP	0.652	**0.820**

Source: Field study 2024 and PLS 4 output

Table 32 depicts that the Fornell-Larcker criterion for Industry 4.0 adoption and Sustainability performance was satisfactory as its scores fall within the recommended limit. Thereafter, the researcher estimated cross-loadings. The cross-loading scores of higher-order reflective constructs are illustrated in Table 33.

Table 33. Cross loading of higher-order reflective constructs

	I4.0A	SP
VI	**0.839**	0.54
HI	**0.741**	0.493
EnP	0.559	**0.891**
EcP	0.400	**0.680**
SoP	0.622	**0.872**

Source: Field study 2024 and PLS 4 output

From Table 33, it was revealed that there were no cross-loading issues in the higher-order reflective constructs. Therefore, it was concluded that the discriminant validity of higher-order reflective constructs (Industry 4.0 adoption and sustainability performance) of this research was established.

4.6.3.2 Assessment of higher-order formative measurement model

This study has two higher-order constructs (HOC), namely, sustainable leadership and green dynamic capabilities. Sustainable leadership (SL) was operationalized as a higher-order formative construct consisting of four lower-order reflective constructs: pro-employee behaviour, long-term orientation, stakeholder orientation and collaborative attitude. In the same vein, green dynamic capabilities (GDC), a formative higher-order construct, are comprised of three lower-order constructs: external resource integration, internal resource integration and resource building and reconfiguration. In formative constructs, the association between higher-order and lower-order components are interpreted as weights. The measurement properties of formative constructs were assessed by checking the significance of outer weight ($p < 0.05$), outer loadings (>0.5) and its significance ($p < 0.05$), and examining the collinearity statistic (VIF statistic <3) in the formative construct (Benitez et al., 2020; Hair & Alamer, 2022; Sarstedt et al., 2019). Table 34 below presents the second-order constructs' measurement properties.

Table 34. Assessment of higher-order formative constructs

HOC	LOC	Weight	p-Value	Loading	p-Value	VIF
Sustainable leadership (SL)	PEB	0.395	0.000	0.619	0.000	1.083
	LTO	0.301	0.003	0.682	0.000	1.318
	SO	0.353	0.000	0.548	0.000	1.074
	CA	0.474	0.000	0.753	0.000	1.286
Green dynamic capabilities (GDC)	ERI	-0.494	0.000	-0.081	0.478	1.327
	IRI	0.942	0.000	0.781	0.000	1.366
	RBR	0.380	0.000	0.591	0.000	1.072

Source: Field study 2024 and PLS 4 output

Table 34 shows that all lower-order construct weights significantly contribute to forming higher-order constructs: sustainable leadership (SL) and green dynamic capabilities (GDC). In addition to that, loading scores of all lower-order constructs are significant except ERI. Though ERI is insignificant it should not be removed with reference to the guidelines of Hair & Alamer (2022) . The researcher also checked the multicollinearity among the lower-order components (PEB, LTO, SO, CA, ERI, IRI and RBR) of higher-order formative constructs using variance inflation factor (VIF) following suggestions of Hair & Alamer (2022) . Table 34 shows that outer VIF values of all lower-order constructs are less than 3, which implies that there was no multicollinearity issue in the formative constructs of this study. Thus, it can be concluded that higher-order formative constructs, sustainable leadership and green dynamic capabilities satisfied the required measurement properties. Since the reflective and formative measurement model revealed solid measurement properties, the refined research model was valid for structural model assessment (Henseler et al., 2009).

4.6.4 Model fitness

After establishing the reliability and validity of the measurement model, the fitness of the model must be assessed. SRMR, Chi-square, and NFI are the available measures in the SmartPLS for measuring model fitness. However, the SRMR is widely recommended for assessing model fitness in PLS-SEM, with a value less than 0.08 indicating a good fit. Aligned with the past study (Ni et al., 2023), this study assessed the fitness of the research model. According to

Table *35* the SRMR value is 0.065, which is below the threshold value, demonstrating that the model is fit.

Table 35. Model fit

	Saturated model	Estimated model
SRMR	0.065	0.065
d_ULS	0.326	0.328
d_G	0.128	0.127
Chi-square	268.825	266.951
NFI	0.744	0.746

Source: Field study 2024 and PLS 4 output

4.6.5 Assessment of structural model

Following the confirmation of the validity and reliability of the measurement model and model fitness, the researcher examined the structural model. The structural model represents the relationship between the constructs in the proposed research model. This study assessed the structural model by following the guidelines in the literature (Benitez et al., 2020; Cohen, 2013; Hair et al., 2022).

Examining the model for collinearity

It is necessary to ensure the absence of high correlations among the constructs in the research model to avoid methodological problems in structural equation modeling. Collinearity statistics can identify high correlation. According to the suggestions of Hair & Alamer (2022) , this study assessed the lateral collinearity in the proposed hierarchical model to confirm that no collinearity is present in the model. Table 36 shows the result of collinearity statistics. The inner VIF (Variance Inflation Factor) values for the independent variable (sustainable leadership) and mediating variables (green dynamic capabilities, Industry 4.0 adoption) were below 3 (Hair et al., 2022) . Consequently, it can be inferred that lateral collinearity did not pose a problem in the current study.

Table 36. Collinearity statistics for the higher-order exogenous constructs

Variables	VIF (GDC)	VIF (I4.0A)	VIF (SP)
Sustainable leadership (SL)	1	1	1.445
Green dynamic capablities (GDC)			1.250
Industry 4.0 adoption (I4.0A)			1.235

Source: Field study 2024 and PLS 4 output

Assessing size and significance of the path coefficients (β)

The researcher applied a non-parametric bootstrapping technique of 5000 subsamples and a bias-corrected confidence method to assess the proposed hypotheses. Bootstrapping yields path coefficients (standardized beta), t-values, and p-values, which help to determine the significance of relationships between constructs in the model (Hair & Alamer, 2022; Henseler et al., 2009). A positive path coefficient suggests a positive relationship between the constructs, while a negative value implies a negative association. The t-value and p-value determine whether the hypothesized structural relationship is statistically significant. The study also followed the threshold value for a standard t-value is 1.96 and above, while the threshold value for a p-value is .05 or less for accepting the hypothesis. Figure 9 and Figure 10 demonstrate the structural model of this research. The results are illustrated in Table 37.

Table 37. Result of path coefficients and significance

Direct paths	Beta (β)	t-statistics	p-values	Decision
H1: Sustainable leadership → Sustainability performance	0.258	5.294	0.000	Accepted
H2: Sustainable leadership → Green dynamic capabilities	0.443	8.527	0.000	Accepted
H3: Sustainable leadership → Industry 4.0 adoption	0.433	8.301	0.000	Accepted
H4: Green dynamic capabilities → Sustainability performance	0.117	2.653	0.008	Accepted
H5: Industry 4.0 adoption → Sustainability performance	0.516	10.937	0.000	Accepted

Source: Field study 2024 and PLS 4 output

According to the findings in Table 37, H1 was accepted, which means sustainable leadership has a positive and significant impact on sustainability performance ($\beta = 0.258$, $t = 5.294$, $p < 0.05$). H2 evaluates whether sustainable leadership affects green dynamic capabilities (GDC) in the RMG industry in Bangladesh. The findings show that sustainable leadership influences GDC ($\beta = 0.443$, $t = 8.527$, $p < 0.05$). Therefore, H2 was accepted. H3 examines whether sustainable leadership affects Industry 4.0 adoption in the RMG industry in Bangladesh. The results demonstrated that sustainable leadership positively influences Industry 4.0 adoption ($\beta = 0.433$, $t = 8.301$, $p < 0.05$). Thus, H3 was accepted. H4 evaluates whether Green dynamic capabilities affect sustainability performance. The findings present a significant relationship between GDC and sustainability performance ($\beta = 0.117$, $t = 2.653$, $p < 0.05$). Accordingly, H4 was accepted. H5 investigates whether Industry 4.0 adoption affects sustainability performance or not. The findings revealed that Industry 4.0 adoption could improve sustainability performance ($\beta = 0.516$, $t = 10.937$, $p < 0.05$). Consequently, H5 was accepted.

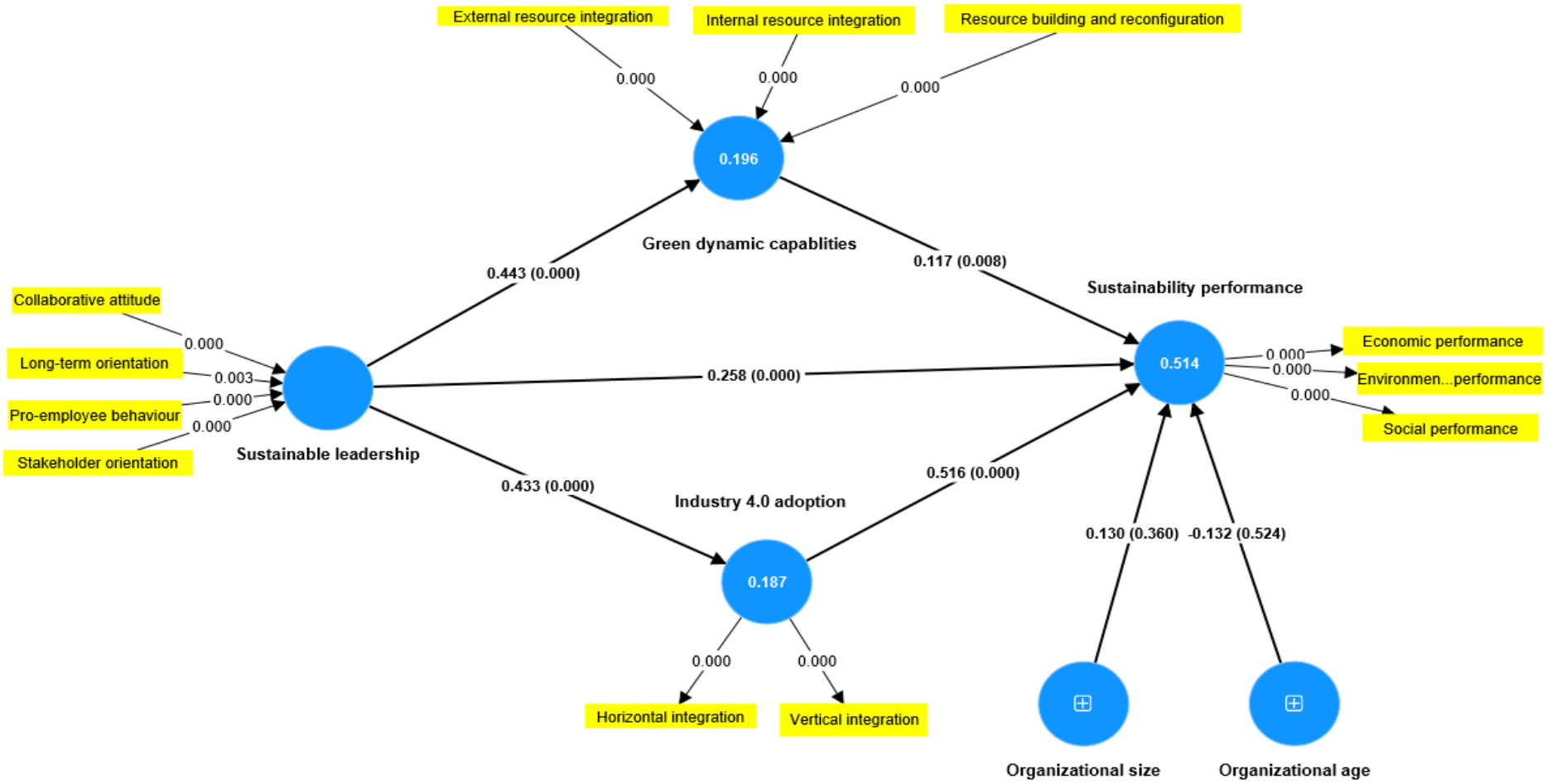

Figure 9. Structural model of study (Path coefficient and p-value)

Source: Field study 2024 and PLS 4 output

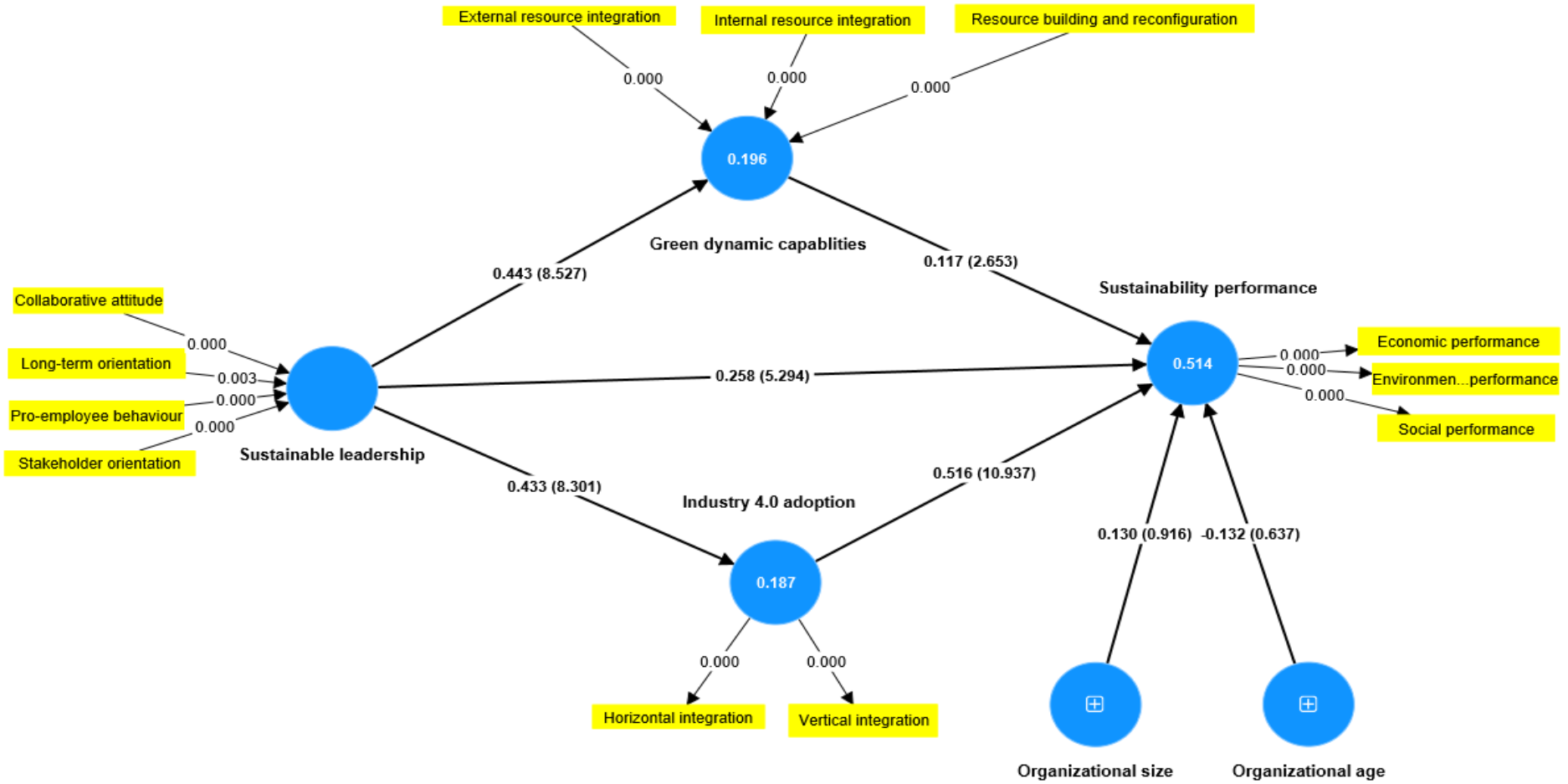

Figure 10. Structural model of study (Path coefficient and t-values)

Source: Field study 2024 and PLS 4 output

Assessing explanatory power of the model

According to Hair et al. (2022) , the explanatory power of a research model can be identified by examining the coefficient of determination, measured by R^2, which indicates the level of variation in the endogenous (dependent) variable caused by the combined effect of exogenous (independent) variables. Moreover, R^2 values measure the model's ability to explain and predict the endogenous variable (Hair & Alamer, 2022). Table 38 presents the R^2 values of the endogenous constructs in the research model.

Table 38. Coefficient of determination (R^2)

Constructs	**R^2**	**R^2 adjusted**
Green dynamic capabilities (GDC)	0.196	0.194
Industry 4.0 adoption (I4.0A)	0.187	0.185
Sustainability performance (SP)	0.514	0.507

Source: Field study 2024 and PLS 4 output

Table 38 shows the result of R^2 for three endogenous constructs: green dynamic capabilities, Industry 4.0 adoption, and sustainability performance in the current study. R^2 values of 0.25, 0.50, and 0.75 are considered weak, moderate, and strong, respectively (Cohen, 2013). The model has an R square value of 0.514 for sustainability performance, which implies that the exogenous constructs, namely sustainable leadership, green dynamic capabilities, and Industry 4.0 adoption, explained 51.4 % of the variation in sustainability performance and is considered moderate explanatory power (Cohen, 2013). However, this finding uncovers new scope for future researchers to identify additional factors contributing to the remaining 49 % in sustainability performance. Moreover, the adjusted R^2 value of 0.506 for sustainability performance indicates that the regression model aligns well with the proposed research hypotheses.

Effect size (f^2)

Effect size (f^2) determines the effect of a specific exogenous variable on the endogenous variable. Cohen (2013) classified effect size as large (f^2 value $\geq$ 0.35), medium (f^2 value $\geq$ 0.15), and small (f^2 value $\geq$ .02). This study calculated effect size for assessing structural models. Table 39 shows the results of effect size.

Table 39. Effect size **(f^2)**

	SP	Effect size	GDC	Effect size	I4.0A	Effect size
SL	0.095	Small	0.244	Medium	0.23	Medium
GDC	0.022	Small				
I4.0A	0.438	Large				

Source: Field study 2024 and PLS 4 output

Table 39 explains that the effect sizes of three exogenous constructs on endogenous (sustainability performance) construct were examined; among them, sustainable leadership and green dynamic capabilities were found to be small. Industry 4.0 adoption was found to have a large effect on the endogenous construct. In addition to that, the effect size of sustainable leadership on green dynamic capabilities and Industry 4.0 adoption was found to be medium. However, ensuring the rules of thumb for high effect size is sometimes challenging due to the nature of the proposed research model and the context of the research (Hair et al., 2022).

Assessment of predictive relevance (Q^2) and PLS-predict

The predictive relevance (Q^2) of a model states the ability of exogenous constructs to forecast endogenous constructs if applied in a different context (Geisser, 1975; Stone, 1974). A Q^2 value greater than 0 is necessary to establish the predictive capability of exogenous constructs on endogenous constructs in a research framework. Table 40 demonstrates that green dynamic capabilities, Industry 4.0 adoption, and sustainability performance constructs have Q^2 values higher than 0 ($Q^2 > 0$), confirming the current research model's predictive relevance and validity (Benitez et al., 2020; Henseler et al., 2009). Following the guidelines of Shmueli et al. (2019) , this study calculated the values of Q^2 in Smart PLS4. The study uncovers that the Q^2 value of GDC is 0.176, I4.0A is 0.168, and SP is 0.256, which is greater than zero, which means the predictive relevance of the model was established.

Table 40. Predictive relevance of the model

Higher-order constructs	Q^2predict
Green dynamic capabilities (GDC)	0.176
Industry 4.0 adoption (I4.0A)	0.168
Sustainability performance (SP)	0.256

Source: Field study 2024 and PLS 4 output

In addition to assessing Q^2 of the structural model, this study determined PLS-predict as suggested by Hair et al. (2022). The output of PLS-predict is provided in Table 41. Being approximately symmetric prediction error distribution, the researcher compared each lower-

order construct's RMSE (Root-mean-square error) values with the values of the linear regression model (LM) to determine the degree of the predictive power of the model.

Table 41. PLS-predict

Lower-order constructs	Q^2predict	PLS-SEM_RMSE	LM_RMSE
External resource integration (ERI)	-0.005	1.006	1.007
Internal resource integration (IRI)	0.126	0.937	0.952
Resource building and reconfiguration (RBR)	0.048	0.978	0.991
Horizontal integration (HI)	0.049	0.978	0.997
Vertical integration (VI)	0.158	0.921	0.941
Economic performance (EcP)	0.154	0.923	0.928
Environmental performance (EnP	0.196	0.900	0.907
Social performance (SoP)	0.168	0.915	0.928

Source: Field study 2024 and PLS 4 output

According to the result in Table 41, it can be concluded that the current study model has medium predictive power as the guideline of Shmueli et al. (2019) stated that the model is considered to be medium predictive power when the majority (or an equal number) of indicators in the PLS-SEM analysis produce smaller prediction errors than the LM.

4.6.6 Mediation analysis

Mediation takes place when an intervening variable exists between the predictor and outcome variable, influencing their relationship (Baron & Kenny, 1986). Therefore, mediation analysis is important in structural model assessment. This study has two mediating constructs, namely, green dynamic capabilities and Industry 4.0 adoption. Baron and Kenny's (1986) approach is traditionally used for mediation analysis. However, given its conceptual and methodological issues highlighted by Hayes (2017), the study followed the guidelines of Zhao (2010) and Nitzl et al. (2016) to estimate mediation analysis. Moreover, the researcher examined the two mediating effects for the structural model in this study using the bootstrapping technique in Smart PLS4 (Hair et al., 2022). The findings of the mediating effect are illustrated in Table 42.

Table 42. Result of mediating effect

	Total effects (SL and SP)				Direct effects (SL and SP)			Indirect effects (SL and SP)		
Hypotheses	β	t-value	p-value	β	t-value	p-value	Hypotheses	β	t-value	p-value
SL - > SP	0.528	11.044	0.000	0.255	5.206	0.000	SL - > GDC - > SP	0.051	2.39	0.017
SL - > SP	0.528	11.044	0.000	0.255	5.206	0.000	SL - > I4.0A - > SP	0.222	7.182	0.000

Source: Field study 2024 and PLS 4 output

shows that mediation analysis was performed to assess the mediating role of green dynamic capabilities (GDC) and Industry 4.0 adoption (I4.0A) in the relationship between sustainable leadership (SL) and sustainability performance (SP). The results revealed a significant indirect effect of SL on SP through GDC (β = 0. 051, t = 2.39, p < 0.017) and I4.0A(β = 0. 222, t = 7.182, p < 0.000). The total effect of SL on SP was significant (β = 0.528, t = 11.044, p < 0.000) with the inclusion of the mediators, the direct effect of SL on SP was still significant (β = 0.255, t = 5.206, p < 0.000). It shows a complementary partial mediating role of GDC and I4.0A in the relationship between SL and SP. Hence, H6 and H7 were supported.

4.6.7 Assessing the impact of control variables

Aligned with prior studies, this study examined the impact of two control variables such as organizational size (expressed in terms of the number of people employed) and organizational age (expressed in the number of years the company has in business operations), on the structural relationship in the model. In the process of hypothesis testing, this study assumed that the size and age of a company could positively influence sustainability performance. The results of the impact of control variables on sustainability performance using standardized beta values, t-values, and p-values are shown in Table 43.

Table 43. Impact of control variables on sustainability performance

With controls				**Without controls**			
Paths	**Beta (β)**	**t-statistics**	**p-values**	**Paths**	**Beta (β)**	**t-statistics**	**p-values**
SL -> SP	0.258	5.294	0.000	SL -> SP	0.255	5.206	0.000
SL -> GDC	0.443	8.527	0.000	SL -> GDC	0.443	8.527	0.000
SL -> I4.0A	0.433	8.301	0.000	SL -> I4.0A	0.433	8.301	0.000
GDC -> SP	0.117	2.653	0.008	GDC -> SP	0.114	2.599	0.009
I4.0A -> SP	0.516	10.937	0.000	I4.0A -> SP	0.514	11.018	0.000
OA_ -> SP	-0.132	0.637	0.524				
OS_ -> SP	0.13	0.916	0.360				

Source: Field study 2024 and PLS 4 output

The study found that control variables were insignificant; that is, organizational age and organizational size did not have a statistically significant impact on sustainability performance. In addition to that, illustrates that control variables did not make any significant change in the research model.

4.7 Discussion of Results in Light of the Study Objectives

Guided by its objectives, this study tested seven new hypotheses, shedding light on sustainable leadership in Bangladesh's RMG sector. The primary contribution of this study was to empirically validate the sustainable leadership towards sustainability firm performance model and test how sustainable leadership, green dynamic capabilities and Industry 4.0 adoption affect sustainability performance using partial least square–-structural equation modeling (PLS-SEM). The study's findings are interpreted here in light of statistical results, theoretical frameworks, and practical implications.

The researcher first interprets the study outcomes against the backdrop of the research objectives. Study objective 1 explores the factors of sustainable leadership and sustainability performance. In contrast, research objective 2 examines how sustainable leadership influences green dynamic capabilities and intellegent technology adoption toward sustainable organizational performance in Bangladesh's RMG industry. As the hypothesized relationships in the model addressing research objective two will be covered in the subsequent section, this section focuses on research objective one.

Research Objective 1: To identify and to measure the dimensions of SL and SP

This research sought to construct the multidimensional and hierarchical measurement construct of "sustainable leadership" and "sustainability performance" to fulfill research objective one. Sustainable leadership was considered as the reflective first-order and formative second-order construct, and sustainability performance was considered as a reflective construct at both lower-order and higher-order levels, drawing on existing literature, and interview results. The higher-order constructs were estimated using a disjoint two-stage approach, providing an effective framework for building a complicated but concise model.

This study proposed that sustainable leadership (SL) is a second-order formative construct formed by four first-order reflective dimensions (i.e., pro-employee behavior, long-term orientation, stakeholder orientation, and collaborative attitude). Findings showed that the collaborative attitude is the most crucial factor of sustainable leadership, with an absolute importance of 0.474, followed by pro-employee behavior (0.395), stakeholder orientation (0.353), and long-term orientation (0.301). The connections between sustainability leadership and its factors are analyzed in the following section, drawing from empirical data and theoretical perspectives.

Pro-employee behaviour (PEB)

The empirical findings of this study revealed that pro-employee behaviour contributes 39.5% in shaping sustainable leadership (SL), with significant statistical support (t=5.061, p=.00). Previous leadership literature (Avery & Bergsteiner, 2010; Hargreaves & Fink, 2012; Lambert, 2011) which contends that employee-oriented behaviour is crucial for sustainable leadership. From the findings, it can be concluded that PEB, which reflects valuing employees and others, fostering amicable labour relations, enhancing the capacity of employees, and recognizing and advancement of employees, is an essential dimension of SL. Additionally, the study findings offer substantial evidence of the significance of the reflective measurement indicators associated with pro-employee behaviour. It was revealed that all the items satisfied the item-total correlation to form a dimension. As a result, all the reflective indicators confirm the validity of pro-employee behaviour.

Long-term orientation (LTO)

The empirical findings demonstrated that long-term orientation accounts for 27.28% of the absolute importance, playing a vital role (t=1.73, p=.10) in statistically constructing the SL construct. Previous studies stated the significance of long-term orientation on business and leadership in terms of length, conservation, innovation, vision, staff retention, resource allocation, and building future competitive advantages (Avery & Bergsteiner, 2010; Cantele et al., 2024; Dou et al., 2019; Hargreaves & Fink, 2012). Therefore, theoretically and empirically it is evidenced that LTO could be the important components of SL.

Stakeholder orientation (SO)

The findings confirm that stakeholder orientation has a 27.28% contribution in defining the SL construct with statistical support (t=1.73, p=.10). The outcomes advocate the earlier scholarly works (Avery & Bergsteiner, 2010; Brulhart et al., 2019; Hargreaves & Fink, 2012; Lee, 2017; Vurro et al., 2022). The literature highlighted the role of business leadership in preserving the environment, participating in community activities, protecting human rights, establishing fairness, and building trust. Consequently, theoretical and statistical evidence support stakeholder orientation as a crucial dimension of SL.

Collaborative attitude (CA)

According to the empirical findings, collaborative attitude plays a significant role, contributing 36.67% to the SL construct, with a noteworthy significance (t=2.17, p=.10).

This finding supports the arguments of earlier research works (Avery & Bergsteiner, 2010; Broman et al., 2017; Gimenez et al., 2012; Hargreaves & Fink, 2012; Visser & Courtice, 2011). Past studies emphasized the impact of collaborative attitude (CA) on business and leadership in terms of building teamwork, knowledge sharing, inclusive culture, diversity, consensual decision making, and effective communication. Hence, CA as a dimension of SL is theoretically and empirically justified.

The researcher developed a hierarchical and multidimensional sustainability performance construct by integrating theoretical insights and interview findings. Sustainability performance construct was treated as multidimensional in the earlier research works (Chow & Chen, 2012; Foo et al., 2021). This research also validates sustainable organizational performance as a second-order reflective construct. Sustainable organizational performance is reflected by three indicators: environmental, economic, and social performance. The study identified measurement items based on literature review and field study and employed EFA to explore the factors and underlying relationship and then confirmed through confirmatory factor analysis. The findings corroborated that environmental performance (FL=0.891) had the highest reflection of sustainability performance, followed by social performance (FL=.872) and economic performance (FL=.680). The relationship between sustainability performance and its dimensions is interpreted below.

Environmental performance (EnP)

This research found environmental performance as an essential aspect of sustainability performance to promote sustainable development in the RMG industry in Bangladesh, which is consistent with previous studies in sustainability literature (Jum'a et al., 2022; Rao, 2002; Zhu et al., 2008) . Reducing carbon footprint, minimising waste, optimising energy use, lowering harmful material usage, and improving compliance with environmental regulations measure environmental performance. The study tested the psychometric properties of environmental performance as a dimension of sustainability performance and verified its validity and reliability (see Table 17, and 18). In addition to that, an assessment of the predictive validity of sustainability performance shows Q^2predict = .192 for environmental performance, which implies its relevance to sustainability performance in the research model.

Economic performance (EcP)

The empirical evidence of this study shows that economic performance measured in sales revenue, market share growth, company image, and profitability is a key element of sustainability performance aligned with past research works (Aftab et al., 2022; Ijaz Baig & Yadegaridehkordi, 2023; Wang & Dai, 2018) . Lower-order reflective measurement items of economic performance were checked to ensure validity and reliability and found satisfactory findings (see Table 17, and 18). The study also evaluated whether the measures demonstrated consistency in line with theoretical assumptions. The result shows the predictive relevance of economic performance by producing Q^2predict = 0.154. The results indicate that economic performance constitutes an important element of sustainability performance.

Social performance (SoP)

The empirical findings confirmed the relevance of social performance measured in improved relationships with employees and community, customer relationship, workplace safety, living quality of community, wage structure, working environment, occupational health and safety of employees as a vital aspect of sustainability performance, aligned with studies of Aftab et al. (2022), Paulraj (2011), and Yusliza et al. (2020). As theoretical advancement requires psychometrically robust measurement tools, the study established the validity and reliability of social performance indicators (see Table 17, and 18). Besides, social performance was also assessed for its predictive power as a dimension of sustainability performance, and it revealed Q^2predict = 0.168.

4.8 Discussion of Results from the Perspective of Hypothesis

Hypothesis (H_1): Sustainable leadership (SL) has a positive and significant impact on sustainability performance (SP)

This research examined the influence of SL on SP to respond to the second research objective. The empirical outcomes uncovered sustainable leadership positively and significantly influences the sustainable organizational performance of RMG companies in Bangladesh with statistical supports (β=0.258, t=5.294, p=000), proving theoretical links that SL represented by pro-employee behaviour, long-term orientation, stakeholder orientation, and collaborative culture is crucial for enhancing environmental, economic and social performance. This finding was consistent with the literature by Abbas (2024), Althnayan et al. (2022) , Lyu et al., (2022) , Sapta et al. (2021) and others who examined the impact of transformational and ambidextrous leadership on improving firms'

sustainability performance. Considering this statistical finding, sustainable leadership is key to driving the sustainability performance of RMG firms in Bangladesh. This research, however, contributes to the extant literature by showing that sustainable leadership also contributes to improving firms 'sustainability performance. Leadership approach to stakeholder orientation and pro-employee behavior, long-term orientation, and collaborative attitude leads to the reduction of environmental challenges and improvement of labor-management relations, workplace safety, and workers' rights, building inclusive and innovative culture, therefore, contributes to improving the company's market reputation. Hence, RMG companies in Bangladesh can easily attract global fashion brands and retailers (buyers) and increase sales volume.

The interview results also support RMG company's leadership role in minimizing environmental challenges and labour issues and expanding the market share and competitiveness of the RMG sector in Bangladesh. Practical evidence is also aligned with this finding. It was noticed that RMG companies are incorporating environmentally friendly manufacturing operations and comply with global and national regulations such as the Green Deal agreement, 2030 agenda, and national environmental acts to attract foreign buyers and stakeholder requirements. They focus on developing the capacity of employees through different training, such as fire safety training, ensuring safety, security, fair pay, human rights, and compliance, and building an inclusive and collaborative environment in the company. Thus, the research outcomes emphasize sustainable leadership to drive sustainability in RMG firms by increasing environmental, economic, and social performance.

Hypothesis (H_2): Sustainable leadership positively affects green dynamic capabilities.

This research assessed sustainable leadership's influence on enhancing the green dynamic capabilities of companies, addressing research objective three. Based on prior studies and field study findings, this study posits that sustainable leadership can improve RMG companies' green dynamic capacities. The study results statistically confirmed a significant positive effect of sustainable leadership on green dynamic capabilities. The results (β=0.443, t=8.527, p=000) demonstrate that sustainable leadership is crucial in strengthening the dynamic capabilities of a firm and suggesting that green dynamic capabilities depend significantly on sustainable leadership. This finding was supported by Ahmad et al. (2024), Lopez-Cabrales et al., (2017) and Bornay-Barrachina et al. (2023) . Hence, the study

outcome suggests that sustainable leadership is crucial in developing green dynamic capabilities and eventually leading to triple bottom line (TBL) sustainability performance.

Hypothesis (H_3): Sustainable leadership positively affects Industry 4.0 adoption.

This research hypothesized that sustainable leadership positively affects Industry 4.0 adoption. The hypothesised link between sustainable leadership and intelligent technology adoption was validated statistically by analysing the findings (β=0.433, t=8.301, p=000). The results agree with the homogeneous study of Jayashree et al. (2022), who found that management leadership can significantly shape employee involvement and promote participation in embracing digital technologies in the organization. Shafique et al. (2020) and Nasir et al. (2022) also revealed a significant and positive influence of leadership on technology adoption in the organization. Accordingly, sustainable leadership ensures the proper allocation of resources to adopt and implement digital technologies such as IoT sensors, RFID, and 3D to promote sustainability. As literature supports that leadership can enable firms to integrate Industry 4.0 adoption, which enhances operational improvements and social and environmental sustainability (Costa et al., 2023; Ghobakhloo, 2020; Jayashree et al., 2021).

Hypothesis (H_4): Green dynamic capabilities positively affect sustainability performance

The study affirmed that green dynamic capabilities significantly and positively influence sustainability performance. The results (β=0.117, t=2.653, p=0.008) validate green dynamic capabilities as a key antecedent for enhancing organizational sustainability. Enriching supportive factors promotes sustainable firm performance. The research outcomes corroborate the earlier studies of Eikelenboom & de Jong (2019) , Borah et al. (2024) and Mathivathanan et al. (2017) which examined how dynamic capabilities positively contribute to the sustainability initiatives of a company support. The study by Li et al. (2024) revealed that green dynamic capacities support firms in leveraging opportunities to enhance business enterprises' triple-bottom-line performance. Research findings reaffirm green dynamic capabilities' influence on sustainable organizational performance.

Hypothesis (H_5): Industry 4.0 adoption positively affects sustainability performance

Past research argued that the adoption of intelligent technologies positively influences sustainable organizational performance. The outcome of this research validated the I4.0A and SP link with statistical support (β=0.516, t=10.937, and p= 0.000), which produced evidence supporting the relationship between I4.0A and SP. It also states that the focus on

I4.0A boosts sustainability performance. Literature also supports the findings of this study. The research of Jayashree et al (2022) on adopting digital technology from Malaysian SME's perspective found positive influence of advanced technology implementation on TBL performance. Additionally, Ferreira et al., (2023), Kamble et al. (2020) and Karmaker et al. (2023) also came to the same conclusions as this study found. Though the phase of adopting digital technologies in Bangladesh's RMG companies is still in the primary phase, RMG firms are gradually integrating technologies of I4.0 in manufacturing process to address sustainability issues due to foreign buyers' pressure and gain multiple benefits of smart technologies to enhance operational and organizational performance in the competitive world. Thus, the implementation of Industry 4.0 assists firms in utilizing their resources efficiently and innovatively towards sustainable development.

Hypothesis (H_6): Green dynamic capabilities positively affect the relationship between sustainable leadership and sustainability performance.

This research tested and validated the function of GDC as mediator in the association between SL and SP. The research results demonstrated SL indirectly influence SP through GDC with statistical evidence ($\beta = 0.052$, $t = 2.437$, $p < 0.015$). In addition, it was observed that SL had a significant total effect on SP ($\beta = 0.533$, $t = 10.999$, $p < 0.000$), and its direct effect remained significant with GDC as a mediator ($\beta = 0.258$, $t = 5.294$, $p < 0.000$). Both direct and indirect effects' statistical significance and directional consistency are evident. It implies that GDC is a complementary partial mediator in the connection between SL and SP, which is aligned with Zhao (2010) and Nitzl et al. (2016) . The literature also supported GDC's mediator function between SL and SP (Mubeen et al., 2024; Singh et al., 2022; Yang et al., 2023) . Therefore, sustainable leadership enhances the green dynamic capabilities of the company toward reducing environmental complications and enhancing market image and social well-being, which leads to sustainable performance.

Hypothesis (H_7): Industry 4.0 adoption positively affects the relationship between sustainable leadership and sustainability performance.

The current research examined and confirmed the mediating function of intelligent technology adoption between sustainability leadership and sustainable organizational performance. The study result revealed that SL significantly influences SP with the support of I4.0A with statistical evidence ($\beta = 0.222$, $t = 7.182$, $p < 0.000$). The research found a significant total effect of SL on SP ($\beta = 0.533$, $t = 10.999$, $p < 0.000$). Even with I4.0A as a

mediator, SL maintained a significant and positive direct effect on SP (β = 0.258, t = 5.294, p = 0.000). The research results show that I4.0A is a complementary partial mediator in the association between SL and SP, which is aligned with previous studies (Jayashree et al., 2022; Kumar & Bhatia, 2021; Nasir et al., 2022). Consequently, the results of this study suggest that organizational leaders should adopt and implement advanced technologies to enhance sustainable organizational performance. Moreover, COVID-19 and the Russia-Ukrain war presented the necessity of adopting digital technologies in the RMG industry in Bangladesh. Hence, RMG companies are adopting smart technologies to survive in the global apparel market.

4.9 Discussion from the Perspective of Control Variables

This study investigated two control variables, organizational size and organizational age, on endogenous variable sustainability performance because of their potential impact on firm performance, as evidenced in the literature. However, the research outcome found that the impacts of organizational size and organization age were insignificant from Bangladeshi garment companies perspective. These findings suggest that sustainable leadership, green dynamic capabilities, and Industry 4.0 adoption support sustainability goals equally across firms, regardless of size and age. This research outcomes are consistent with past research (Harun et al., 2023; Wang et al., 2022). However, Table 44 presents the summarized result of all hypotheses testing of this study.

Table 44. Result of all hypothesis testing

Hypothesis	Beta (β)	t-value	p-value	Findings
H1: Sustainable leadership → Sustainability performance	0.258	5.294	0.000	Supported
H2: Sustainable leadership → Green dynamic capabilities	0.443	8.527	0.000	Supported
H3: Sustainable leadership → Industry 4.0 adoption	0.433	8.301	0.000	Supported
H4: Green dynamic capabilities → Sustainability performance	0.117	2.653	0.008	Supported
H5: Industry 4.0 adoption → Sustainability performance	0.516	10.937	0.000	Supported
H6: Sustainable leadership → Green dynamic capabilities → Sustainability performance	0.051	2.39	0.017	Supported
H7: Sustainable leadership → Industry 4.0 adoption → Sustainability performance	0.222	7.182	0.000	Supported
Control Variables				
Organizational age → Sustainability performance	-0.132	0.637	0.524	Insignificant
Organizational size → Green dynamic capabilities	0.13	0.916	0.360	Insignificant

Source: Field study 2024 and PLS 4 output

5 NEW SCIENTIFIC RESULTS

This study first explored the measurement indicators of sustainable leadership and sustainability performance in Bangladesh's clothing sector context. Then it tested the structural links in the proposed framework. Thus, the research found some unique findings that would add some value to the field of leadership literature. The new scientific findings obtained by conducting this research are stated below.

1. This study revealed new psychometric scales to measure hierarchical and multidimensional sustainable leadership and sustainability performance constructs. Most of the existing sustainable leadership and sustainability performance scales are developed based on the context of a developed country and lack psychometric property evaluation, which is the essential condition for theory advancement. The study developed and validated the scales by following Churchill's (1979) scale development process and adopting a sequential exploratory mixed-method research design. The study assessed the psychometric properties of the Bengali version of the sustainable leadership and sustainability performance scales in Bangladesh's clothing sector context. The EFA result of this study revealed four latent factors of sustainable leadership with 20 items and three underlying factors of sustainability performance with 17 items. The study also ensured the quality of the measurement properties by assessing item reliability, construct reliability, convergent validity and discriminant validity. Figure 11 shows the psychometric measures of sustainable leadership and sustainability performance.

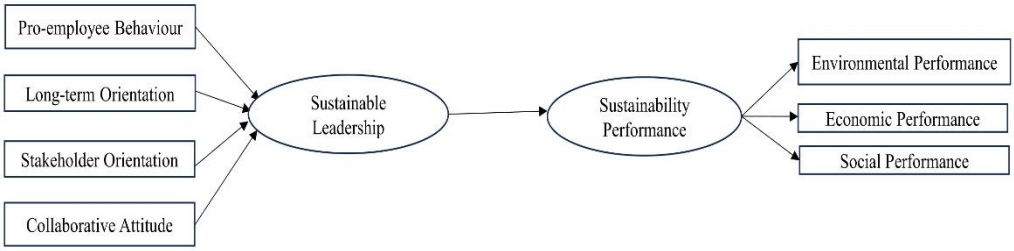

Figure 11. Psychometric measures of sustainable leadership and sustainability Performance

Source: Researcher's construction

2. This study employed a sequential mixed method for exploring factors, developing instruments, and testing hypotheses in the realm of sustainable leadership research. The application of mixed research methods in leadership literature is

underdeveloped. In contrast, this research employed qualitative field study and quantitative survey tools to answer research questions employing SEM analysis at the organizational level, making novel methodological contributions in this field. Besides, as the earlier instruments are not sufficient in the context of the RMG industry in Bangladesh, this study developed and tested two new instruments by following the standard method of instrument development in a new context, showing a new methodological contribution.

3. This study found a direct positive relationship between sustainable leadership and sustainability performance in Bangladesh's clothing sector by examining hypothesis testing using structural equation modeling. Besides, this research pioneers in uncovering a direct positive association between sustainability leadership and sustainable firm performance, viewed as hierarchical and composite constructs; most of the earlier studies put little attention on the composite multidimensional sustainable leadership and triple bottom line performance in a single study. It is also mentioned here that all the variables in this study are multidimensional, and the unique findings show positive and significant links among all variables.
4. The integrated mediating effect of green dynamic capabilities and Industry 4.0 adoption on sustainable firm performance in Bangladesh's clothing sector is significant and positive, which remained underexplored in the existing literature. This study outcome was revealed through the hypothesis testing of the indirect effect of green dynamic capabilities and industry 4.0 adoption on sustainability performance. The findings suggested a complementary mediating impact of the mentioned two variables, which is a new addition to the existing research. Two control variables, organizational size and organizational age, show no significant influence on sustainable firm performance.
5. This study integrated sustainable leadership theory and dynamic capability view theory to represent the structural relationship and validate the hypothesis, as a single theory was insufficient to address the research problem comprehensively. Thus , the study combined two theories to overcome the limitations of the theoretical perspectives of both theories, which facilitated to advance of the theory. This is also unique in the literature. In addition, this study extended sustainable leadership theory by integrating triple-bottom-line performance in the research framwork, as Avery & Bergteiner's current sustainable leadership theory focuses mainly on financial and

non-financial performance and undermines environmental performance. This study validates the extension of sustainable leadership theory by providing empirical support from the RMG industry in Bangladesh.

6. Literature can be found in diverse sectors, such as the construction business (Opoku et al., 2015) , the cement sector (Kantabutra & Avery, 2011) , learning organizations (Iqbal & Ahmad, 2021), small and medium-sized enterprises without industry specifications (Bencsik & Pangsy-Kania, 2023; Burawat, 2019; Suriyankietkaew, 2023) , IT organizations (Sikand & Saxena, 2022), federal agencies (Lee, 2017) , community-based social enterprise (Suriyankietkaew et al., 2022) and health-care organizations (Suriyankietkaew & Kungwanpongpun, 2022) that focus on sustainable leadership and sustainability performance. However, the study revealed contextual uniqueness by investigating the structural relationship between sustainable leadership, green dynamic capabilities, Industry 4.0 adoption, and sustainable firm performance in Bangladesh's clothing sector context.

6 CONCLUSION AND FUTURE RESEARCH DIRECTIONS

The present research aimed to explore measures of sustainable leadership and sustainability performance in the clothing sector of Bangladesh and examined the proposed research model. The study first reviewed the relevant literature to identify the factors of sustainable leadership and sustainability performance and then conducted semi-structured interviews with senior managers to contextualize the factors in the RMG sector of Bangladesh. A research framework was proposed and tested to validate the structural relationship by collecting cross-sectional survey data from 355 garment companies in Bangladesh relying on literature reviews, qualitative field interviews, and pilot surveys. Besides, the study investigated the direct effects of sustainable leadership on green dynamic capabilities, advanced technology adoption, and sustainable firm performance, as well as the function of green dynamic capabilities and intelligent technology adoption as mediators on sustainable organizational performance. As one of the initial studies, this research provides empirical evidence supporting the relationship among sustainable leadership, green dynamic capabilities, adoption of Industry 4.0, and sustainable organizational performance. The study examined seven hypotheses. Among them, five hypotheses evaluated the direct effect, and two hypotheses verified the indirect effect. The first hypothesis test result produced a positive and significant effect of sustainable leadership on sustainable firm performance in the Bangladeshi clothing industry. The second hypothesis assessed the effect of sustainable leadership on the green dynamic capabilities of the fashion companies in Bangladesh. The statistical result found a positive and significant impact of sustainable leadership on green dynamic capabilities. The third hypothesis testified to sustainable leadership's influence on Industry 4.0 adoption. The hypothesis testing result uncovered the positive and significance of sustainable leadership on digital technology adoption in the RMG industry. The fourth hypothesis measured the impact of green dynamic capabilities on sustainability performance. The statistical result provided the positive and significant impact of green dynamic capabilities on sustainability performance. The study also found empirical evidence of Industry 4.0 adoption on sustainability performance in the apparel sector of Bangladesh. The indirect effect of sustainable leadership through green dynamic capabilities on organizational sustainability performance was evidenced in this study. The final hypothesis confirmed the positive and significant indirect impact of sustainable leadership on a firm's sustainable performance in Bangladesh through Industry 4.0 adoption. In addition, the study revealed the complementary partial mediating effect of green dynamic

capabilities and Industry 4.0 adoption on the sustainable organizational performance of garment companies in Bangladesh. Considering the qualitative study and quantitative study findings of this study, the researcher concluded that this study's outcomes are of great relevance in the context of Bangladeshi clothing firms as the study developed and validated comprehensive multidimensional psychometric scales: sustainable leadership and sustainability performance and textile professionals can use them to adopt and evaluate for their firms. As the newly developed scales were theoretically justified and empirically tested can also be used in other sectors. This study concluded that sustainability performance is not only confined to environmental performance but also combines economic and social performance. To sum up, the researcher inferred that sustainability leadership, along with green dynamic capabilities and Industry 4.0 adoption, could provide a scaleable solution to recurring environmental, economic, and social performance issues of the RMG industry in Bangladesh. The integrated sustainable firm performance can be improved with the direct role of sustainable leadership and the indirect function of green dynamic capabilities and Industry 4.0 adoption.The study uncovers implications relevant to theory, practice, and policy development.

6.1 Implications

6.1.1 Implications for theory development

This research contributes to advancing the theory through developing theoretically justified and empirically validated two multi-dimensional scales for sustainable leadership (pro-employee behavior, stakeholder orientation, long-term orientation, and collaborative attitude) and sustainability performance (environmental, economic, and social). Moreover, drawing on two theories, namely, sustainable leadership (SL) theory and dynamic capability view (DCV) theory, and earlier empirical research, this study bridged the voids in the extant studies. It developed a research framwork to establish structural link between sustainability leadership and sustainable firm performance. The present study contextualized the research model by conducting interviews with apparel prfessionals.

The research framwork was empirically tested to verify the relationship among sustainable leadership, green dynamic capabilities, adoption of Industry 4.0, and sustainable firm performance in Bangladesh's clothing sector.The study found a positive and significant effect of sustainable leadership, green dynamic capabilities, and adoption of Industry 4.0 on sustainability performance. The result from the study also examined and validated the

indirect influence of sustainable leadership through green dynamic capabilities and the adoption of Industry 4.0 on sustainable firm performance. The study found a complementary mediating effect, another unique contribution of this research.

Green dynamic capabilities and Industry 4.0 technologies are the dynamic capabilities of a firm that enhance the capacity and competitiveness of business enterprises, leading to sustainability performance. Finally, the outcomes of this research added value to the existing literature by developing a sustainable firm performance model in the RMG business in an emerging country like Bangladesh and evaluating it through the lens of SL theory and DCV theory. In addition, the study findings supported SL theory and DCV theory, which posit that the company will gain a competitive advantage by shifting conventional leadership to a sustainable leadership approach, adopting digital technologies, and reconfiguring internal and external resources toward sustainability performance.

6.1.2 Implications for practice

The study findings provide some implications for RMG entrepreneurs and professionals. The study uncovered that sustainable leadership significantly and positively influences green dynamic capabilities, adoption of Industry 4.0, and sustainable organizational performance. The finding suggests that managers and owners of the RMG companies can fulfill stakeholder requirements and enhance ecological and socio-economic performance by cultivating alternative leadership approaches, integrating Industry 4.0 technologies, and rebuilding resources. Therefore, RMG managers should focus on pro-employee behavior, stakeholder orientation, long-term orientation, and collaborative attitude in managing company operations as developing sustainable leaders to steer firms toward triple-bottom-line performance. As highlighted by the findings of this study, RMG firms in Bangladesh are still in the early phases of adopting smart technologies. Consequently, RMG companies must train their workforce to implement digital technologies in the company operations and rearrange resources in response to changing business conditions. Recently, global and national regulations and stakeholder pressure, especially foreign buyers' requirements, are forcing apparel manufacturing companies to incorporate social, ethical, and environmentally friendly practices to minimize their operations' negative impact on nature and people, which presented the necessity of shifting traditional organizational leadership approach to stakeholder focused leadership and adopting Industry 4.0 technologies and sustainability-oriented dynamic capabilities. Being idealistic and humanistic, sustainable leaders strive to integrate ethical, social, and eco-friendly practices into business policy and strategies; RMG

companies can stay ahead of the global competition using and restructuring resources such as digital technologies to strengthen their capacity for eco-friendly and proactive measures, leading to sustainability performance. Finally, this research can help managers understand the key elements required for sustainability performance by identifying critical factors of sustainable leadership and sustainability performance.

6.1.3 Implications for Government and other agency

The study found that sustainable leadership, Industry 4.0 adoption, and green organizational capacities are important to enhance sustainable organizational performance in Bangladesh's clothing business. Considering the significance of the clothing industry to the Bangladeshi economy, the government can formulate a policy that will aid in incorporating smart technologies and facilitate RMG companies to integrate dynamic capabilities and adopt a humanistic leadership approach in the industry. Labor issues and environmental pollution are major drawbacks in ensuring sustainability performance; the government may take steps to establish human rights for workers and constantly monitor environmental pollution. The government may establish a framework of incentives and deterrents, including carbon taxes, fines, and license revocations, to push companies toward sustainable actions such as fair wages practices, fire safety, and green production. Finally, the trade associations in the RMG sector, such as BGMEA, can advocate for reforms in environmental laws to enable the seamless integration of I4.0 technologies in RMG operations.

6.2 Recommendations

Several recommendations are proposed based on the findings and conclusions of this study. Figure 12 shows the parties for whom the study proposes the recommendations.

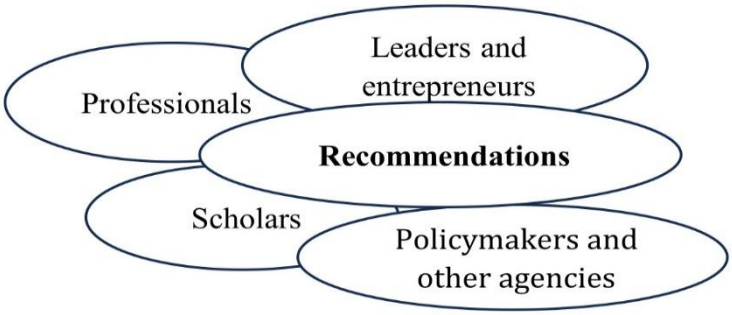

Figure 12. Recommendations

Source: Researcher's construction

First, leaders and entrepreneurs of the RMG industry are recommended to incorporate the features of sustainable leadership to address the challenges of sustainability and drive comprehensive sustainability performance, leading to sustainable competitive market performance. It is also important for RMG owners to strengthen the environmentally friendly dynamic capabilities of firms employing eco-friendly practices, providing employee training, and adopting digital technologies to enhance sustainability performance. Second, RMG managers should take into account employee-supportive behaviour in the company and focus on the socio-environmental requirements of buyers. Business managers of RMG companies need to emphasize sustainability-oriented initiatives in organizational activities to address sustainability challenges. Third, policymakers and regulatory bodies need to formulate industry-specific policies and efforts to improve the sustainability performance of the RMG industry in Bangladesh. The Government should make a policy to reduce adverse socio-environmental effects of industry and expand business opportunities. Initiatives such as implementing digital technology adoption policies and monitoring humanistic leadership practices taken by the Government for RMG companies can drive sustainability performance. Fourth, researchers are recommended to employ the framework of this study in different settings. Scholars should replicate the study in other countries and compare cross-cultural differences.

6.3 Limitations of the research and future research directions

Though the present research has made significant contributions to sustainable leadership literature, the study has some weaknesses that can be avoided in future studies. Figure 13 presents the limitations and future opportunities for research. The first limitation of this study is that the study has focused only on the composite impact of sustainable leadership, green dynamic capabilities, and Industry 4.0 adoption on sustainability performance. On the other hand, the impacts of each dimension of all exogenous constructs on each dimension of endogenous construct can provide new insights. Therefore, future researchers may conduct research on the dimensional impacts of newly developed sustainable leadership on triple-bottom-line dimensions. Second, this study has examined only two mediators: green dynamic capabilities and Industry 4.0 adoption; future research could investigate other emerging constructs as mechanisms to drive sustainability performance, such as green innovation and knowledge management. Besides, the study avoids the role of moderators; future studies may adopt conditional variables, such as organizational culture, to explore the moderating effect. Third, the study has limitations in sampling design selection. The study

employed simple random sampling for quantitative survey data collection and purposive sampling for qualitative field study. Though simple random sampling is appropriate for the generalization of the study result, it may restrict in-depth results. Therefore, cluster sampling can be considered for deeper insights in future studies for quantitative surveys. Fourth, the limitation is the sample size. The study has collected survey data from 355 companies among 3810 RMG companies listed in the BGMEA. Though the sample size of this study is methodologically correct, a larger sample size will increase the generalizability of the study findings. Fifth, this study conducted semi-structured interviews only with managerial-level staff. However, key informant and focus group interviews can provide additional insights into sustainability leadership and sustainable firm performance. Thus, future researchers may combine these techniques. Sixth, the study has shortcomings in selecting respondents. As managerial employees have adequate knowledge of the subject matter of study variables, data was collected only from the managerial level of RMG companies. In contrast, non-managerial staff and stakeholders can provide essential data. Therefore, future researchers can collect data from multiple stakeholders.

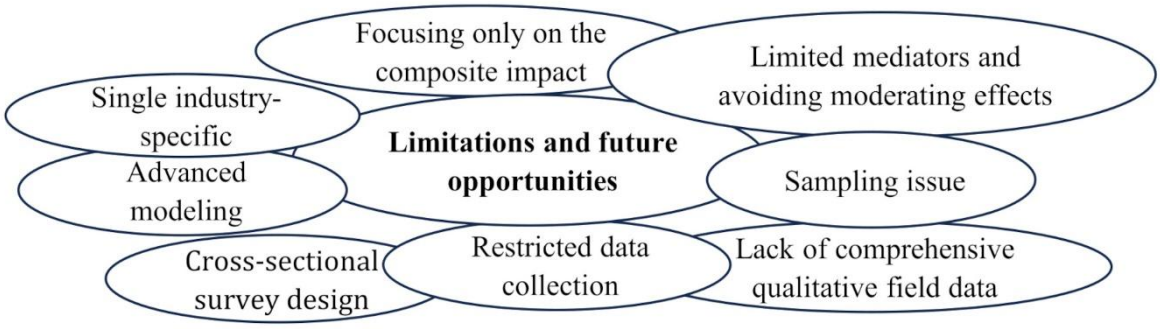

Figure 13. Limitations and future opportunities

Source: Researcher's construction

Last but not least, the study employed a cross-sectional survey design, which may produce a biased result. Consequently, future longitudinal research designs can be undertaken to avoid the limitation. In addition, the study was confined to analyzing the research model using PLS-based SEM; advanced model analysis, like necessary condition analysis (NCA), can be employed in future research for robust analysis of the model Finally, this study focused on only one industry and country, restricting the generalization; future studies can consider multiple industries and countries.

7. SUMMARY

Global challenges such as environmental pollution, climate change, and socio-economic disparity are mounting problems in the current world that need collective attention. In addressing the challenges, the UN formulated global goals that are applicable to all countries and industries. The RMG industry, being one of the major manufacturing industries around the world, is a significant source of sustainability challenges like natural resource depletion, carbon emission, water pollution, unethical labor practices, etc. Therefore, sustainability practices have become crucial for the RMG industry to implement sustainability. Moreover, global regulations like the Green Deal agreement, the 2030 agenda, the Paris Agreement, and stakeholder pressure are forcing the RMG industry to execute sustainable approaches in their operations. However, integreting sustainability practices is still questionable for the RMG industry in Bangladesh. Literature found that an alternative and humanistic leadership is necessary to implement sustainability in the industry. This leadership is known as sustainable leadership that can promote sustainabilty in the organization.

The study aimed to identify the specific factors and measures of sustainability leadership and sustainable firm performance in Bangladesh's clothing industry context and examine sustainable leadership's influence on green dynamic capabilities, adoption of advanced technology, and sustainable organizational performance. The researcher conducted a qualitative study to contextualize the factors and measurement indicators of sustainability leadership and sustainable firm performance in the perception and experience of apparel professionals in Bangladesh. The researcher designed a model based on literature reviews, interviews, and pilot surveys. The model was examined by collecting questionnaire data from RMG companies in Bangladesh. The study employed an exploratory sequential mixed research method to accomplish the study objectives. As a sampling technique, simple random sampling for collecting quantitative data and purposive sampling for qualitative interviews were used for this study. Qualitative research data was analyzed through content analysis and thematic approach, and the Nvivo 14 software package was applied to manage and analyze data. The research study developed a questionnaire based on qualitative interviews for sustainable leadership and sustainability performance.

On the other hand, an established, validated questionnaire was adapted for green dynamic capabilities and Industry 4.0 adoption. The questionnaires were distributed online and offline to collect adequate responses. The study conducted pre-testing and a pilot survey before the main survey. The researcher conducted a final survey among garment companies

working in Bangladesh after ensuring the questionnaire's validity and reliability in pilot surveys. Descriptive and inferential statistics were employed to interpret quantitative survey data. SPSS 25 was used for descriptive analysis, and smart PLS-4 was used for inferential statistics. The study result shows that sustainable leadership significantly and positively influence green dynamic capabilities, adoption of Industry 4.0, and sustainable organizational performance in Bangladesh's clothing industry.

Additionally, a complementary mediating effect was found in this study. This study was solely focused on a specific industry and country, which reduced the generalization of the outcomes. Therefore, subsequent studies can examine multiple sectors and countries to enhance generalizations. A longitudinal study could also be conducted to analyze sustainable leadership's influence on sustainable firm performance and minimize the methodological limitations of cross-sectional survey research.

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APPENDICES

Appendix A: Interview guide for field study

General instruction

The semi-structured interview will allow participants to raise and explore issues relevant to the research. You can freely describe, in your own words, how you experience your job and the company. Positive and negative aspects are equally important! There are no "right" or "wrong" answers as long as you tell me about your experience in your job and the organization." The following questions are indicative questions that will act as a question guide for the start of the interview.

Research question: What are the managerial perspectives and experiences on sustainable leadership and sustainability performance in Bangladesh's Ready-Made Garments (RMGs) industry?

Research objective: To explore the specific factors of sustainable leadership and sustainability performance in Bangladesh's Ready-Made Garments (RMGs) industry.

Sustainable leadership

Sustainable leadership is an alternative and holistic approach that prioritizes an organization's current and prospective financial gains while improving the overall well-being of all stakeholders. It fosters adopting sustainability principles through valuing employees, building capacity, shared vision, social responsibility, environmental stewardship, innovation, and amicable labour relations. (Will be explained to the interviewee).

1. Please describe your job and duties in your company.
2. In your professional role and experiences, what does sustainable leadership mean to you?
3. What is your company’s perspective on improving the technical, operational, and human relations capabilities of employees in the RMG company?
4. What approaches does your company take to build a sustainable future?
5. How would you describe your company’s view on building conceptual skills, teamwork, and organizational culture?
6. How does your company management handle ethical, social, and environmental values?

7. What is your company’s perspective on quality, innovation, and employee engagement?
8. In your opinion, what are the essential features that act as driving forces of sustainable leadership in the RMG industry in Bangladesh?

Probing Questions, if necessary:

Can you share any examples of long-term perspectives of your company?

What do you think about the employee-oriented activities of your company?

How does your company integrate environmental, social and ethical values into its leadership approach?

Could you please share any examples of collaboration or partnership behaviors of your company?

How does your company engage with stakeholders?

What role does your company play in driving innovation?

How do you manage stakeholder issues/ environmental and social issues?

Sustainability performance

Sustainability performance refers to an organization's capacity to balance economic profitability with social and environmental factors, considering all stakeholders' interests. (Will be explained to the interviewee).

1. What is your perception regarding the sustainability performance of your company?
2. What environmental, economic, and social factors may influence sustainability performance in the RMG company? Please explain.

Probing if necessary

What economic factors (share value, sales growth, productivity, profitability) do you usually think important for sustainability performance in the RMG sector?

What social factors (worker safety and health protection, fair wages, safe working environments) do you usually think important for sustainability performance in the RMG sector?

What environmental factors (pollution prevention, waste generation, wastewater, carbon emissions, energy consumption) do you usually think important for sustainability performance in the RMG sector?

Do you have any additional thoughts or insights on the topic of sustainable leadership and sustainability performance of the RMG industry in Bangladesh that you would like to share?

Thank you for your time and input.

Appendix B: Survey questionnaire

Sustainable Leadership and Sustainability Performance of the Ready-Made Garments Industry in Bangladesh

Part A: General and organizational information- Please read each question and put a check mark (√) on your response.

0 What is the name of your company? Please specify:

1. Identify your current managerial hierarchy in the company?
   a) Top management (Managing Director/General Manager/Equal status manager) b) Middle-level management (DGM/Senior Manager/Manager/Head of Department/Equal status manager) c) Junior management (Assistant Executive/Executive / Executive Officer/Staff Engineer/System Analyst/Assistant Manager/ Equal status manager)
2. Identify your gender: a) Male b) Female
3. Your age a) 18-25 years b) 26-35 years c) 36–45 years d) more than 45 years
4. Your educational qualification a) Secondary b) Higher-secondary c) Undergraduate d) Graduation
5. Identify your year of experience a) less than 5 years b) 5 to 10 years c) 11 to 15 years d) 16 to 20 years e) More than 20 years
6. What is the number of employees working in your company? a) less than 1000 employees b) 1001-2000 employees c) 2001 -3000 employees d) 3001 -4000 employees e) more than 4000
7. How long has your company been established? a) less than 5 years b) 5 to 10 years c) 11 to 15 years d) 16 to 20 years e) More than 20 years
8. What is your company's annual sales revenue in BDT? a) less than 10 million b) 10-20 million c) more than 20 million
9. Identify the Industry 4.0 adoption level of your company (Application of Industry 4.0 technologies, for example, automated machines or robots, IoT sensors, 3D printing, additive manufacturing, computer vision, Radio-frequency identification (RFID), blockchain, and digital twin, etc.) a) Fully implemented b) Partially implemented c) Development phase

Part B: Sustainable leadership: In this part, you will be asked to express your opinion on your company's sustainable leadership. The following statements reflect sustainable leadership on different indicators. Please read each statement carefully and put a check mark (√) on a number that corresponds most closely to your response (Strongly disagree=1, Disagree=2, Neutral = 3, Agree = 4, Strongly agree=5)

Pro-employee behaviour	1	2	3	4	5
Our company's leadership cares for the welfare of its employees	1	2	3	4	5
Our company's leadership develops all employees' knowledge and skills through continuous training	1	2	3	4	5
Our company's leadership values the cooperation of employee representatives to foster amicable labour relations	1	2	3	4	5
Our company's leadership promotes employees wherever possible	1	2	3	4	5
Long-term orientation					
Our company's leadership emphasizes long-term plans and strategies for investment and resource management.	1	2	3	4	5

Our company's leadership considers its vision as an indispensable strategic tool to drive business	1	2	3	4	5
Our company encourages innovative activities across the company	1	2	3	4	5
Our company's leadership emphasizes producing high-quality products to gain a competitive advantage.	1	2	3	4	5
Our company's leadership values emotionally committed employees for future benefits	1	2	3	4	5
Stakeholder orientation					
Our company's leadership acts in an environmentally responsible manner	1	2	3	4	5
Our company's leadership acts in a socially responsible manner	1	2	3	4	5
Our company's leadership behaves in an ethically responsible manner	1	2	3	4	5
Our company's leadership values the interests of all stakeholders.	1	2	3	4	5
Collaborative attitude					
Our company's leadership cultivates a widely shared culture in the workplace	1	2	3	4	5
Our company's leadership encourages knowledge and skill sharing throughout the company	1	2	3	4	5
The top management team, not just our CEO, makes crucial strategic decisions in our company	1	2	3	4	5
Our company's leadership emphasizes building a team-based work culture across the company	1	2	3	4	5
Our company's leadership strives to correct mistakes that affect sustainability	1	2	3	4	5
Our company's leadership strives to maintain open communication with diverse stakeholders.	1	2	3	4	5
Our company's leadership demonstrates support for Work/Life Programs	1	2	3	4	5

Part C: Green dynamic capabilities: In this part, you will be asked to express your opinion on the Green dynamic capabilities of your company. The following statements reflect green dynamic capabilities on different indicators. Please read each statement carefully and put a check mark (√) on a number that corresponds most closely to your response (Strongly disagree=1, Disagree=2, Neutral = 3, Agree = 4, Strongly agree=5)

External resource integration					
Our company integrates buyers' environmental requirements in products	1	2	3	4	5
Our company integrates knowledge of the environmental impact of products during customers' use	1	2	3	4	5
Our company integrates suppliers' knowledge and competencies on the environmental impact of components or materials	1	2	3	4	5
Our company integrates suppliers' knowledge and competencies on the environmental impact of production processes	1	2	3	4	5
Internal resource integration					
Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental sustainability unit) and design function/department within the company	1	2	3	4	5
Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental	1	2	3	4	5

sustainability unit) and production function/ department within the company					
Our company collaborates among specialized environmental unit (e.g. environmental sustainability managers, environmental sustainability unit) and marketing function/ department within the company	1	2	3	4	5
Resource building and reconfiguration					
Our company hires environmental specialists (e.g. experts on Life Cycle Assessment (LCA) and Design for Environment (DfE))	1	2	3	4	5
Our company organizes training (e.g. through attendance to conferences, workshops, and courses) for product development teams' members to upgrade their environmental knowledge and competencies	1	2	3	4	5
Our company organizes training (e.g. through attendance to conferences, workshops, and courses) for R&D staff to upgrade their environmental knowledge and competencies upgrading environmental knowledge and competencies	1	2	3	4	5
Our company strengthens environmental R&D (e.g. increasing the scope, increasing investments)	1	2	3	4	5
Our company reconfigures organizational structure to focus on environmental sustainability (e.g. creating a new division, reconfiguring product lines)	1	2	3	4	5
Our company reconfigures product development teams to include environmental specialists	1	2	3	4	5

Part D: Industry 4.0 technologies adoption: In this part, you will be asked to express your opinion on the industry 4.0 technologies adoption of your company. The following statements reflect the adoption of Industry 4.0 on different indicators. Please read each statement carefully and put a check mark (√) on a number that corresponds most closely to your response (Strongly disagree=1, Disagree=2, Neutral = 3, Agree = 4, Strongly agree=5)

Vertical integration : While Industry 4.0 adoption, our company's technological integration …….					
enhances employees' innovation performance enhances employees' innovation performance	1	2	3	4	5
helps employees manage the tools and techniques	1	2	3	4	5
enables the creation of various products	1	2	3	4	5
allows in improving the product quality	1	2	3	4	5
Horizontal integration : While Industry 4.0 adoption, our company's technological integration …….					
makes inventory-related information visible throughout the supply chain	1	2	3	4	5
helps to maintain a smart product order management system	1	2	3	4	5
allows for building cloud-based customer service data management	1	2	3	4	5
assists early market entrants	1	2	3	4	5

Part D: Sustainability performance: In this part, you will be asked to express your opinion on your company's sustainability performance during the last three years. The following statements reflect the sustainability performance on different indicators. Please read each statement carefully and put a check mark (√) on a number that corresponds most closely to your response (Strongly disagree=1, Disagree=2, Neutral = 3, Agree = 4, Strongly agree=5)

Environmental performance: During the last three years	1	2	3	4	5
Our company has reduced air emissions	1	2	3	4	5
Our company has reduced wastewater	1	2	3	4	5
Our company reduced solid waste	1	2	3	4	5
Our company reduced energy consumption	1	2	3	4	5
Our company has decreased the use of toxic materials	1	2	3	4	5
Our company has improved environmental compliance (comply with environmental standards, environment certification and audit process)	1	2	3	4	5
Our company has increased the usage of eco-friendly materials	1	2	3	4	5
Economic performance: During the last three years	1	2	3	4	5
Our company's market share has been improved	1	2	3	4	5
Our company's image has been improved	1	2	3	4	5
Our company's position in the marketplace has been improved	1	2	3	4	5
Our company has received increased orders from buyers	1	2	3	4	5
Social performance: During the last three years	1	2	3	4	5
Our company has improved relationships with the employees and community	1	2	3	4	5
Our company has improved workplace safety measures	1	2	3	4	5
Our company has improved the work environment	1	2	3	4	5
Our company has improved the living standard of the surrounding community	1	2	3	4	5
Our company has improved the wage structure of employees	1	2	3	4	5
Our company has improved employees' health security measures (pure drinking water, cleanliness and adequate toilet facilities)	1	2	3	4	5

Thanks for your time and efforts

Appendix C: **Declaration on identity**

DECLARATION ON IDENTITY

I, the undersigned, **Md. Sadrul Islam Sarker**, declare that **the printed and electronic versions** of the doctoral dissertation and thesis booklet **are identical in all respects**.

Sopron, 20_____ year _____ month _____ day

_____

signature of PhD candidate

Appendix D: **Legal declaration**

LEGAL DECLARATION

I, the undersigned, **Md. Sadrul Islam Sarker**, by signing this declaration declare that ..... my PhD dissertation was my own work; during the dissertation I complied with the Act LXXVI of 1999 on the rules of copyright and the rules of the doctoral dissertation prescribed by the Doctoral School, especially regarding references and citations.[1]

Furthermore, I declare that I did not mislead the supervisor (s) or the program leader with the dissertation.

By signing this declaration, I acknowledge that if it can be proved that the dissertation is not self-made or the author of a copyright infringement is related to the dissertation, the University of Sopron is entitled to refuse the acceptance of the dissertation.

I further declare that I am not in the process of obtaining a doctoral degree in the same discipline, that I am not in the process of having my doctoral degree revoked, and that I have not had a previously awarded doctoral degree revoked within 5 years.

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[1] *LXXVI. TV. 1999 Section 34 (1) Any person may quote the details of the work, to the extent justified by the nature and purpose of the receiving work and in the original, by the name of the source and the author designated there.*

Article 36 (1) Details of public lectures and other similar works, as well as political speeches, may be freely used for information purposes, within the scope justified by the purpose. For such use, the source, along with the author's name, should be indicated, unless this is impossible.

Appendix E: **Co-author's declaration**

Co-author's declaration
(each article must be declared on a separate page)

I/We, the undersigned **Dr. István János Bartók Ph.D** co-author agrees that **Md. Sadrul Islam Sarker** , a doctoral student **may use the results of the joint publication** titled **"Global trends of green manufacturing research in the textile industry using bibliometric analysis"** in his/her doctoral dissertation titled **"Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh".**

Sopron, 11 March 2025

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signature of co-author(s)

Co-author's declaration
(each article must be declared on a separate page)

I/We, the undersigned **Dr. István János Bartók Ph.D** co-author agrees that **Md. Sadrul Islam Sarker** , a doctoral student **may use the results of the joint publication** titled **''A Systematic Review of Green and Digital Transitional Factors in the Fashion Industry''** in his/her doctoral dissertation titled **''Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh''.**

Sopron, 11 March 2025

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signature of co-author(s)

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I/We, the undersigned **Dr. István János Bartók Ph.D** co-author agrees that **Md. Sadrul Islam Sarker** , a doctoral student **may use the results of the joint publication** titled **"A Bibliometric Review of Green Technology- Related Research in the Textile Industry"** in his/her doctoral dissertation titled **"Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh".**

Sopron, 11 March 2025

_____

signature of co-authors

Co-author's declaration
(each article must be declared on a separate page)

I/We, the undersigned **Dr. István János Bartók Ph.D and Dr. K. M. Faridul Hasan PhD** co-authors agree that **Md. Sadrul Islam Sarker** , a doctoral student **may use the results of the joint publication** titled **"Green Manufacturing Practices Towards Sustainable Development in the Ready-Made Garments (RMG) Industry of Bangladesh"** in his/her doctoral dissertation titled **"Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh".**

Sopron, 11 March 2025

signature of co-authors

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I/We, the undersigned **Dr. István János Bartók Ph.D and Thi Thuy Sinh Tran** co-authors agree that **Md. Sadrul Islam Sarker** , a doctoral student **may use the results of the joint publication** titled **Circular Economy Research Trends in the Textile and Apparel Industries: A Bibliometric Analysis** in his/her doctoral dissertation titled **"Sustainable Leadership and Sustainability Performance of the Ready-made Garments (RMG) Industry in Bangladesh".**

Sopron, 11 March 2025

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signature of co-authors

Appendix E: **Acknowledgements**

Acknowledgements

All praise belongs to Allah (SWT), the Lord of the worlds, whose infinite mercy and guidance gave me the strength and patience to complete this dissertation. His blessings deeply humble me. May Allah's blessings be upon Prophet Muhammad (SWA), his family, companions, and all followers, whose legacy continues to guide us toward excellence and virtue. This research would not have been possible without the unwavering support, encouragement, and invaluable guidance of those who stood by me throughout my doctoral journey. I am deeply grateful to each one of them.

I sincerely thank the Faculty of Economics, University of Sopron, and the Tempus Foundation for awarding me the Stipendium Hungaricum scholarship that enabled me to conduct my PhD research at this University.

My deepest gratitude goes to my supervisor, Dr Istvan Janos Bartok, for supporting me during my PhD journey and for his supervision and guidance. I am also thankful to Prof. Dr Csilla Obádovics, head of the doctoral school, for her support in continuing my doctoral studies and smoothly handling the PhD process. My extended appreciation goes to all the teachers and staff of the economics faculty and all my PhD colleagues, and special thanks to Emad for supporting me during my PhD journey.

I sincerely appreciate the efforts of the reviewers in evaluating my research work and providing me with valuable feedback. I am really indebted to them.

I want to thank all the participants of the interviews, respondents of the questionnaire survey, and their companies for their willingness to share their knowledge, time, and experience. I could not complete this research without their cooperation in data collection.

I am deeply indebted to my parents, siblings, and relatives, who always offered support and love during my PhD journey. I also acknowledge my friends and colleagues for their constant motivation and encouragement.

I want to convey my warmest and most profound appreciation to my wife, Kamrunnahar, and my 2.5-year-old son, Ihan Mutasir, for their love, immense sacrifice, and unconditional support during this journey.