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Source	*International Journal of Production Economics* Volume 248 (2022) 108496 Pages 1-19 https://doi.org/10.1016/j.ijpe.2022.108496 (Database: Science Direct)

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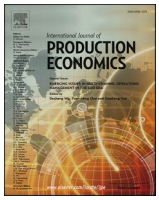

Adoption of circular economy practices in small and medium-sized enterprises: Evidence from Europe

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ABSTRACT

Circular Economy (CE) practices have the potential to enhance sustainability performance of organisations and therefore can help respond to United Nations Sustainability Development Goals. The aim of this research is to examine the adoption of CE in Euroepan small and medium sized enterprises (SMEs) and its impact on sustainability performance. We analyse the current state of CE practices and its impact on sustainability performance across key CE fields of action (design, procurement, production, distribution, consumption and recover) for SMEs in France, Greece, Spain and the UK A mixed-methods approach (survey, interviews, case studies) is undertaken to collect data from around 100 SMEs in each country, employing resource-based view as the theoretical lens. Our findings reveal that CE adoption can result into superior environmental performance through energy and resource efficiency, and waste reduction. Moreover, the 'design' function contributes the most towards the adoption of CE in SMEs, whereas the 'recover' function contributes the least, considering the current state-of-practices. From a theoretical perspective, we outline the issues and challenges, impact of support from customers and policymakers, and self-motivation of SMEs to adopt CE. Based on the findings, we propose an implementation framework for SMEs to develop organisation wide strategic initiatives for CE adoption in business operations.

1. Introduction

The European Union's (EU) target to become carbon neutral by 2050 is not achievable unless larger companies include small and medium sized enterprises (SMEs) in their supply chain within formers' carbon reduction programmes. SMEs account for the majority of businesses worldwide and are important contributors to job creation and global economic development. They represent about 90% of businesses and more than 50% of employment worldwide (World Bank Finance, 2021). For the EU, the average value that SMEs contribute to the economy is around 56 percent. During 2017, SMEs in the EU (approximately 25.1 million) employed over 94 million people, or approximately 66 percent of the workforce (Statista, 2021). In the UK, there are 6 million SMEs employing more than 16 million people, contributing close to 47% of the GDP (UK Small Business Statistics., 2021). The UK SMEs are likely to contribute more than £250 billion by 2025 to the GDP, which is 19% more than the current figure (OECD 2020 Economic Surveys).

SMEs create opportunities across wide range of geographical sectors and areas through employment and value creation, provide skills development opportunities and drive innovation, contributing directly to inclusive growth and social goals (OECD, 2017a and 2017b). However, existing literature and government reports estimate that SMEs have high environmental footprint (for e.g., contribute 60–70% of industrial pollution in Europe), particularly in the manufacturing sector (OECD, 2018a and 2018b). Manufacturing SMEs are reported to account for 64% of air pollution, whereas only a small proportion of 0.4% of these SMEs comply with an environmental management programme (Bonner, 2019). This can be attributed to the fact that a manufacturer spends more than 60 percent of its income on materials and services (Krajewski et al., 2010). This spending accounts for a large share of

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global resource consumption, pollution, and waste generation, which genitively impact green transformation (EU Commission Sustainability, 2021; EU Greed Deal, 2020). Therefore, original equipment manufacturers (OEMs), SMEs (supply chain partners) and other business customers directly and indirectly contribute to environmental pollution. Although 8 out of 10 SMEs plan to introduce more ethical and sustainable practices, 40% thought that sustainable practices were too costly to implement, while 42% claimed that the UK Government was not doing enough to encourage sustainable business practices (Edie newsroom, 2018). It is estimated that cost-effective energy efficiency measures could shave off as much as 30% of their consumption, namely 22 EJ, which is more energy consumed by Japan and Korea combined per year (IEA, 2015). Climate change issues are the major threat to mankind, which are caused by global warming through greenhouse gas emission. SMEs have the potential to become eco-innovators by enhancing their environmental performance through lean and green improvement measures.

The EU defines a SME as a business with fewer than 250 employees, a turnover of less than €50 million, or a balance sheet total of less than €43 million (European Commission, 2020). Within this umbrella, here are three different categories: medium-sized, small, and micro-businesses. These categories are defined by turnover and number of employees. SMEs' businesses are characterised by numerous competitions, demand side uncertainties, cash flow issues, lack of standardized business practices, skill shortage, and higher employee turnover (Dey et al., 2020a). Hence, SMEs, decisions on adopting environmental and social friendly practices (e.g. lean approach, eco-design, green procurement, employee wellbeing measures etc.) are governed by their economic performance. However, pressures from their customers and policymakers also play an important role in their strategic decision-making. There are several barriers to adopt advanced environmental measures within SMEs' businesses such as a lack of financial support, inadequate information management system, lack of proper technology, technical and financial resources, lack of consumer interest in the environment, lack of support from public institutions, lack of access to qualified professionals in environmental management, and lack of senior management commitment, which collectively lead to slower and/or unsuccessful uptake of circular economy within these organisations (Prieto-Sandoval et al., 2018; Ormazabal et al., 2016; Ritzén & Sandström, 2017; Rizos et al., 2016). This negatively impacts the long-term sustainability of SMEs which is critical for economic development, reducing environmental degradation resulting in climate change (referred to as code red for humanity by United Nations - UN 2021), and non-adherence to the low carbon action plans framed by the policy makers (e.g., EU carbon tax, EU ETS, 2021), which will be detrimental to global climate action plans.

The concept of circular economy (CE) has emerged as a major paradigm shift in the way that human society interacts with nature (Geissdoerfer et al., 2017). Attaining circular model requires cyclic and regenerative environmental innovation in the way society legislates, produces and consumes. It constitutes four emerging components to achieve sustainability: (1) recirculation of resources and energy; (2) the minimisation of demand for resources, and the recovery of value from waste (namely reuse, reduce, and recycle); (3) the need for a multi-level (micro, meso and macro) approach; and (4) its importance as a path to achieve sustainable development (Kristensen and Mosgaard, 2020). CE then manifests through closed loop supply chain functions – design, procurement, production, distribution, usage/consumption and recover (Stahel, 2016), and these functions are often referred to as CE fields of action.

Recent evidence suggests that CE is being adopted across the industries covering manufacturing (Lieder and Rashid, 2016), construction (Benachio et al., 2020; Dadhich et al., 2015), power (Wang et al., 2020), maritime sector (Milios et al., 2019), textile and apparel industry (Saha et al., 2021; Jia et al., 2020), and services sector (Fernandes et al., 2020). The current research focuses on design, implementation, and operations of CE (Suárez-Eiroa Suárez-Eiroa et al., 2019; Dey et al., 2020a) including performance analysis (Sassanelli et al., 2019; Malesios et al., 2018a) and raising awareness among the employees through training (Dey et al., 2019). Theoretically, prior research has contributed towards conceptualising CE (Suárez-Eiroa Suárez-Eiroa et al., 2019), its definitions (Farooque et al., 2019), business models (Pieroni et al., 2019), taxonomy of CE indicators (Kristensen and Mosgaard, 2020; Saidani et al., 2019), relationship between sustainability and CE (Liu et al., 2018), eco-innovation pathway to a CE (de Jesus et al., 2019), and cost-benefit analysis of CE (Gigli et al., 2019). Additionally, there are cross disciplinary approaches towards smart, resilient and sustainable CE through energy and water management, waste management, green policy and pollution minimisation strategy (Fan et al., 2019). Studies have also linked theory and practices of CE (Suárez-Eiroa Suárez-Eiroa et al., 2019) for digitization (Schalkwyk et al., 2018), product designing and business modelling (Pieroni et al., 2019), carbon footprint calculation (Wang et al., 2020), exploring the potential of additive manufacturing for product design (Lieder and Rashid, 2016), and reuse and remanufacturing (Suárez-Eiroa Suárez-Eiroa et al., 2019). Although the above studies are not particularly related to SMEs, the constructs are relevant to SMEs' CE adoption that covers various industries, multiple stakeholders' perspectives, technology enablers, and sustainability-oriented innovation.

Despite of the above mentioned developments, there is a strong scarcity of research in the field of CE from a multi-disciplinary perspective that facilitate real life applications (Nasir et al., 2017). Recent research indicates wide scope for further contributions covering – common way of measuring micro level CE and development of industry specific indicators (Saidani et al., 2019); consideration of social sustainability within the CE framework (Pieroni et al., 2019); developing business model for each phase of businesses (e.g. construction projects - Benachio et al., 2020); degree of circularity of the companies (Sassanelli et al., 2019); societal aspects of CE including social innovation and alternative economies (Türkeli et al., 2018); design for circularity, procurement and circular supply chain, biodegradable packaging, circular supply chain collaboration, drivers and barriers for circular supply chain, circular consumption, product liabilities, and producers' responsibility (Farooque et al., 2019); critical success factors, barriers, new business models and innovative framework for circular supply chain management (Lahane et al., 2020); case studies and prototypes using consensus building among the stakeholders through feasibility analysis to enable environmental sustainability (Fan et al., 2019); how green supply chain management theories facilitate to adopt CE and help build CE theories that not only help achieve environmental sustainability but also social sustainability (Liu et al., 2018); industry specific work on design, implementation and operational tools for 6R (redesign, reduce, reuse, recycle, remanufacture and repair) (Jia et al., 2020); revealing 3 levels of industrial ecology contribution to CE – conceptual, technical and policy aspects (Saavedra et al., 2018); circular business model through integration of waste, natural resources, environmental and economic aspects (Rosa et al., 2019; Battini et al., 2017). This research intends to address some of the above highlighted challenges.

Although, research has been undertaken on CE adoption in larger organisations (e.g., Lieder and Rashid, 2016), studies examining adoption of CE in SMEs are relatively scant (Dey et al., 2019). Additionally, prior research reveals the relationship between sustainability practices and performances along with the impact of various enablers, drivers, and external and internal pressures on economic, environmental, and social performance (Panda et al., 2017; He, 2017). However, there is lack of comprehensive approach for facilitating SMEs to adopt CE practices that objectively reveals current state of CE adoption, analyses issues and challenges, and derives improvement measures. Furthermore, comparative analysis of CE across geographical locations to reveal the best practices and means for achieving sustainability in SMEs is scant. A CE approach in the EU countries will encourage sustainability and competitiveness in the longer term. It will help preserving resources – including some of which are increasingly scarce (raw materials), or

subject to price fluctuation; reduce costs for European industries; unlock new business opportunities; build a new generation of innovative, resource-efficient enterprises – making and exporting green products and services around the globe; create local low and high-skilled jobs; and create opportunities for social integration and cohesion (EU Commission Sustainability, 2021).

As articulated above, although CE has been adopted in the industrial supply chains of European companies, there is still huge scope of enhancing circularity performance of SMEs supply chain in the EU countries. Considering recent conceptualizations and empirical studies, this research will address the following research questions (RQs) in the context of SMEs.

- **RQ1:** How CE fields of action (design, procurement, production, distribution, consumption and recover) are contributing towards sustainability (economic, environmental, and social) performance in the UK, France, Greece, and Spain?
- **RQ2:** Which CE field of action contributes to achieving superior sustainability performance in SMEs? What are the issues and challenges of each CE field of action to achieve superior sustainability performance? Do they vary across the research countries?
- **RQ3:** What measures across the CE fields of action in each participating country can be adopted to improve sustainability performance?

The rest of the paper is structured in six sections. Section 2 presents the theoretical framework and hypotheses for this research. Section 3 elaborates the methodology of the research including data analysis. Section 4 presents the results of the analysis, key findings, and validation of the model. Section 5 discusses the key findings linking them to the literature answering the three questions. Section 6 presents the theoretical and practical implications of the study. Section 7 concludes with the limitations of this research and future research directions.

2. Theoretical framework and hypotheses development

2.1. Background review

CE is proving to alter the traditional linear business model to circular (design, procurement, production, consumption, and recover) using reduce, reuse and recycle principles (Prieto-Sandoval et al., 2018). Prior research has looked into the impact of CE fields of action on sustainability performance (e.g., Dey et al., 2020a). Adhering to desired environmental and social goals as per legal regulations often makes the SMEs economically inferior as not only many environmental and social projects are cost intensive, but also these may not help them to attract customers. Scholars (e.g. Türkeli et al., 2018; Katz-Gerro and Sintas, 2019) have studied the effectiveness of circular economy model in China and some countries in the EU to resolve the dilemma between continuous top line growth, environmental and social goals. Businesses and in particular SMEs can achieve CE by transforming their linear business processes to circular (Prieto-Sandoval et al., 2018). Closed loop supply chain functions (i.e., design, procurement, production, distribution, usage and reverse logistics) enable to adopt CE which will enhance the sustainability performance. There are several benefits and opportunities (Prieto-Sandoval et al., 2018) for the SMEs adopting CE such as increased brand reputation, cost reduction (operational), business growth, higher productivity (throughput), recovery of environment through reduced CO2 emission, and greater sustainability. However, successful implementation of CE will depend on several internal and external organisational factors. External factors include public policy, market conditions, technological development, and stakeholders' actions, whereas internal factors are the firm's resources, capabilities, and competencies (Prieto-Sandoval et al., 2018).

Research by Katz-Gerro and López Sintas (2019) within 11,000 SMEs in EU-28-member states reveals that SMEs in the EU are likely to undertake waste minimisation, energy efficiency measures, redesigning products and services, using renewable energy, and water usage in descending order. The study by Prieto-Sandoval et al. (2018) reveals that the most motivating aspect of CE adoption is cost savings compared to building brand reputation and regulatory pressure. Kirchherr et al. (2017) identify cultural barriers such as lack of consumers' interest and awareness, which along with a hesitant company culture are considered as main barriers to adopt CE. They further reveal that these are driven by market barriers, which in turn are induced by a lack of governmental interventions. Rizos et al. (2016) present business models for adopting CE within SMEs' businesses and reveal that despite the various policy interventions, both organisational and policy barriers act as obstacles to implement CE. The study recommends emphasizing on company culture, consumer preference, and company's green business model. Prieto-Sandoval et al. (2018) demonstrate key strategies, resources, and capabilities for implementing CE in SMEs. Garcés-Ayerbe et al. (2019) analyse the CE practices of EU SMEs for facilitating implementation. They also identify the barriers to CE implementation as administrative processes, regulations, and lack of trained human resources. Ü; nal et al. (2019) have developed business models for designing CE using a case of an Italian SME in office supply industry.

Our study considers measuring the impact of circular economy fields of action on sustainability (economic, environmental, social) performance of SMEs in the research countries. The components of closed loop supply chain – design, procurement, production, distribution, consumption, and recover are considered as latent variables for CE fields of action. Revenue, business growth and contribution to local economy; energy efficiency, resource efficiency, waste management; employee wellbeing, health and safety, and social wellbeing are considered as proxies for economic performance, environmental performance, and social performance, respectively. The theoretical framework for examining the relationships between CE fields of action and sustainability performance of SMEs is shown in Fig. 1. Table 1 shows the constructs, sub-constructs and proxies of CE and sustainability performance along with their sources derived from extant literature (Ünal et al., 2019; Kumar et al., 2019; Prieto-Sandoval et al., 2018; Katz-Gerro and López Sintas, 2019; Zhu et al., 2007; Sassanelli et al., 2019; Geissdoerfer et al., 2017; Dey et al. 2018, 2019; Malesios et al. 2018, De et al., 2020). Appendix A provides the narratives of all constructs and sub-constructs for circular economy fields of action and sustainability performance.

2.2. Theoretical lens

The study is developed on the tenets of resource-based view (RBV) of the firm (Barney, 1991). The RBV is a strategic managerial framework often used to determine the internal resources that an organisation can exploit to achieve enhanced sustainability performance. The RBV focuses on the organisation's internal resources such as assets, capabilities and competencies with the potential to deliver superior competitive advantages (Hooley et al., 2001). While traditionally RBV is focused on intra-organisational resources and capabilities, research has also pointed out the importance of inter-organisational routines that facilitates enhancing the ability to manage inter-organisational relationships to improve business performance (Dyer and Singh, 1998; Kale et al., 2002). RBV focuses not only on the intra-organisational capabilities but also supply chain collaboration through strategies, resources, and competences of all the concerned stakeholders that can enhance sustainability performance. Fig. 2 presents the conceptual framework of this research stemming from the literature discussed in the subsequent sections and by adopting the RBV theoretical lens.

2.3. Hypotheses

The closed loop supply chain functions (discussed in the preceding sections) contribute towards transforming SMEs supply chain from linear to circular through eco-design, green procurement, green

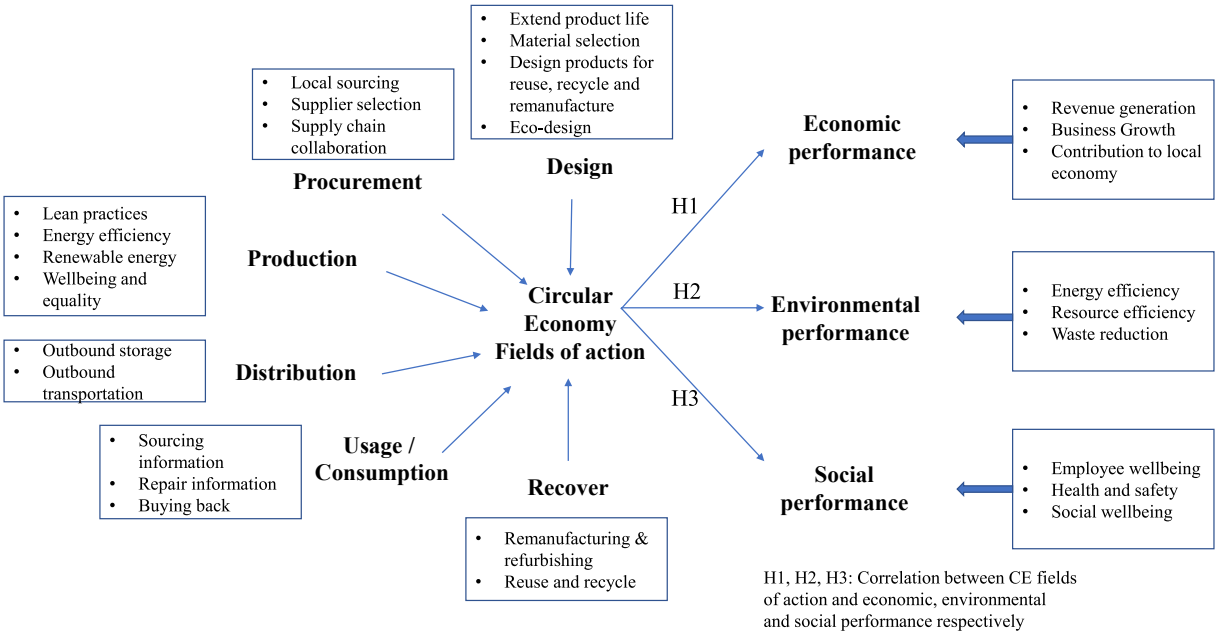

Fig. 1. Theoretical Model relating constructs and latent variables of circular economy and sustainability performance.

manufacturing, green logistics, and recycling products (Tseng et al., 2018; De et al., 2020). These require transforming the products, processes, people and facilities. For many SMEs, they are very capital-intensive projects, their payback period is lengthy, and return on investment is likely to be uncertain. However, the customers (e.g. original equipment manufacturers [OEM], public sector units, retailers etc.) of SMEs might prefer green suppliers (i.e. SMEs) that enhances businesses of SMEs with CE (Dey et al., 2015; Ho et al. 2010, 2011; Scott et al., 2015). Therefore, there are instances of SMEs with CE principles in their supply chain that will help them to achieve higher revenue and business growth in the long run (Dey et al., 2020a). Additionally, material and supplier selection, reducing risks of price volatility in materials, supply chain collaboration, lean practices, energy efficiency measures, third party logistics, reuse and recycle may be cost effective (Lee, 2008; Kumar et al., 2019). Hence, this research intends to reveal whether in SMEs in the EU countries, CE supported by closed loop supply chain variables will lead to achieving higher economic performance. Accordingly, we hypothesise that:

H1. *Circular economy fields of action* are positively correlated to *economic performance*.

Although SMEs emphasize on economic performance over environmental and social to remain competitive, products design is largely guided by customers, and if SMEs have long term relationship with their customers, production processes are also aligned with customers' requirements. The environmental performance of SMEs in this situation is likely to be higher than the other two (i.e. social and economic) if customers follow the principles of CE. Procurement decisions are made predominantly with economy focused by SMEs to keep the production cost lower, unless customers have specific requirements. However, SMEs' customers (e.g. OEM) may specify materials from specific source that leads them to give up their economy focused approach. Lean practices, energy efficiency measures, and use of renewable energy for production help achieve higher environmental performance (Liu et al., 2018; Tseng et al., 2016; Zhu et al., 2007; Malesios et al. 2018; Dey et al., 2020b), though these are all predominantly economy focused. Wellbeing measures of for SMEs' workforce create a positive impact on environmental performance of SMEs, as wellbeing fosters a conducive productive climate across the various functions of the organisation (Dey et al., 2019, 2020a). For many SMEs, the third party logistics reduces carbon footprint drastically. Various initiatives such as making product information on sources of raw materials, repair opportunities available, provision for buy back, etc. contribute toward lowering carbon footprint with higher environmental performance. Additionally, reverse logistics always contributes to higher environmental performance, although they may be capital intensive (Zhang et al., 2015). However, there are instances of SMEs that have also implemented several measures for practicing closed loop supply chain without achieving desired environmental performance (e.g. lean approach helped many SMEs to be efficient but not environmentally responsive). Based on such assumptions, we hypothesise that:

H2. *Circular economy fields of action* are positively correlated to *environmental performance*.

Training workforce for undertaking all the functions of closed loop supply chain following reduce, reuse and recycle principles foster a conducive environment for CE that leads to achieve higher social performance. Although, sourcing locally may help to enhance the social performance by facilitating growth of local economy, but it is unlikely to result in superior economic performance (Blome et al., 2014; Testa et al., 2016). However, many SMEs prefer this to reduce risk of supplies. Although use of regenerative materials, eco-design, additive manufacturing, lean approach etc. are predominantly adopted due to achieve superior environmental performance, they also contribute to higher social performance as SMEs adopting various advanced environmental measures are likely to transform their manpower culturally. These also contribute to achieve higher competitiveness and in turn economic performance. Additionally, closed loop supply chain activities leading to CE adoption transform organisations from efficient to resilient and form a collaborative environment across their supply chain (Dey et al., 2019). However, prior research has also seen contradictory outcomes, where most of the closed loop supply chain activities could not contribute to achieving higher social performance even if they are exclusively implemented for superior social performance (Asif and Searcy, 2014; Morioka and de Carvalho, 2016). Hence, we hypothesise that:

H3. *Circular economy fields of action* are positively correlated to *social performance*.

Table 1
Constructs and variables of CE and sustainability performance of SMEs.

Constructs	Closed loop supply chain functions/ variables	Proxies	Sources (References)
Circular Economy	Design	Design aim is to extend product life Material selection Design products for reuse, recycle and remanufacture Eco-design	Ünal et al., 2019; Kumar et al., (2019); Prieto-Sandoval et al. (2018); Katz-Gerro and López Sintas (2019);
	Procurement	Applying environmental and social criteria in the selection of suppliers Local sourcing to mitigate risks Supply chain collaboration	Zhu et al. (2010); Sassanelli et al., (2019); Geissdoerfer et al., (2017); Dey et al., (2019); Dey et al., (2018); Malesios et al. 2018; De et al. (2020)
	Production	Lean practices Energy efficiency Use of renewable energy Wellbeing and equality	
	Distribution	Outbound storage Outbound transportation	
	Usage/ consumption	Providing repair information Providing sourcing information Buying back used products from customers	
	Reverse Logistics	Remanufacturing and refurbishing Reuse and recycle	
Sustainability performance	Economic performance	Revenue Business growth Contribution to local economy	Dey et al., (2019); Dey et al., (2018); Malesios et al. 2018; De et al. (2020)
	Environmental performance	Energy efficiency Resource efficiency Waste reduction	
	Social performance	Employee wellbeing Health and safety Social wellbeing	

3. Methodology

3.1. Methodological steps

The study adopts both quantitative and qualitative methods. Firstly, through literature review the constructs and sub-constructs for CE fields of actions (e.g. SMEs' closed loop functions and their proxies) and sustainability performance (economic, environmental and social performance) are identified (see Table 1) and a framework (see Fig. 2) for analyzing their relationship is designed along with development of hypotheses. Appendix A provides narratives of the constructs and sub-constructs. Secondly, a questionnaire survey in line with the proposed framework and hypotheses is developed to examine the correlation among the proposed constructs. Thirdly, a survey is conducted with SMEs in each of the four countries – the UK, Greece, France and Spain. Fourthly, the responses are processed using structural equation modelling (SEM) to reveal the relationships among each CE field of action and sustainability performances. Fifthly, this leads to identifying the issues and challenges pertaining to each CE field of action to achieve sustainability performance. Sixth, the improvement measures (resources, strategies, and competences) are captured using focus groups with the managers of selected SMEs in each participating country. Finally, the results are validated through a case study in each country.

3.2. Survey, focus groups and case study methods

The survey responses were received from around 100 SMEs' representatives in each country. The countries have been chosen on the basis of their economies (e.g. similarities and differences). The UK is a highly developed economy with industry contributing 19.2% of the GDP and very low unemployment rate (3%), compared to other EU countries. France is also a highly developed economy (second after Germany in the EU) with slightly higher (9%) unemployment rate and 19.5% contribution to the GDP by the industry. Spain is less developed compared to France and the UK but % GDP contribution by industry is higher (23.2%), but unemployment rate is more than France (13%). Greece is relatively a smaller economy. However, its GDP contributions by industry is 15.28%, which is close to the UK and France, but with a higher unemployment rate (16% in 2019) due to ongoing financial crisis. Therefore, these four countries could represent other EU countries in terms of economy and other characterises to further help generalise the findings of this study for other EU countries.

The responses were analysed to estimate the relationship of the variables within the model using SEM (Bollen, 1989; Hussey and Eagan, 2007) via AMOS. The SEM technique models the causal relationships between variables (constructs). Their distinguishing feature is that variables in contrast to typical regression analysis techniques can be either directly observed or latent or a mixture of both of these. This type of modelling is deemed to be most suitable for testing hypotheses and establishing correlations in our paper.

The SEM model was fit by the method of weighted least squares (Joreskog, 1994), which is the estimation method that is most suitable for the type of non-normal data gathered by the survey. Regarding the fit assessment of the fitted SEM model, we test its validity by using several alternative fit statistics (Marsh and Balla, 1994), such as the GFI (goodness-of-fit index), the AGFI (adjusted goodness-of-fit index) and the PGFI (parsimonious goodness-of-fit index), with AGFI adjusting the GFI for the complexity of the fitted model. Typically, for a good fit the

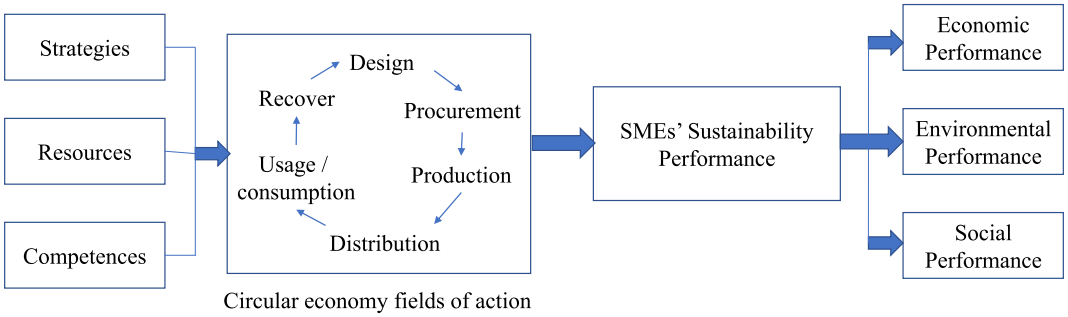

Fig. 2. Conceptual Model for Resource Based View of SMEs Sustainability Performance through Circular Economy Fields of action.

indices should be above 0.9, however this cut-off threshold has been often criticized. The demographic details of the sampled SMEs are provided in Table 2.

The focus groups were undertaken involving representatives of SMEs, their customers and suppliers, policymakers, and researchers. Table 3 provides demographic information of the focus groups in each country. Four focus groups were conducted. Other than the SMEs representatives each focus group was attended by minimum five researchers from the participating universities to facilitate the focus groups. For case studies, four SMEs were chosen randomly, one from each country. For undertaking case studies, a team of four persons (two researchers and one senior manager from the case study company) was formed. They interacted with concerned people in the company following the templates for information gathering and a report was developed. In an average, each case study required 20 h hands on time with around a week elapsed time.

3.3. Data collection and analysis

A questionnaire (Appendix B) is developed using the theoretical model (Fig. 2) for the survey to test the three hypotheses and address the research questions. The study adopts a quantitative research approach to analyse the responses gathered from a total of 401 EU SMEs (98 in Greece, 104 in France, 99 in Spain and 100 in the UK). The questionnaire was filled by the selected SMEs managers, directors and/or owners (see Table 2). The items utilized for SEM modelling are tested for reliability and validity performance. In particular, the Cronbach's α (Bollen, 1989) along with the percentage of variance of the selected items explained by each of the latent factors are calculated and they are within the acceptable limits.

The survey was completed using an on-line survey platform (www.qualtrics.com) through third party. All the contacted persons responded to the questionnaire. All data were saved anonymously on the Qualtrics platform database. Certain quotas included in the design of the survey have ensured that the sample collected is representative of SMEs in each of the four countries, including the wide geographical distribution of companies in each country. The questionnaire included questions on both the assessment of sustainability performance (i.e., economic, environmental and social), as well as items associated with the circular economy fields of action implemented in these companies using the functions of closed loop supply chain (see Appendix B). The conceptual model for CE and sustainability performance proposed in this paper is tested through the SEM approach (Bollen, 1989). All the latent variables used in our SEM analyses are measured via the indicator variables developed from the responses obtained. To ensure a high degree of validity, we used multiple indicators to measure each construct, based on prior literature. We explore the direct connections between the CE constructs and the latent variables of economic, environmental and social performance, by fitting four SEM models, employing the data related to each country.

Table 2
Demographic Details of SMEs, who participated in survey.

Title	Number			
Type of employees	Greece	France	Spain	The UK
Owner	23	19	10	22
Production manager	25	15	17	13
Marketing manager	14	19	12	11
Supply chain manager	12	17	15	15
Purchasing manager	4	11	11	19
Quality manager	10	12	15	10
Maintenance manager	10	11	19	10
Total	**98**	**104**	**99**	**100**
Industry category				
Primary metal manufacturing	25	13	17	24
Fabricated metal product manufacturing	15	17	11	12
Machinery manufacturing	13	21	13	17
Electrical equipment and components manufacturing	13	5	12	9
Chemical manufacturing	10	12	16	13
Food and beverage manufacturing	7	17	9	13
Apparel manufacturing	10	11	11	7
Wood product manufacturing	5	8	10	5
Total	**98**	**104**	**99**	**100**

Table 3
Demographic Details of SMEs, who participated in Focus groups.

Title	Number			
Type of employees	Greece	France	Spain	The UK
Owner	2	0	0	3
Production manager	2	2	1	3
Marketing manager	1	3	2	0
Supply chain manager	3	3	2	3
Purchasing manager	1	2	3	3
Quality manager	1	2	2	2
Maintenance manager	1	1	0	2
Total	**11**	**13**	**10**	**16**
Industry category				
Primary metal manufacturing	1	3	2	3
Fabricated metal product manufacturing	3	1	0	3
Machinery manufacturing	1	2	0	2
Electrical equipment and components manufacturing	1	3	3	2
Chemical manufacturing	1	1	2	1
Food and beverage manufacturing	2	1	2	3
Apparel manufacturing	2	0	0	1
Wood product manufacturing	0	2	1	1
Total	**11**	**13**	**10**	**16**

4. Results

4.1. Results of reliability and validity analysis

Table C1 in Appendix includes the percentage of variance explained by the corresponding constructs and sub-constructs as fitted in the SEM model as well as the Cronbach's alpha values, for evaluating the validity and reliability of the questionnaire. In general, results show that the utilized constructs are adequately addressing the reliability and validity prerequisites with only few exceptions. The collected data from the four countries do not suffer from common method bias, with variance explained by each construct being higher than 50%, with few exceptions near the borderline.

4.2. Checking goodness-of-fit for the country-level SEM models

Goodness-of-fit (GoF) statistics for all the examined models show that the path analysis structures tested provided a good fit, since that most of the values are above the acceptable limits or at the borderlines (see Table 4). Among the four fitted SEM models, the best fit has been observed to relate to the Greek SME data (See Table 4).

4.3. Estimated parameters

In order to test the influence of the CE on the three sustainable

Table 4
Goodness-of-fit statistics for the four SEM models.

Country	GoF measures			
	RMR	GFI	AGFI	PGFI
Spain	0.07	0.918	0.887	0.825
France	0.10	0.875	0.824	0.793
UK	0.09	0.887	0.857	0.806
Greece	0.06	0.927	0.901	0.882

Table 5
Estimated standardized path coefficients of the SEM models (Greece, France, Spain, UK).

Constructs			Country							
			Greece		France		Spain		UK	
			Estimate	P	Estimate	P	Estimate	P	Estimate	P
Circular economy	→	Economic performance	0.450	**	0.702	***	0.446	**	0.278	**
Circular economy	→	Environmental performance	0.805	***	0.685	***	0.622	***	0.795	***
Circular economy	→	Social performance	0.334	*	0.726	***	0.275	*	0.488	**
Distribute	→	Circular economy	0.308	*	–	n.s.	–	n.s.	–	n.s.
Reverse logistics	→	Circular economy	–	n.s.	–	n.s.	–	n.s.	−0.348	**
Usage/consumption	→	Circular economy	–	n.s.	–	n.s.	–	n.s.	0.222	*
Design	→	Circular economy	0.478	**	0.536	***	0.671	***	0.891	***
Procurement	→	Circular economy	−0.335	**	0.232	*	0.579	***	–	n.s.
Production	→	Circular economy	0.403	**	0.445	***	–	n.s.	–	n.s.

*: p < 0.1; **: p < 0.05; ***: p < 0.01; n.s.: non-significant.

performance constructs (economic, environmental and social) that contribute to the SMEs' enhanced sustainability, a total of four SEM analyses were performed respectively, testing the hypothesized model structure of Fig. 2, deriving results separately for the SMEs in the UK, France, Spain and Greece data in order to identify possible geographical similarities and diversifications (see Table 5). The path diagrams obtained by the fit of the four country-specific models are shown in Figs. 3–6. The single-headed arrows in the path diagrams are used to imply a direction of assumed causal influence while the numerical values next to each arrow correspond to the standardized regression weights of the corresponding item on the latent construct while the statistical significance of each weight is also indicated. The dashed lines in the path diagrams indicate no statistical significance for the specific associations.

4.4. SEM analysis

Table 4 summarizes the results of the fit of the structural equation models on the SME data, broken down at the country level (Table C2 in the Appendix presents a more detailed picture of estimations from SEM model, with all standardized path coefficients between (sub)-factors and observed items in the model).

By examining the separate SEM models' results we observe certain differentiations regarding the results of estimated standardized path coefficients. First, the model based on the SME data in Greece shows a statistically significant effect of the CE factor on all three sub-constructs of sustainability performance, with most dominant effect being on the environmental performance sub-construct of sustainability (beta = 0.805; p-value<0.01). It seems that for Greek SMEs, the main positive effect of CE practices is on the environmental aspect, second on the economic aspect (beta = 0.45; p-value<0.05) and to a less extend on the social aspect (beta = 0.334; p-value<0.1). Therefore, SMEs in Greece with CE implemented are quite likely to have greater environmental performance than economic and social performances. Additionally, CE is likely to contribute to achieving SMEs' business growth, energy efficiency, resource efficiency, waste reduction, employee wellbeing and health and safety. However, they are likely to not facilitating revenue generation, contributing to local economy and social wellbeing. Additionally, the factor loading of latent variables of SMEs in Greece reveals that design, operations, and distribution contribute to CE, whereas procurement negatively affects CE, and usage and reverse logistics are not related to CE at all. Therefore, it implies that 'procurement' needs substantial improvement, and 'use' and 'recover' could also be improved to contribute to CE. In other words, design, production and distribution functions of closed loop supply chain contributes to CE implementation, procurement function is negatively relating to CE, and usage and reverse logistic are neutral for CE implementation in SMEs in Greece. Fig. 3 depicts the correlations between CE and economic, environmental and social performances of SMEs in Greece with factor loading for all the variables related to CE and sustainability performances.

We found a highly positive association between CE and all three sub-factors of sustainability performance. CE is highly positively related to economic performance (beta = 0.702; p-value<0.01), environmental performance (beta = 0.685; p-value<0.01) and social performance (beta = 0.726; p-value<0.01). Therefore, any SME in France implementing CE is likely to have higher economic, environmental, and social performances. Hence, a more balanced and important effect of CE on sustainability performance is observed for the French SMEs. The analysis

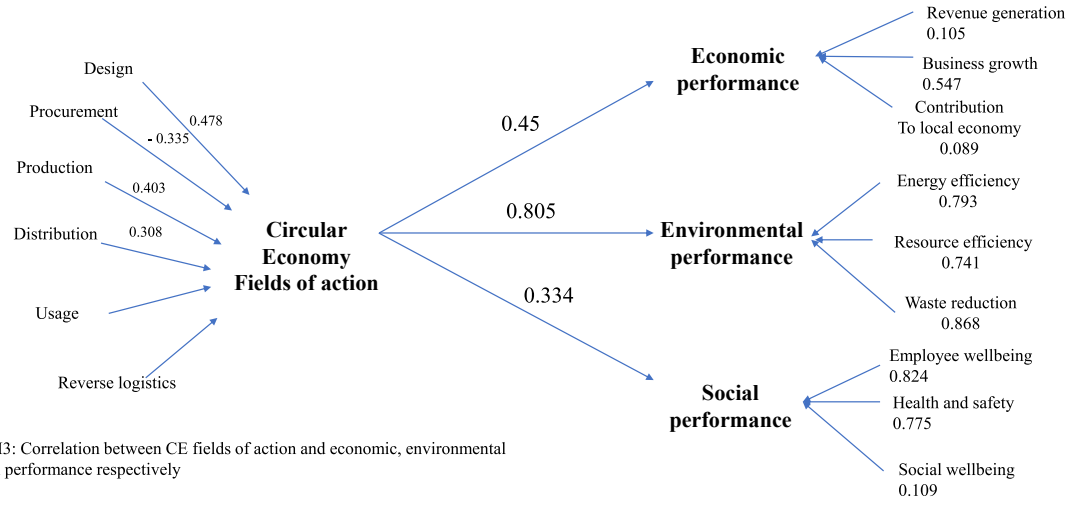

Fig. 3. Results showing among the constructs and latent variables of circular economy and sustainability performance of SMEs in Greece.

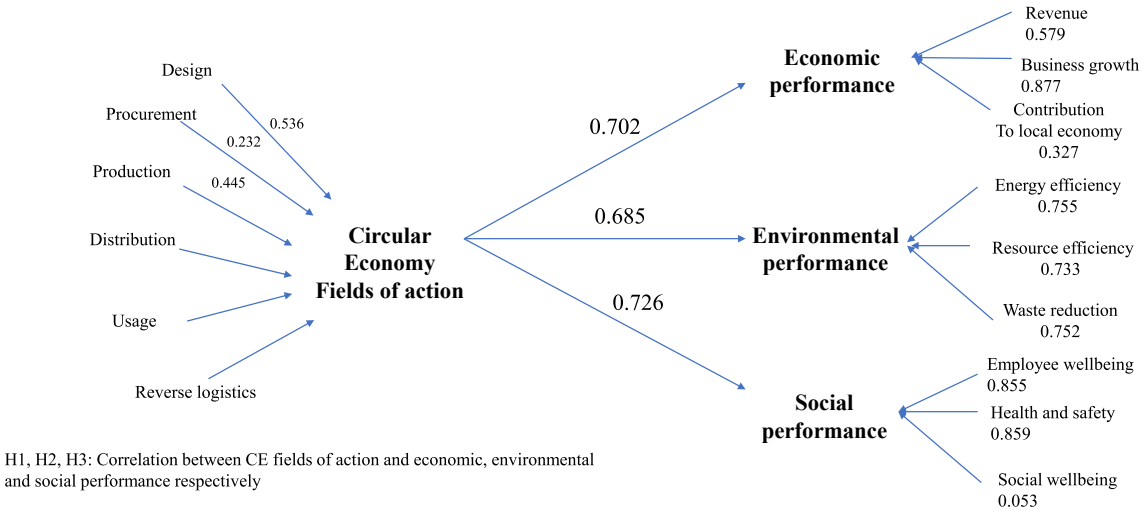

Fig. 4. Results showing among the constructs and latent variables of circular economy and sustainability performance of SMEs in France.

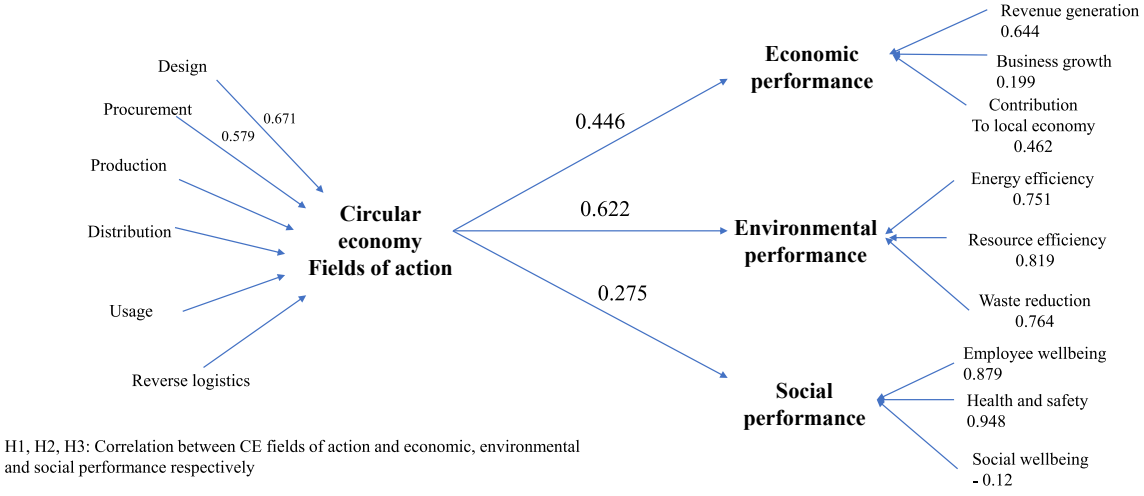

Fig. 5. Results showing among the constructs and latent variables of circular economy and sustainability performance of SMEs in Spain.

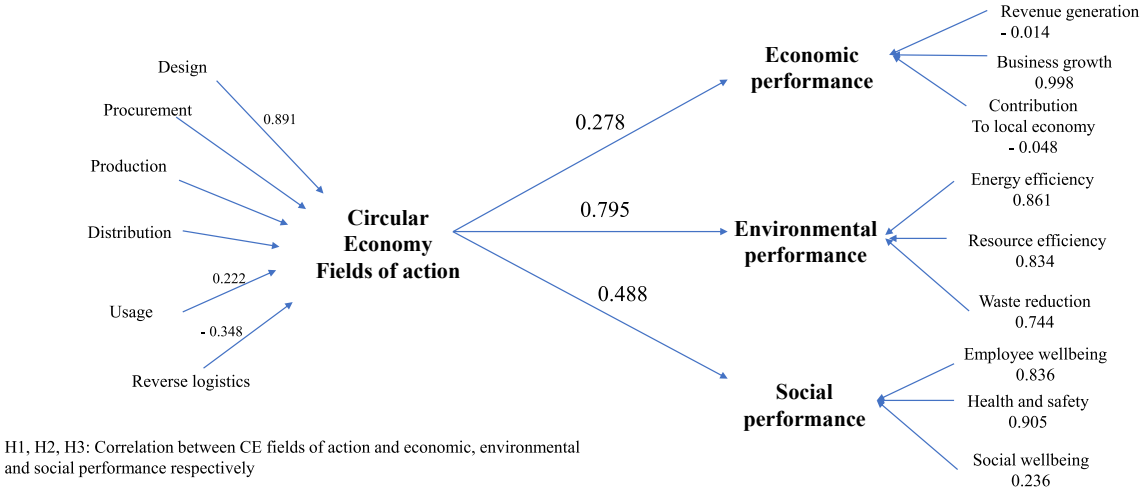

Fig. 6. Results showing among the constructs and latent variables of circular economy and sustainability performance of SMEs in the UK.

reveals that SMEs in France are also likely to achieve higher revenue, business growth, energy and resource efficiency, waste reduction, employee wellbeing, health and safety standard, but without any impact on contribution to the local economy and social wellbeing through CE adoption. Among the closed loop supply chain functions of SMEs in France, only design and production contribute to CE. Other functions

(procurement, distribution, usage, and reverse logistics) have room for practicing circularity more effectively. In other words, SMEs in France are likely to have only design and production function following circular economy principles closely, which is sufficiently strong enough to contribute to enhancing the overall sustainability performance. If other functions could be improved alongside, there is opportunity to further enhance the sustainability performance of SMEs in France. Fig. 4 demonstrates the relationship between CE and sustainability performance along with their latent variables for SMEs in France.

The SMEs in Spain are also likely to achieve higher environmental performance (beta = 0.622; p-value<0.01) through CE adoption compared to economic (beta = 0.446; p-value<0.05) and social (beta = 0.275; p-value<0.1) through CE adoption. Although higher revenue, energy and resource efficiency, waste reduction, employee wellbeing, and health and safety are likely to enhance but business growth, contribution to economy, and social wellbeing outcomes may remain unchanged with CE implementation and operations. Design and procurement functions contribute to CE adoption within SMEs in Spain. Other functions are quite unrelated to CE. As there is room for improving economic and social performance, SMEs in Spain are likely to achieve enhanced sustainability performance through improving practicing CE principles in production, distribution, usage, and reverse logistics functions. Fig. 5 reveals the relationship between CE and sustainability performance along with their latent variables for SMEs in Spain.

The environmental performance is likely to be higher (beta = 0.795; p-value<0.01) than economic (beta = 0.278; p-value<0.05) and social performance (beta = 0.488; p-value<0.05), for SMEs in the UK, Greece and Spain. While business growth of the UK SMEs is assured through CE adoption, higher revenue and contribution to local economy are less likely. Social performance with respect to employee wellbeing, and health and safety are likely to be higher but social wellbeing has room for improvement. Design is likely to be the only closed loop supply chain function that contributes to adopt CE within the UK SMEs. On the contrary, reverse logistics is likely to hinder the CE adoption. While usage is weekly related to CE, other three functions – procurement, production, and distribution are not related to CE. Therefore, procurement, production, distribution and usage could be improved for enhancing economic and social performance. Fig. 6 demonstrates the relationship between CE and sustainability performance along with their latent variables for SMEs in the UK.

4.5. Hypothesis results

Hypothesis 1 proposed a positive correlation between *CE fields of action* and *economic performance*. The results of each country reveal that CE is positively related to economic performance of SMEs. Therefore, SMEs in the research participating countries are likely to achieve higher economic performance if they adopt the practice of CE. However, SMEs in France are likely to achieve much higher economic performance than SMEs in the other three countries. Hence, there is room for improving economic performance of SMEs in Greece, Spain and the UK. Economic performance related to higher revenue generation and greater contribution to local economy of SMEs in Greece and the UK need attention, whereas, business growth is the greatest challenge to SMEs in Spain. The findings of this research thus support hypothesis 1 and are aligned with previous research but make useful and novel contextual (for the four countries) empirical contribution.

Hypothesis 2 proposed a positive linkage between *CE fields of action* and *environmental performance*. The results reveal that SMEs of all the participating countries are likely to achieve higher environmental performance upon adopting the practice of CE. All energy and resource efficiency, and waste reduction are likely to be quite higher with CE implementation. Thus, contributing towards national 'net zero' initiatives. Therefore, the results support hypothesis 2.

Hypothesis 3 proposed a positive correlation between *CE fields of action* and *social performance*. Our results indicate that the adoption of CE practices is likely to positively contribute towards social performance of the sample SMEs in our research, but not equally in each participating country. While SMEs in France are likely to achieve very strong social performance through CE adoption, there is room for improvement for SMEs in other countries. SMEs in Greece, Spain and the UK are likely to be performing well in employee wellbeing, and health and safety performance, but less in social wellbeing. Hence, SMEs in these countries could improve their social performance by deriving means for improving social wellbeing. Nevertheless, the study results support hypothesis 3.

Table 6 consolidates the findings of this research with respect to each hypothesis along with related references to the current literature, which show the current state of performance of SMEs in each country and their comparative positions.

The CE fields of action correlate and contribute to the economic performance. The study outcome is aligned with previous research Lee (2008), Kumar et al. (2019), Dey et al. (2020a), Lieder and Rashid (2016). The study also finds that CE strongly correlates to the environmental performance, which is aligned with Liu et al. (2018), Tseng et al., 2016; Zhu et al. (2007), Dey et al. (2020b), Rashid, et al., 2013 Geissdoerfer et al. (2017). There are few studies (e.g. Andersen, 2007; Allwood, 2014), which negatively contribute to the environmental performance. The negative correlation is due to the parameters consider in the above-mentioned study. Andersen (2007) and Allwood (2014) argue about the increase in energy consumption in the process of recycling products. Circular economy is correlated with social performance in line with the studies like Blome et al. (2014); Testa et al. (2016), Asif and Searcy (2014), Morioka and de Carvalho (2016), and Dey et al. (2019a,b). However, many studies do not correlate circular economy with social sustainability (Gray et al., 2014; Haynes and Murray, 2015).

Table 7 shows comparative analysis of correlation of the closed loop supply chain functions with CE philosophy of SMEs in each country along with issues and challenges so as to derive improvement measures. The design function of closed loop supply chain contributes to CE adoption in SMEs in each participating country. In other words, SMEs across the participating EU countries are likely to have design function aligned with CE requirements to contribute to sustainability performance. Procurement function negatively contributes to CE adoption in turn sustainability performance of SMEs in Greece, partially in France, strongly in Spain, but doesn't contribute towards CE adoption at all in SMEs in the UK. Production function of closed loop supply chain facilitates SMEs in Greece and France partially to adopt the practice of CE and in turn sustainability performance, whereas and surprisingly, the production function of SMEs in the UK and Spain is not aligned with CE requirements to achieve higher sustainability performance. Similarly, the distribution function helps only SMEs in Greece to partially adopt the practice of CE but there is no linkage between distribution and CE adoption in SMEs in other countries. Also, usage and reverse logistics do not relate to CE adoption in SMEs in Greece, France and Spain. However, while usage helps SMEs in the UK partially, reverse logistics negatively links to CE adoption. Therefore, reverse logistics function needs substantial improvement within SMEs in the UK in order to enhance CE adoption and in turn to enhance sustainability performance.

4.6. Improvement measures to enhance circular economy adoption in SMEs

To further develop our empirical and contextual contributions and complement our survey findings, we utilized the conceptual model, survey questionnaire and results to develop a focus group template (see Appendix D) to derive improvement measures to enhance sustainability of SMEs' business through CE adoption. A focus group in each country was organized to determine the issues and challenges of adopting CE from the design, procurement, production, distribution, usage and recover perspectives and sustainability performance as shown in Fig. 2. The outcomes of the focus groups are summarised in Table 8.

Table 6
Comparative analysis of contribution of circular economy on sustainability performance.

Hypotheses	Countries				Previous research
	Greece	France	Spain	The United Kingdom	
H1: Correlation between circular economy and economic performance	CE is partially correlated to economic performance. Although SMEs in Greece are likely to get economic benefits with CE adoption, there are rooms for improvement in revenue generation and contributing to local economy.	CE is strongly correlated to economic performance. SMEs in France get economic benefits with CE adoption.	CE is partially correlated to economic performance. Although SMEs in Spain are likely to get economic benefits with CE adoption, there are rooms for improvement in business growth and contributing to local economy.	CE is partially correlated to economic performance. Although SMEs in the UK are likely to get economic benefits with CE adoption, there are rooms for improvement in revenue generation and contributing to local economy.	The findings are aligned with previous research (Lee 2008; Kumar et al., 2019; Dey et al., 2020a)
H2: Correlation between circular economy and environmental performance	CE is strongly correlated to environmental performance. SMEs in Greece improve their environmental performance substantially with CE adoption.	CE is strongly correlated to environmental performance. SMEs in France improve their environmental performance substantially with CE adoption.	CE is strongly correlated to environmental performance. SMEs in Spain improve their environmental performance substantially with CE adoption.	CE is strongly correlated to environmental performance. SMEs in the UK improve their environmental performance substantially with CE adoption.	The findings are aligned with previous research (Liu et al., 2018; Tseng et al., 2016; Zhu et al., 2007; Dey et al., 2020b)
H3: Correlation between circular economy and social performance	CE is partially correlated to social performance. Although SMEs in Greece are likely to achieve desired social performance with CE adoption, there are rooms for improvement in social wellbeing	CE is strongly correlated to social performance. SMEs in France enhance social performance through CE implementation.	CE is partially correlated to social performance. Although SMEs in Spain are likely to achieve desired social performance with CE adoption, there are rooms for improvement in social wellbeing	CE is partially correlated to social performance. Although SMEs in the UK are likely to achieve desired social performance with CE adoption, there are rooms for improvement in social wellbeing	The findings are aligned with previous research (Blome et al., 2014; Testa et al., 2016; Asif and Searcy, 2014; Morioka and de Carvalho, 2016; Dey et al., 2019)

Table 7
Comparative analysis of contribution of closed loop supply chain functions on circular economy.

Closed loop supply chain functions	Countries				Previous research
	Greece	France	Spain	The United Kingdom	
Design	Partially contributes to achieve CE	Strongly contributes to achieve CE			Dey and Cheffi (2013); Dey (2012); Howard et al., (2019); Atabaki et al., (2020); Tseng et al., (2020)
Procurement	Negatively contributes to CE	Partially contributes to achieve CE	Strongly contributes to achieve CE	Currently does not contribute to achieve CE	
Production	Partially contributes to achieve CE		Currently does not contribute to achieve CE		
Distribution	Partially contributes to achieve CE	Currently does not contribute to achieve CE			
Usage/consumption	Currently does not contribute to achieve CE			Partially contributes to achieve CE	
Reverse Logistics	Currently does not contribute to achieve CE			Negatively contributes to CE	

The participants also discussed on various best practices from their experience. As a result of their brainstorming, innovative improvement measures for CE adoption were derived that would likely to enhance sustainability performance. These have been presented in Table 9.

4.7. Validation of the results

We further validated the results from survey and focus groups through case studies in four SMEs, one each in Greece, France, Spain and the UK by conducting interviews with senior managers, in order to achieve robustness in our research findings. The interview protocol (Appendix E) was developed in line with the theoretical model (see Fig. 2). First, a supply chain mapping was done for each SME covering materials and information flow to understand their business. Second, information related to latent variables for economic, environmental, and social performance, and CE fields of action (functions of closed loop supply chain - design, procurement, production, distribution, usage and reverse logistics) were gathered through informal interviews. The key themes emerging from the analysis are summarised in Table 10. The observations using case studies from each randomly selected SME in four participating countries validates the findings from both the surveys and focus groups on current state of CE, issues and challenges, and improvement measures.

5. Discussion

5.1. Current state, issues and challenges, and improvement measures

This study considers the closed loop supply chain functions – design, procurement, production, distribution, consumption and recover as latent variables for implementing CE practices. The analysis reveals that the knowledge on current state of closed loop supply chain functions of SMEs in the four countries will facilitate identifying the challenges to adopt CE and deriving improvement measures. In Greece, while CE principles (reduce, reuse and recycle) is embedded in closed loop supply chain functions – design, production and distribution to achieve high economic, environmental and social performance, procurement acts negatively, and consumption, and recover do not contribute towards sustainable performance. These are attributed to lack of support from SMEs suppliers and customers along with SMEs' self-motivation. Policymakers also have a role to provide conducive environment for CE adoption through appropriate support (financial) and initiatives (training, certifications, and regulations). Therefore, there is sufficient room for improving procurement, consumption and recover functions of closed loop supply chain in Greece.

Adopting a lean approach (i.e. zero waste policy), long term collaboration with customers and suppliers, conducive regulations and

Table 8
Comparative analysis of issues and challenges of closed loop supply chain processes of SMEs in four participating countries.

Closed loop supply chain processes	Countries				Previous research
	Greece	France	Spain	The United Kingdom	
Design	Product, process and facility designs are often governed by economic consideration due to competitive business environment resulting sacrifice of a few CE requirements (mainly the social and environmental factors). Hence, there is room for improvement in design function.	Product, process, and facility designs are aligned with CE principles. Nothing to address at this stage.			Bocken et al., (2016); Hollander et al., (2017) Rios and Charley (2017); Franco (2019)
Procurement	Emphasizing on price in procurement is the major issue for SMEs in Greece. Tremendous competitive environment due to recent economic recession could be the cause of this. SMEs need to provide equal emphasize on social factors along with environmental and economic to achieve CE.	Although along with economic factors, both environmental and social aspects are being considered in procurement following customers' specification, often priority remains on economic factor.	Customers specify the procurement procedure when there is long term relationship established leaving less room for innovation. As the OEMs have already adopted CE, their supply chains have also transformed to practice CE in procurement.	Supplier are selected predominantly on the basis economic factor including quality. Many SMEs are yet to consider both environmental and social factor in their procurement practices.	Alhola et al., (2018); Braulio-Gonzalo and Bovea (2020)
Production	Through ISO accreditation and lean approach, production is both economy focused and environmentally friendly. However, there are rooms for adopting other advanced methods (e.g. additive manufacturing) and social-oriented accreditations (e.g. SA 8000 for social sustainability).	Through ISO accreditation and lean approach, production is both economy focused and environmentally friendly. However, there are rooms for adopting other advanced methods (e.g. additive manufacturing).	SMEs try to be competitive in production processes through efficient inventory management, better capacity utilisation, labour productivity etc., which reduce their agility substantially. Flexibility results achieving higher CE allowing SMEs to become more environmental and social friendly.		Moktadir et al., (2018); Sousa-Zomer et al., (2018)
Distribution	Mostly third-party logistics are used resulting in a quite balanced CE performance.	There is no standard policy established. Decisions are arrived on logistics selection predominantly with economic consideration. Hence, CE principles are sacrificed.			Seroka-Stolka and Ociepa-Kabicka (2019); Kuo et al., (2019)
Usage/ consumption	End users' requirements are looked from immediate customers' perspectives and necessary information is provided for usage, repair and recycling. There is room for improvement for CE perspectives with information on environment (e.g. waste management) and social perspectives.			Due to pressure from policymakers and customers SMEs in the UK are more environmentally friendly. They provide information on recycling, repairing and reusing of the products.	Tunn et al., (2019); Tseng et al., (2020)
Reverse Logistics	Although there are strategies and policies for disposing unused materials, and machines and equipment, practices need improvement in terms of adding value to the society.			This is a major issue for the SMEs in the UK. Both materials, and unused machines and equipment recycling depends on local council's infrastructure and process. There is hardly any policy set by individual SMEs for disposing their unused machines and materials.	Bernon et al., (2018); Guarnieri et al., (2020)

Table 9
Proposed improvement measures to enhance CE practices across the closed loop supply chain to enhance sustainability performance in each participating country.

Closed loop supply chain processes	Countries				Previous research
	Greece	France	Spain	The United Kingdom	
Design	SMEs in Greece must strengthen their relationship with their customers and emphasize on adopting green philosophy across the supply chain. Policymakers may also encourage green initiatives across the supply chain through additional funding.	Design related to products, processes, facilities and people of closed loop supply chain that are aligned with CE and in turn enhanced sustainability performance. Customers (e.g. OEMs, PSUs, retails) play a major role for this as they predominantly specify SMEs to adhere to CE principles related to environmental and social requirements. No action required.			Bocken et al., (2016); Hollander et al., (2017) Rios and Charley, 2017; Franco (2019)
Procurement	SMEs' customers might influence them to source from more environmentally friendly suppliers. Policymakers must also create a conducive environment for green initiatives across the industrial supply chains.	SMEs must give higher priority to green suppliers	Green procurement strategy in fully operational within SMEs' supply chains across the industry in cooperation with all the stakeholders. No action required.	SMEs must adopt green strategy in their procurement. SMEs' customers, suppliers and policymakers must also push green agenda across the supply chains	Alhola et al., (2018); Braulio-Gonzalo and Bovea (2020)
Production	SMEs must adopt formal ISO 14000, SA8000 accreditations, implement lean approach, and additive manufacturing method, where applicable. If they have already implemented these, they must make it better functional to achieve higher sustainability performance. SMEs' customers must provide incentives to their suppliers with various green initiatives.		SMEs must adopt formal ISO 14000, SA8000 accreditations, implement lean approach, additive manufacturing method, and/or similar methods where applicable. Customers' may formally announce to prefer green suppliers. Policymakers may provide incentives (e.g. match funding for resource and energy efficiency, waste reduction)		Moktadir et al., (2018); Sousa-Zomer et al., (2018)
Distribution	Develop long term relationship with third party logistics service providers	SMEs need decision support system to select the most appropriate logistics for their product distribution that has equal emphasize on economy, environment and social consideration, which is aligned with their customers and policymakers.			Seroka-Stolka and Ociepa-Kabicka (2019); Kuo et al., (2019)
Usage/ Consumption	All the stakeholders including the end customers must be integrated digitally to receive information related operations, repair and recycle of the products.			Although the stakeholders are integrated but there are rooms for engaging more so as improve CE through higher sustainability performance	Tunn et al., (2019); Tseng et al., (2020)
Reverse Logistics	SMEs must operationalised this to get the advantage of higher sustainability performance through improving economic, environmental and social performance. Policymakers must regulate this through incentives and penalties. Customers may also force SMEs to provide this information for bid submission and factor them in their bid evaluation process.			SMEs must make strategy, policy and operational plan to address this. This should be integrated with forward logistics of the company. Policymakers must regulate this through incentives and penalties. Customers may also force SMEs to provide this information for bid submission and factor them in their bid evaluation process.	Bernon et al., (2018); Guarnieri et al., (2020)

sustainability audit helps SMEs in France to be more open towards adopting CE practices. However, they can improve their sustainability performance by addressing the challenges in distribution, consumption and recover functions. Strengthening the presence of third-party logistics and collaboration with customers along with their self-motivation towards CE might enhance their sustainability performance. Similarly, SMEs in Spain need to pay attention to their production function along with distribution, consumption and recover functions. This is mainly due to macro-economic challenges (e.g. stagnant economic growth, and institutional external pressures) of the country. Additionally, all the stakeholders need to be responsive towards environmentally friendly practices. Finally, SMEs in the UK need to improve their procurement, production, distribution and recover functions. As customer-supplier relationship across the manufacturing supply chain of SMEs is conducive, design function of the UK SMEs is aligned with CE philosophy. Additionally, government is also very responsive for reducing carbon footprint of SMEs through policies, training incentives, and capital support. However, SMEs' self-motivation for environmental and social friendly practices will play a major role for effective and efficient CE adoption resulting in higher sustainability performance.

Overall, while the design function of SMEs in these countries contributes to CE adoption and higher sustainability (economic, environmental, and social) performance, recover function needs serious attention in every country. As design is mainly governed by SMEs' customers, it implies that SMEs' customers can drive CE implementation within organisations (through their green preferences). The effectiveness of the recover function however will depend on SMEs' self-motivation and/or pressure from policymakers, which seems low within the SMEs industries in these countries due to their efficiency (economic) focused business approach. This results in lower contribution to recover function. Therefore, policymakers can potentially promote all facets of CE practices through policy reforms, training programmes (creating awareness among suppliers, distributors, and consumers), periodic audits (as in France), benchmarking performance relative to climate action plans (e.g. energy and resource consumption, reusability, and recyclability), and financial support (for e.g. based on SMEs' self-motivation, performance and achieving audit targets).

Although SMEs' stakeholders (e.g. customers, suppliers, and policymakers) play important roles to aid adopting CE along with SMEs' self-motivation, each function may need support from specific stakeholder. This study reveals that design is governed predominantly by SMEs' customers, which is aligned with previous research (Bocken et al., 2016; Hollander et al., 2017; Rios and Charley, 2017; Franco 2019). However, CE implementation in procurement function is driven mainly by their suppliers and individual SMEs' self-motivation in line with previous studies (Alhola et al., 2018; Braulio-Gonzalo and Bovea, 2020). CE initiatives in production, and distribution functions are practiced mainly through SMEs' self-motivation along with customers' pressures and competitive market environment, which aligns with the prior research (Moktadir et al., 2018; Sousa-Zomer et al., 2018; Seroka-Stolka and Ociepa-Kabicka, 2019; Kuo et al., 2019). CE practices pertaining to consumption and recover functions are mostly driven by policymaker, but SMEs' self-motivation will also enhance successful adoption (Tunn et al., 2019; Tseng et al., 2020; Bernon et al., 2018; Guarnieri et al.,

Table 10
Case studies on CE implementation through closed loop supply chain and sustainability performance of SMEs in four EU countries.

Constructs	Functions/ Variables	Countries			
		Greece	France	Spain	The United Kingdom
General Information		Industry: Processing/trading sector Location: Orestiada, Northern Greece Employee number: 20 Business start: 2002 Business type: Consumer market	Industry: Manufacturing Location: Normandi Employee number: 35 Business start: 1956 Business type: B2B	Industry: manufacturing and trading sector Location: Madrid, Spain Employee number: 140 Business start: 1950 Business type: B2B	Industry: Manufacturing, Aerospace industry Location: Birmingham Employee number: 45 Business start: 1983 Major customer: Rolls Royce Business type: B2B
Closed loop supply chain	Design	SMEs' products are currently more and more developed towards environmental friendly way. Also, design, manufacture and decorations of glass containers in the company are approved and getting accreditations for being environmentally friendly. The company does not currently have ISO 90001 or ISO 14001, due to the lack of interest by the customers.	Design is constantly implemented into the SMEs' CE strategic plans. The company has ISO 9001 accreditation, which is a significant advantage of the company in relation to competition in the sector since the majority of competitors do not have ISO 9001 or other similar accreditations.	The SME is a fast moving business that sets the quality of products as a first priority. They have a product quality department and the company has ISO 14001 accreditation. However, design of products is not underestimated and efforts are given towards this closed loop supply chain CE practice.	Products and production process design is specified by the customers and as customers are predominantly have environmentally friendly practices, all CE principles are followed strictly. The company has ISO 14001 accreditation. Facility planning and design are economy, environmental and social friendly
	Procurement	Procurement is a major concern for the company, with special attention on the economic performance, being a priority over environmental and social part. A major drawback is the difficulty to engage with local suppliers, since they are struggling to find local suppliers and most of the times resort to suppliers further distant apart.	A major concern in the company is the old age of tools and machinery, which needs replacement. This is a first priority in the near future for the SME. Financial part and innovation part are the two most important targets for the company in order to differentiate from the large competition (there are at least 20 competitors within a range of 100 km).	Procurement is of concern in the company, especially due to the large supply and demand uncertainty in this sector. The major issue is due to that the company produces large customer stock which is not easy to manage in case of losing a large customer.	Procurement is focused towards economy of scale without sacrificing quality. Therefore, they tend to have more raw material inventory. They prioritise cost over environmental and social criteria. They do consider risk factor in procurement and intend to develop long term relationship with local suppliers.
	Production	Production is more and more demanding for the company, due to the large expansion during the last decade. The company emphasizes on covering the needs for larger demands in production. Large emphasis is also put minimizing waste through their production process, with large gains in both the economic and the environmental performance of this Greek SME.	Recently, production has arisen due to new clients and innovations applied to their old products. There is much room for improvements in the environmental management and waste management. The latter is the most important for them and they will seek to fix in the coming years.	Production is large and heavily depends on large suppliers. Supply uncertainty is mostly met in terms of delivering times. Although they try to minimize uncertainty, there is still room for improving inventory management and capacity utilisation.	Production processes are reasonably agile to accommodate and customise varied customers' needs. Through lean approach they emphasize on resource and energy efficiency, and waste reduction all through their production processes. There are rooms for improving inventory management, capacity utilisation and quality of products.
	Distribution	Warehousing is serviced within the company, whereas third party logistics mixed with internal transporting is utilized for distribution of the produced goods.	Third party logistics service providers are used for warehousing and transportation for materials and end products.	The SME has significantly improved the transport of goods and products within the company in recent years, with the use of trucks and lorries. Also, they are making use of more automatic transport through HUVs (automated guided vehicles). External transport is also improving in terms of economic and environmental terms, by attempting shifting from trucks to train transportation.	Third party logistics service providers are used for warehousing and transportation for inbound raw materials and outbound finished products giving emphasize on economy.
	Usage	The SME seeks to have long term relationships with most of their immediate customers in the supply chain. The company combines half-century traditional techniques and experience with modern equipment. Newly developed modern facilities based on all National & European regulation, are constantly expanded with more tanks and machinery.	The company has long term relationship with their local customers since first years of establishment. However in the recent years, and due to expanding to new products through innovations, they have gained new clients boosting the economic performance of the company.	They are using approximately 60% of recycled carton board for their production. However recycling also depends on the specific client. There is an inherent difficulty in finding and engaging with local clients, since the suppliers are mostly outside the country.	They have long term relationship with most of their immediate customers in the supply chain. They make the desired product information available to their customers. Products are repaired, reused and recycled following customers' instructions. They are also involved in new product development along with their major customers, when they

(*continued on next page*)

Table 10 (*continued*)

Constructs	Functions/ Variables	Countries			
		Greece	France	Spain	The United Kingdom
					consider end customers' requirements directly.
	Reverse Logistics	Reverse logistics in the closed loop supply chain of the company is currently not implemented at a high level within the SME. Waste is handled within the company.	Innovation has recently helped improve the reverse logistics in the company, although much more improvement is required. Recycling of waste is mixed procedure, using internal process and third party.	Reverse logistics is a closed loop supply chain CE aspect that currently has been not given fully attention in the company.	Reverse logistic needs substantial improvement in terms of raw materials inventory management and recycling old machines and equipment. Production waste recycling is done through third party.
Sustainability performance	Economic performance	Greek economic crisis in the last 10 years has large negative impacts in the financial performance of the SME, however during the last years there have been positive indications of stabilization in their financial results and even increases in turnover and profits.	The company operates since 1956 and performs generally well in the economic aspect of sustainability. Performance on spending on local suppliers is quite high, according to the manager of the company, ranging between 35 and 50% of total spending on suppliers.	Economic crisis in Europe in the last decade has affected the company in terms of economic performance, however there are significant signs of improvement. Funding for SMEs in Spain is a priority as was revealed by our case study analysis, although there are specific problems and challenges, mainly due to issues related to bureaucratic bottlenecks and administrative burden. Contribution to the local economy is rather limited due to difficulties in engaging with the local suppliers.	Economic performance with respect to revenue generation, and business growth are constantly high over last five years. However, contribution to local economy could be improved through more local sourcing. As their procurement is driven by customers they have constraints to contribute to local economy.
	Environmental performance	Regarding their environmental management, the company is currently improving their efficiency regarding waste management and disposal in an environmentally friendly way. No third party is utilized, however there are procedures implemented within the company for handling waste residuals from wine and relevant material processing. These practices are of high importance for the company and the local community towards an environmental friendly environment.	The SME is putting much importance in the environmental part of sustainability, achieving already low levels of energy consumption and further seeking to improve in various aspects of energy reduction and waste management. Especially, the utilization of recycling materials as inputs in production process is an environmental practice that considered of high importance. The waste management is currently managed both internally and by a third party.	Environmental improvement is of high importance within this Spanish small-and-medium sized enterprise, with much emphasis given in the recent years in improving recycling practices within the company, although currently the basic focus is on resource efficiency.	They have ISO 14000 accreditation and lean approach in production processes, which help them be both energy and resource efficient. Additionally, facilities are also made energy efficient with Government funding. Production waste has been considerably reduced all through production processes substantially using technology and training their manpower. However, as recycling is being managed through third party there is room for improvement.
	Social performance	There is lack of advanced social performance, since that the general sense on behalf of the managerial staff in the company is that their customers are not interested in certifications such as ISO 9001. Regarding health and safety issues for the employees, their level has significantly improved in the last years, as a result of both governmental drivers and within company managerial orientation.	In the social performance aspects, the SME reported that the clients often demand high health and safety standards and following this demand it substantially improves their image to the customers. Also, no penalty and sanction from the regulatory bodies received in last five years. Wages of the employees is at the average country and industry level.	Regarding the social aspect of the SMEs' sustainability management, the company faces difficulties in finding local suppliers although their target is on putting emphasis on collaboration with local suppliers. However, in most of the cases they are forced to seek other sources for materials since local supply is expensive. Salaries in the company as the per the industry are higher. No fines or other incidents are reported concerning non-compliance to health and safety rules in the last five years of the company's operations. Also their clients demand high health and safety standards.	Improvement in facilities layout and environment friendly facilities helped improve work culture within the employees. Higher economic performance enables company to maintain high salary for their employees. Therefore, morale of the employees is very high. Absenteeism in last five years is within the limit. There is no health and safety issue exist. No penalty and sanction from the regulatory bodies received in last five years. Also promotes local and national charities. Runs an apprentice scheme to train young people. Works with local schools and Universities.

2020).

5.2. Responses to research questions stemming from the empirical evidence

RQs 1 and 2 are addressed by examining the three hypotheses, i.e., positive, and significant correlation between CE fields of action, and economic, environmental, and social performance. With regards to RQs 1 and 2:

- Our analysis shows that CE fields of action are strongly related to all economic, environmental, and social performance of SMEs only in France. However, although, CE is strongly related to environmental performance of SMEs, but only moderately impacted by the economic and social performance. SMEs in France can further improve their sustainability performance in 'contribution to local economy'

through engaging with local suppliers, and 'social wellbeing' through corporate social responsibility initiatives (Cheffi et al., 2021).

- Similar to France, SMEs in Greece can enhance their performance in both 'contribution to local economy' and 'social wellbeing', along with 'revenue generation'. While SMEs in Spain need to pay attention to 'business growth' and 'social wellbeing', SMEs in the UK need to focus on achieving higher performance in 'revenue generation', 'contribution to local economy', and 'social wellbeing'.
- Overall, the output latent variables - 'contribution to local economy' and 'social wellbeing' are the common factors that needs attention from the SMEs in the four participating countries for facilitating CE adoption. In this context, Haj Mohammad (2013) has shown the positive impact of lean practices on and Dey et al. (2020b) has further shown latter's positive influence on sustainability performance of the UK SMEs. In this context, CE practices and strategies concerning human resources (well-being, rewards, and equality) will enhance the innovation capability of organisations (Lei et al., 2021), intellectually stimulate employees' ability to perform their tasks and embrace change (Gui et al., 2021). Skills and competencies harnessed through training for wider adoption and diffusion of CE practices (Schroeder et al., 2019) will positively influence psychological immunity of the employees (organisational commitment, job satisfaction, meaningfulness, and productivity), i.e., social performance.

These findings are unique compared to the existing literature (Panda et al., 2017; Manninen et al., 2018; Nasir et al., 2017; Dey et al., 2019), where preference is more on achieving environmental performance. These are due to the major uncontrollable external forces (economic, demographic, technological, natural, social, and cultural, legal, and political) that vary across the countries (geographical locations), influencing a firms' strategic decision making and business priorities, which will impact their sustainable performance. Although incorporating the three dimensions of sustainable performance is complicated (Bom et al., 2019), existing research does not necessarily account for the trade-offs between economic, social and environmental performance (Aktin and Gergin, 2016; van Loon et al., 2021). Studies have focused on a single performance measure (Lee and Raschke, 2020; Wagner, 2015; van Loon et al., 2021) rather than holistically considering the social, economic, and environmental performance, which we have addressed in our study.

RQ3 was answered using focus groups among the SMEs' participants. First, various issues and challenges are identified in Table 7 and subsequently improvement measures are derived in Table 8. The issues and challenges that are derived from the focus groups exactly match with the findings from the survey data analysis. The CE function wise improvement measures in each participating country are as follows.

SMEs in Greece must strengthen their relationship with their customers and emphasize on adopting green philosophy across the supply chain including products, processes and facilities of all the concerned stakeholders. Policymakers must also encourage green initiatives across the supply chain through additional funding. Design aspects with respect to products, processes and facilities of SMEs in other participating countries are currently aligned with the CE philosophy.

The procurement function of SMEs in Greece, France and the UK also needs attention. SMEs must adopt green procurement principles emphasizing on selecting environmentally friendly suppliers. SMEs' customers might create a pressure and influence them to source from more environmentally friendly suppliers. Policymakers must also create a conducive environment for green initiatives across the industrial supply chains. SMEs in all the participating countries must adopt formal ISO 14000, SA8000 accreditations, implement lean approach, and additive manufacturing method, where applicable. With increased awareness regarding the benefits of adopting CE principles, customers may formally prefer green suppliers. Policymakers may provide incentives (e.g. match funding for resource and energy efficiency, waste reduction) facilitating green practices.

The distribution function within closed loop supply chain of SMEs in every participating country can be improved through selecting most appropriate third-party logistics service providers and developing long term relationship with them. A digital multi-stakeholder platform could also be established to integrate all the stakeholders of the supply chain including end users and customers. This will enhance the consumption function of the closed loop supply chain to achieve desired sustainable performance. Most of the SMEs suffer from achieving desired performance outcome from the consumption function, therefore, SMEs must make strategies, policies and operational plans to address this. It should be integrated with forward logistics of the company. Policymakers must regulate this through incentives and penalties. Customers may also force SMEs to provide this information during bid submission and factor them in their bid evaluation process.

6. Implications

6.1. Theoretical implications

This research makes several contributions. First, it provides empirical evidence regarding the positive correlation between the adoption of CE principles and sustainability performance in SMEs in the four participating countries. Second, it offers a robust framework (see Fig. 7) for CE adoption in SMEs' supply chain by analysing the current state of CE, identifying issues and challenges, deriving improvement measures through strategies, resources, and competences, and deriving roles of each concerned stakeholder using design, plan, implement and evaluation (principles). The framework has leading factors – the functions of closed loop supply chain (e.g. design, procurement, production, distribution, usage and reverse logistics) and lagging factors – economic, environmental and social performance along with their sub-constructs. These variables might vary across scenarios (e.g., regions, consortia, individual company). The proposed framework (Fig. 7) is the extension of the RBV of CE (Figs. 1 and 2), where life cycle approach of CE has been incorporated along with both intra and inter-organisational strategies, resources, and competences with the involvement of concerned stakeholders. Third, the study reveals the current state of CE adoption in SMEs in four diverse countries - Greece, France, Spain and the UK along with the impact of CE adoption on sustainability (economic, environmental, and social) performance. This enables individual SME, SMEs' consortia and policymakers to make decisions that will enhance CE implementation (e.g., prioritising initiatives through strategy formulation, policy deployment, resource allocation and competence building). Although this research is limited to four countries, but it could be extended in other countries across the globe, via the proposed framework (Fig. 7), measures derived and robust methodology. The findings could be compared to derive desired actions that can improve sustainability performance of SMEs in any industry and geographical location. The findings also support the RBV theory (Barney, 1991) as it reveals strategies, resources, and competences necessary for SMEs using intra and inter organisational strengths (to enhance dynamic capability).

6.2. Practical implications and impact

This research has also significant practical implications. Implementing CE across the industrial supply chains has been quite popular in recent years in line with the climate change policy of most countries globally (Dey et al., 2020a; Kristensen and Mosgaard, 2020; Saidani et al., 2019). However, the knowledge about implications of CE adoption on economic, environmental, and social performance were limited for SMEs in Greece, France, Spain and the UK. The means for improving sustainability performance through CE adoption is extremely value added for SMEs and their stakeholders to adopt right approach for tackling and responding to contemporary climate change issues. This research provides a pathway to implement CE across the industrial

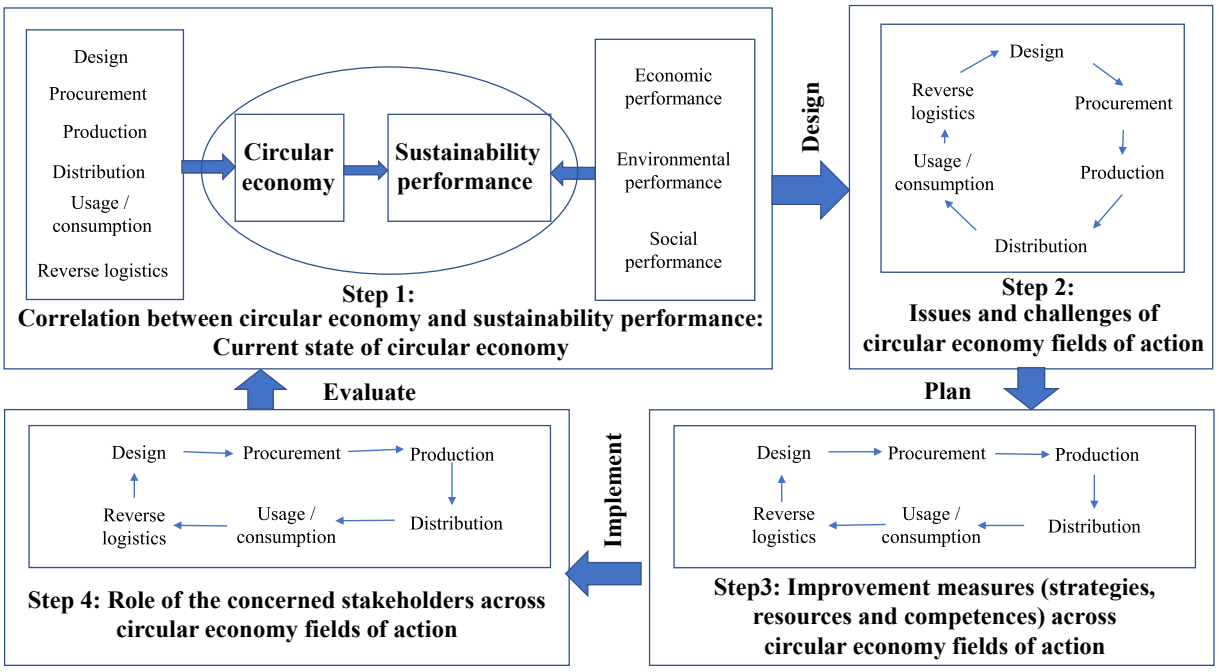

Fig. 7. Framework for CE adoption in SMEs in region, industry consortia and individual levels.

supply chain in regional, industry consortia and individual SME levels (see Fig. 7).

While undertaking this research, the team has worked directly and indirectly with more than 400 SMEs and their supply chain across the four countries through survey, focus groups, and interviews including relevant policymakers of each country. The project reports are made available to them through University website enabling them to adopt the findings and recommendations of the study. Therefore, the companies are likely to be benefited from the project due to their closed association throughout the project delivery. The findings are being communicated to policymakers so as to facilitate them to adopt CE in SMEs. Additionally, with follow on workshops and other communications through research articles and webinars, SMEs and their supply chain across the EU region are likely to get further benefits. Diagnostic aspects of the methodology and enhancing SMEs employees' awareness on environmental challenges and remedies particularly have greater impact to adopt CE implementation in all the participating countries. The case study SMEs in each participating country are planning to implement the improvement measures that are derived from the analysis. An informal interview with the representatives of the SMEs who participated in the focus groups reveal that each SME has undertaken plans for adopting CE and currently in varied phases of implementation.

7. Conclusion

Although from prior research, there is evidence of SMEs achieving superior environmental performance by adopting CE, economic and social performances are not assured (Türkeli et al., 2018; Katz-Gerro and Sintas, 2019). This motivated us to undertake empirical research to reveal the means for achieving higher sustainability performance (economic, environmental, and social) through CE adoption. Data was gathered from around 100 SMEs from each of the four selected countries – Greece, France, Spain and the UK using a survey to study the current state of CE adoption, and subsequently, focus groups were organized which involved SMEs owners and managers, policymakers, SMEs' customers and suppliers, in each country to derive means for improving the impact of CE on sustainability performance. The study reveals that SMEs in the participating countries are likely to achieve higher environmental performance through CE adoption, although economic performance and social performance may not be fully assured other than in France. This study specifically contributes to objectively determining the means for improving SMEs' sustainability in the participating countries. Products, processes and facilities design is likely to facilitate SMEs most in all the participating countries to adopt CE. In other words, SMEs in the EU countries are likely to have sustainable design practices aligned with the CE philosophy. On the contrary, SMEs in the participating countries are likely to have worst recover function. This implies that customers' pressure works for SMEs to adopt CE principles as design function in most of the SMEs' businesses is governed by SMEs' customers. Whereas effective recover function depends on SMEs' self-motivation and policymakers' pressure. There is also room for improving other closed loop supply chain functions – procurement, production, distribution and usage/consumption in SMEs across these countries in order to enhance their sustainability. However, the means for improving each function varies across industries, sizes, turnover, and geographical locations. The study proposes a comprehensive framework (see Fig. 7) extending RBV theory for adopting circular economy in SMEs businesses across regional, consortia and individual SME levels through diagnostic for designing, planning, implementation and evaluation.

7.1. Research limitations

The research has a few limitations in the form of sample size, selection of geographical locations, research methodology, selection of statistical technique etc. that has implications on the results and findings. In order to address the above limitations, we have always compared our findings with contemporary literature, and referred to experts' views and opinions. Additionally, by adopting the mixed methods approach and triangulation (data acquisition), we have addressed most of the methodological issues concerning research validity and applicability. As indicated in the preceding sections, all constructs and corresponding proxies for the analysis are identified through both secondary and primary research methods. Therefore, they might vary across the scenarios (i.e., primary context of the study). The potential beneficiaries and researchers should keep in mind the above limitations while adopting the proposed research methodology, and the outcomes.

7.2. Scope for further research

The findings of this research warrant several new research questions in the area of CE and sustainability pertaining to SMEs and their supply chain encompassing all the concerned stakeholders (i.e. SMEs owners and managers, industry consortiums, and policymakers). As the design function was found to be the strongest closed loop supply chain function for adopting CE in SMEs' supply chain in the EU countries, a detailed work could be undertaken on the critical success factors of the design aspects (e.g. products, processes, facilities) that will significantly contribute to CE in practice. Additionally, recover function is the weakest function of SMEs in the EU countries that contributes least to CE adoption, thus examining the root causes for this could be an interesting study. Moreover, the roles of other functions in closed loop supply chain are also interesting to design, implementation, and operationalisation a fully operational CE strategy in SMEs' business networks across the nations. Additionally, roles of each stakeholder SMEs, customers, and policymakers across the supply chain is always an important question to examine. The role of organisational human resource factors (such as employee wellbeing, commitment, leadership, skills utilization, co-worker sustainability support and job characteristics) on the adoption of CE practices and subsequently the impact on sustainability performance, organisational resilience, and dynamic capability can be examined to help develop sustainability culture within SMEs' organisations.

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Company Performance: Are Environmental, Social, and Governance Factors Important?

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Abstract. Building on the resource-based view of entrepreneurship, we examine the association between environmental, social, and governance (ESG) factors and company performance, measured by return on assets, return on equity, and return on invested capital. We use regression models on a dataset of 60 observations of Russian companies including RAEX agency ESG ratings from 2018 to 2019. The results show that, in line with expectations, companies that comply with ESG principles demonstrate significantly better financial performance than other companies. This result holds true irrespective of the performance indicator used. Moreover, the governance factor is strongly related to company performance, providing implications for companies' policymakers in terms of the utility of adopting ESG information. The study provides insights into the resource-based view of entrepreneurship, demonstrating that ESG factors, and mainly the governance factor, create a competitive advantage for companies and allow superior performance.

Keywords: Environment; Governance; Performance; Social; Sustainability

1. Introduction

Since the last financial crisis, environmental, social, and governance (ESG) factors have received growing attention from multinational companies (Sahut and Pasquini-Descomps, 2015; Velte, 2016). According to an Ernst and Young (EY) survey, investors around the world are increasingly using ESG principles when choosing companies to invest in. Since 2014, the value of "responsible" investment capital has grown by a third every two years (Trends Report, 2018). As a result, many companies are striving to consider ESG principles as part of their development strategy. With the theme of responsible investing expected to continue to play a considerable role in company development, it is important to understand the influence of ESG factors on corporate performance. In addition, a recent literature review by Gerard (2019) highlights the need to investigate the drivers of company success. We address this gap from the perspective of ESG factors.

Nowadays, there are many different definitions of and terms for responsible investing and ESG principles. In the framework of this research, we use a definition of ESG principles based on the European Commission's vision and on the United Nations Principles (Galvin,

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2019). Analysis of the elements that make up the concept ESG must inevitably be sought in the individual components of the acronym. Environmentalism stands for the principles of green finance, understood as the process of decision making in the investment phase. Social considerations may refer to issues of inequality, inclusiveness, labor relations, investment in human capital, and communities. The governance of public and private institutions, including management structures, employee relations, and executive remuneration, plays a fundamental role in ensuring the inclusion of social and environmental considerations in the decision-making process. The integration of the three components constitutes a set of sustainable development principles both in economic and financial terms. The interpretation of ESG used in the framework of this research was selected for two main reasons. First, the subject of study is Russian companies. Russian legislation on the subject has been developed according to American and European standards and principles. The second is the fact that the ESG ratings of Russian companies were developed by the European rating agency, which uses current European and American sustainability principles.

The theoretical background of the research is the resource-based view of entrepreneurship (Barney, 1991; Newbert, 2007). It assumes that the key drivers of company performance are resources that are difficult to imitate. Resources make it possible for a company to create a competitive advantage and achieve superior performance. We suppose that ESG factors can be considered difficult-to-imitate resources. Scientific literature has found different and heterogeneous results about the relationship between ESG scores and performance indicators. For example, several authors (Hart, 1995; Christmann, 2000; Clarkson et al., 2011) suggest that companies with more significant financial resources and superior management capabilities do not benefit from having a proactive environmental strategy. According to some researchers, the social factor in the business model of companies can also set back operational and financial performance (Yunus et al., 2010; Siew, 2012).

The goal of this paper is to analyze the association between ESG factors and company performance. Regression models are used on a dataset of 60 observations of 30 Russian companies from 2018 through 2019. The results show that company performance depends on the company's position in ESG ratings. Performance indicators are higher for companies with policies that support ESG principles. Moreover, governance is a crucial factor and has the most influence of any principle on company performance in Russia.

This paper contributes to the literature on the resource-based view of entrepreneurship (Barney, 1991; Leung et al., 2014; Sharma et al., 2019) by revealing ESG factors as difficult-to-imitate resources. It also complements the literature on ESG in Russia (Atnashev and Vashakmadze, 2014; Glazova, 2018) by being the first to evaluate the association between ESG factors and company performance. To the knowledge of the authors, no previous paper has investigated the influence of ESG factors on company performance in Russia. This study should help company managers to shift their focus to non-financial indicators and to adopt new business models to achieve competitive advantages.

The paper is structured as follows. Section 2 provides an overview of the theoretical background of the research. Data and methods are discussed in section 3. Results and discussion are presented in section 4. Finally, section 5 provides the conclusion.

2. Literature Review

The resource-based view of entrepreneurship emerged in the field of strategic management in the late 20th century (Prahalad and Hamel, 1990; Barney, 1991). It

supposes that company resources are the main determinants of performance. Only rare and difficult-to-imitate resources allow a company to achieve a competitive advantage. The resource-based view of entrepreneurship has been widely tested and broadly supported in numerous studies (Newbert, 2007). In the framework of this research, we assume that ESG factors are complex and difficult-to-imitate resources and try to fill the gap in existing research by analyzing the association between ESG factors and company performance.

ESG scores provide transparency of information that is useful to both investors and managers of companies (Kocmanová and Dočekalová, 2012). Several case studies prove there is a positive correlation between the implementation of ESG practices and company performance. Pasquini-Descomps and Sahut (2014) revealed the positive influence of ESG factors on company performance in their study considering 11 Swiss banks. Ortas et al. (2015) and Brogi and Lagasio (2019) obtained similar results. The authors attributed this relationship to investment practices which favor sustainable investment projects that guarantee workers' rights and improvements in the management and corporate governance of organizations. Based on the studies mentioned above, the researchers developed the following hypotheses:

H1: ESG is positively associated with company performance.

However, many antitheses could be raised contesting this general idea and the positive influence of ESG on financial and operational returns (Atan et al., 2018). Empirical research by Horváthová (2010) shows that the probability of finding a negative impact of ESG factors on performance indexes increases with the complication of the linear coefficients used in the model. Siew (2012) showed that ESG scores are also negatively associated with the performance of Australian companies.

Taking into account the separate analysis of ESG factors, we reveal that, in this case, the results are more heterogeneous and ambiguous. In the course of the study, it was found that the real positive impacts of ecological factors on financial performance were measured across a range of financial ratios (Siew et al., 2013). The study conducted by Russo and Fouts (1997) on a sample of 477 companies demonstrated a positive relationship between the ecological factor and return on assets. The meta-analysis conducted by Albertini (2013), who analyzed 52 previous studies, also confirms the previous results. Therefore, we propose the following hypothesis:

H2: Environmental factors are positively associated with company performance.

As pointed out above, environmentally-friendly investment practices do not have the same positive effect on performance and risk indicators for all companies (Freedman and Jaggi, 1982).

Edmans (2011) proves that the effects of social actions improve share returns by nearly 2.3% annually. Several researchers have focused their attention on the role of corporate philanthropic donations. A study by Brammer and Millington (2008) shows that companies that focus on charity achieve higher financial returns than others. These results lead to the following hypotheses:

H3: Social factors are positively associated with company performance.

Many studies aimed at analyzing the effect of good governance policies (transparency in reports, shareholder involvement, responsible behavior, ownership structure, independent managers) have shown greater homogeneity in results than those analyzing the previous factors. Most of the authors find as a common and undeniable result that better quality governance and higher transparency of managerial actions improve financial performance (Gompers et al., 2003; Giroud and Mueller, 2010). The findings of the empirical study carried out by Cremers and Nair (2005) affirm that well governed

companies achieve an extra annual redemption of 10-15%. Generally, we can formulate the following:

H4: Governance is positively associated with company performance.

3. Data and Methods

We collected data on 30 Russian organizations rated on ESG factors by RAEX, an independent rating agency. According to the methodology adopted by RAEX (2017), in their social reports the 30 companies for which the scoring was carried out pay particular attention to the themes of corporate social responsibility, investments in sustainability, environmental respect and improvement of workforce management. The ratings were issued twice, in 2019 and 2018. In order to be included in the ratings and our dataset, the companies had to be registered in Russia and listed on the Russian stock exchange.

Data on financial and ESG factors were combined with information hand collected from official websites of the companies and the Rusprofile database. Due to difficulties encountered in the conversion of different currencies, data from financial reports prepared by Russian Accounting Principles was given preference. The final dataset used for estimations contains data on 60 observations of 30 companies. The analyzed companies come from a variety of different sectors (Table 1).

Table 1 The distribution of companies by sector

Sector	Number of companies	Company names
Mining industry	9	MMK, Alrosa, NMLK group, UC Rusal, Evraz, Severstal, Metalloinvest, Mechel, UMMC, Norilsk Nickel
Petroleum industry	8	Lukoil, Tatneft, Gazprom, Rosneft, Novatek, Sibur holding, Surgutneftegaz, Trasneft
Electric power industry	7	Rosseti, Inter RAO, Rushidro, Sakhalin energy, Siberian Coal Energy Company, Tplus
Transport industry	2	Russian Railways, Aeroflot
Engineering industry	2	United Shipbuilding Corporation, United Aircraft Corporation
Nuclear industry	1	Rosatom
Mineral fertilizer production	1	Eurochem group

The sectors best represented by the analyzed companies represent the greatest strengths of the country's economic development. This sample of companies subject to ESG analysis is concentrated in the metallurgical, energy, oil, and gas extraction sectors. These sectors represent the core of Russia's GDP (Zlobina et al., 2019).

Performance variables are used as dependent variables in regression models. Many different indexes are used to measure performance (Gozali et al., 2020). In one type of research the authors use absolute performance indicators such as gross profit, revenue, and net profit (Santos and Brito, 2009; Fried and Tauer, 2015). Unfortunately, in this case it is not suitable to use such indicators because the companies in the analyzed dataset are of varying sizes and come from different sectors. More often, authors use traditional indicators such as return on assets (ROA), return on equity (ROE), and return on invested capital (ROIC) (Mayer-Haug et al., 2013). These indicators allow for both evaluating performance of a company and comparing companies of various sizes. The indicators are

also suitable for this research because none of the analyzed companies is a high-tech company (Brooks and Oikonomou, 2018).

Based on the identified hypotheses, we analyze the company's overall position in the RAEX ratings (ESG) and position for each indicator (E, S & G) as explanatory variables. The ESG scoring for the 30 companies was carried out by RAEX using a rating scale. Companies following ESG principles got higher scores and positions in the rating. This means that, in the framework of this research, a negative association between position in the RAEX ratings and company performance will prove the suggested hypothesis. According to the ESG rankings published on RAEX's official website in 2018-2019, the best performing companies were Lukoil, MMK, and Tatneft. The worst ESG total scores were received by United Aircraft Corporation and UMMC.

In order to integrate a proportional measure referring to company size in the statistical model, we collected data referring to two controllable variables: number of employees (Em) and natural logarithm of total assets (lnta).

The descriptive statistics of dependent and controllable variables are presented in Table 2.

Table 2 Descriptive statistics of dependent variables

Variable	Description	Obs.	Mean	Std. Dev.	Min	Max
ROA	return on assets	60	0.29	0.63	0.01	4.53
ROE	return on equity	60	0.37	0.53	-0.59	3.10
ROIC	return on invested capital	60	0.23	0.20	0.01	0.76
lnta	natural log of total assets	60	20.01	1.59	16.31	23.48
Em	number of employees	60	113104.50	155479.70	2277.00	755000.00

As can be seen from the table, the three performance indicators are rather heterogeneous. There is no particular reason for these deviations except for the heterogeneity of the analyzed sectors, the global context of the industrial economy, and intrinsically random features. The control variables were chosen to be integrated in the statistical model to eliminate the scope of company activities. The natural log of total assets has the lowest variability, which is due to the specifics of the variable. The high variability of the Em variable is also explained by variations in company size.

Due to a limited sample period, we estimate regression models where identified indicators are calculated within 2017-2018.

We test H1 using the following model:

$$\text{Perf}_i = f(\text{ESG};\ \text{lnta};\ \text{EM}) \quad (1)$$

H2 to H4 are tested using the following model:

$$\text{Perf}_i = f(\text{E};\ \text{S};\ \text{G};\ \text{lnta};\ \text{EM}) \quad (2)$$

Perf_i refers to one of the three performance indexes (ROA, ROE, ROIC).

We use pooled OLS regression analysis, modelling the performance of the firm as a function of the following explanatory variables: ESG rating, total assets and number of employees. The regression estimations control for heteroscedasticity. In the tables presented, it is specified that robust standard errors are reported.

4. Results and Discussion

We have carried out the correlation matrix of the independent variables in order to avoid multicollinearity of factors (Table 3). This provides a statistical adjustment to the correlations among the remaining variables using multiple regression.

Table 3 Correlation matrix

	lnta	ESG	E	S
lnta	1			
ESG	-0.45	1		
E	-0.29	0.72	1	
S	-0.37	0.84	0.45	1
G	-0.40	0.59	0.19	0.40

As can be seen from the table, the ESG rating is correlated with the environmental and social rating. Since these factors are used in models to test different hypotheses, these factors were left for further investigation.

The results of testing the ESG rating against company performance are presented in Table 4.

Table 4 H1: Regression results

Dependent variable	ROA		ROE		ROIC	
Constant	4.20	***	0.70	***	0.93	**
	(0.79)		(0.17)		(0.37)	
ESG	-0.02	**	-0.01	*	-0.01	*
	(0.01)		(0.01)		(0.00)	
lnta	-0.20	***			-0.03	
	(0.04)				(0.02)	
Em	0.00	***	-0.00	**	-0.00	**
	(0.00)		(0.00)		(0.00)	
No. of obs.	60		60		60	
Adj. R2	0.590		0.055		0.079	
F stat.	29.26	***	2.722	***	2.692	***

A negative correlation between the dependent and explanatory variables means the ESG factors have a positive effect of on the financial performance indicators. In line with expectations (H1), companies that follow ESG principles have higher performance indexes. This result holds true irrespective of the performance indicator used. However, the results show a discreet influence of the ESG factor on ROA and less significant effects on ROE and ROIC. Companies that are oriented to ESG principles have 2% higher ROA and 1% higher ROE and ROIC. This supports H1.

In terms of control variables, we observe a rather significant association between number of employees and the performance indexes. The natural log of total assets is significant only in the case of ROA. Table 5 presents the results of the influence of the separate environmental, social, and governance ratings on the performance indexes.

In Table 5, for each performance index, we present the initial (2.1) and final (2.2) versions of the model. In the context of ROA, governance has a strongly negative association with the identified performance index. This means that companies that take governance aspects into account have 2% higher ROA overall. Environmental and social factors appear statistically insignificant in this case.

Table 5 H2, H3, H4: Regression results

Dependent variable	ROA				ROE		ROIC			
Model	(2.1)		(2.2)		(2.1)		(2.1)		(2.2)	
Constant	4.47	***	4.30	***	1.68		1.06	***	1.09	***
	(0.80)		(0.75)		(1.75)		(0.37)		(0.34)	
E	-0.01	*			0.00		0.00			
	(0.01)				(0.01)		(0.00)			
S	0.01				-0.02	*	0.01			
	(0.01)				(0.01)		(0.00)			
G	-0.02	***	-0.02	***	0.01		-0.01	***	-0.01	***
	(0.01)		(0.01)		(0.01)		(0.00)		(0.00)	
lnta	-0.21	***	-0.20	***	-0.05		-0.03	**	-0.03	**
	(0.04)		(0.04)		(0.05)		(0.02)		-0.02	
Em	0.00	***	0.00	***	-0.00	*	-0.00	*	-0.00	*
	(0.00)		(0.00)		(0.00)		(0.00)		0.00	
No. of obs.	60		60		60		60		60	
Adj. R2	0.620		0.609		0.030		0.178		0.157	
F stat.	20.26	***	31.58	***	1.364		3.56	***	4.674	***

We get similar results for another performance index: ROIC. Only the governance rating influences this performance indicator. Companies with policies oriented to governance aspects have 1% higher ROIC. In the case of ROE, we obtained insufficient dependence and unsatisfactory results that is why we do not present the final version of the model (2.2). In terms of control variables, we observe a rather significant association between them and the performance indexes.

As a result, the strongest support for H4 is found for the positive association between the governance rating and the performance indicators ROA and ROIC. Companies oriented toward governance factors have a competitive advantage that is reflected in superior financial performance. Environmental factors appear statistically significant only in the initial model using ROA as a dependent variable. In this model, companies oriented toward environmental factors have higher ROA. Considering that the variable became statistically insignificant in the final version of the model, H2 is not supported. In terms of social factors, we also fail to observe the superiority of socially responsible companies' financial performance (H3).

Relying on the resource-based view of entrepreneurship, we reveal that ESG factors,are rare and difficult-to-imitate resources that allow companies in Russia to achieve superior performance and obtain a competitive advantage.

4. Conclusions

Our paper provides additional evidence related to the resource-based view of entrepreneurship. We show that, in line with expectations (H1), Russian companies oriented to ESG principles tend to exhibit superior performance than others. This result confirms previous research (Pasquini-Descomps and Sahut, 2014; Ortas et al., 2015; Hassan et al., 2018; Brogi and Lagasio, 2019). It also supports the view that ESG policies are an essential factor in business development that give the company great opportunities to improve efficiency. ESG initiatives help companies at all stages of the value chain, from reducing costs to securing a competitive advantage. ESG encourages companies interested in investments and listed on the stock exchange to consider sustainability and thus contributes to a more robust green securities market. As our

dataset was restricted to ESG ratings from two years only, this aspect deserves attention in future studies focusing on Russian companies as well as on other countries.

In the context of the separate analysis of ESG factors, we found strong support for H4: Russian companies with policies aimed at good governance have higher performance indicators. These results expand the findings of previous studies (Gompers et al., 2003; Cremers and Nair, 2005; Brammer and Millington, 2008; Ting et al., 2020; Zhang et al., 2020). Environmental and social ratings would seem to influence company performance. However, contrary to expectations, we failed to observe that companies with policies focused on social and environmental factors performed better than others (H2, H3). Interestingly, the ESG rating consists of three elements in equal parts but when they are analysed separately only one is statistically significant. In comparison with the other factors, governance encompasses the largest number of indicators: board of directors; ownership; business ethics; anti-competition practices; risk management; accounting; and taxation disclosure. In Russian practice, the identified indicators play a vital role in the conditions of economic and political instability.

The results obtained from the two regression models show that it is possible to implement sustainability policies even in the absence of a strong regulatory base, which is common in Russia. Today's regulatory base in Russia is substantially lacking in comparison with that in Europe. The analyzed companies currently provide a fair degree of voluntary disclosure and are leading the way toward improving reporting policies in Russia. Russia is one of the major BRICS countries and is already turning toward the new business models exemplified by these companies.

This empirical study was able to demonstrate that, at least for Russian companies from industrial sectors, policies focused on mainly good governance can improve profitability.

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ARTICLES FOR FACULTY MEMBERS

ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG), CIRCULAR BUSINESS AND SMES

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Corporate ESG performance, Shariah-compliant status and cash holdings

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Abstract

Purpose – This study aims to examine the association between environmental, social and governance (ESG) performance and cash holdings, as well as whether this association is moderated by Shariah-compliant status. The aim was to test the joint effect of two ethical precepts, namely, the ESG and Shariah-compliant status, in explaining variations in cash holdings.

Design/methodology/approach – A sample set that consisted of 9,244 firm-year observations from 25 countries from 2016 to 2020 was analysed using regression analysis. Firm-level data were sourced from Thomson Reuters and Refinitiv databases, while country-level data were derived from the World Bank and Hofstede Insights websites.

Findings – Firms with greater ESG performances were found to have higher cash holdings. The positive association between ESG performance and cash holdings was greater for Shariah-compliant firms compared to non-Shariah-compliant firms. In support of the stakeholder theory, the evidence indicated that Shariah-compliant firms with higher ESG commitments also have higher cash holdings as part of their corporate strategy.

Practical implications – These findings provided further comprehension to investors that ESG practices among Shariah-compliant firms are essential information during investment decision-making processes.

Social implications – These findings highlighted ethical corporate practices through two frameworks, namely, ESG commitment and Shariah compliance; hence, contributing towards strategies to reach the Sustainable Development Goal 16 of promoting just, peaceful and inclusive societies.

Originality/value – This study has focused on the motives for cash holdings by considering the ethical precepts embodying ESG and Shariah compliance to uphold the positive impact of high cash reserves.

Keywords ESG, Corporate cash holding, Shariah compliance, Cross-country analysis

Paper type Research paper

JEL classification – G18, G38, M41, M43, M44

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1. Introduction

The corporate sustainability (CS) concept has become a fundamental strategic priority for firms worldwide. There are calls for CS that focuses on shared value creation and integrates core business strategy and business model (Husted and de Jesus Salazar, 2006; Jamali, 2007). The strategic role of CS implies that firms need to consider stakeholders' expectations by integrating the triple bottom line of environmental, social and governance (ESG) practices (Maas *et al.*, 2016). The focus on CS goes hand in hand with the continuous threats to sustainability, such as global warming, violation of human rights and depletion of natural resources (Jan *et al.*, 2018; Zahid *et al.*, 2016) that can affect businesses, economics and society. ESG practices have become the main pillar in addressing CS issues. The importance of being environmentally and socially responsible has not only become a focal point of risk management concerns for the public, investors, shareholders and governments but it has also become an emerging part of competitive advantage strategies for firms. CS endeavours could develop responsible actions with the aim of improving corporate performance and creating value for all stakeholders (Freeman, 2010; Harrison and Wicks, 2013).

In line with the importance of CS issues in the capital market, several studies have explored how ESG influences corporate performance (Lins *et al.*, 2017). Prior findings were in line with the stakeholder theory that the quality of ESG was positively associated with corporate financial performance. Relevant to this study was the view that ESG serves as a trust mechanism that bridges the relationships between a company and its stakeholders. Thus, through ESG engagement, stakeholders would entrust a company to have higher cash holdings, mainly to cater for any unexpected shocks (Chang *et al.*, 2019), as those with high cash holdings could provide a competitive advantage in the marketplace. Aside from ESG, this study has also reviewed ethical practices from the lenses of Shariah, i.e. the fundamental Islamic law. Maqasid al-Shariah, or the objectives of Shariah, aim to promote the welfare of humankind and prevent harm by preserving religion, life, intellect, the interests of the future generation and wealth. Tlemsani (2022), for example, highlights on the advantages of Islamic finance in economic rebuilding through the principles of risk-sharing and equity-like contracts. More specifically, firms with Shariah-compliant status are deemed ethical firms due to their commitment to adhering to Shariah principles. In this context, corporate social capital was established (Lins *et al.*, 2017) based on the stakeholder theory. This is because stakeholders perceive a strong incentive towards ESG and Shariah-compliant could facilitate a better prospect of resource accumulation and allocation, which warrants a company to maintain high corporate cash holdings (CCH).

This study used an international data set consisting of 9,244 firm-year observations from 25 countries over the period of five years, from 2016 to 2020. CCH was measured by the proportion of cash and cash equivalents to total assets, while ESG performance was proxied by ESG scores derived from Thomson Reuters (Refinitiv). Shariah compliance was identified based on the Shariah Compliance Flag in Refinitiv. The analysis also included a series of firm-level and country-level control variables and various specification tests for robustness, including the endogeneity test. In this study, CCH was a proxy for liquidity, which is a vital performance measure that reflects the abilities of firms to reserve liquid resources, balance the need to take actions to mitigate any unexpected future crisis and preserve their core business models and innovations to align with a sustainable approach. The analysis results showed a positive association between ESG performance and cash holding. Thus, firms with greater ESG performance were found to have higher cash holdings compared to firms with lower ESG performance. The positive association between ESG and cash holdings was found to be greater for firms with Shariah-compliant status, which implied that ESG performance and Shariah compliance were jointly affecting CCH. These results were robust to various alternative analyses that were conducted to support the main results.

This study offers several contributions to the body of literature. Firstly, it provides an overview of CCH determinants by testing the joint effect of two ethical precepts, namely, ESG performance and Shariah-compliant status, on CCH. Consequently, this study has extended prior works on corporate governance and CCH, such as by Frésard and Salva (2010) and Harford *et al.* (2008), by emphasising the roles of the ethical forces that act as complementary players to governance. This study has also extended the view of the stakeholder theory on ESG (Lee and Isa, 2020), in suggesting ethical forces as tools to incentivise managers towards complying with the shareholders' interests by mitigating conflicts (Arouri and Pijourlet, 2017) in cash holding strategy. The findings of this study confirmed the significant role of Shariah-compliant status in moderating the relationship between ESG and CCH. Secondly, this study is the first cross-country study that could advance the general understanding of sustainable and ethical behaviours that are underlying the firm-level forces on CCH strategy. Hence, this work could help other single-country or specific-region studies that are attempting to explain the determinants of cash holding (Muhmad *et al.*, 2022), including studies that are analysing the role of Shariah-compliant status (Bugshan *et al.*, 2021) by using the large international data set available in this study. The findings of this study have greater generalisability and are applicable in a broader context compared to other empirical works in this study area.

The following sections are arranged as follows: Section 2 discusses prior literature and hypotheses development, Section 3 presents the data and methodology, Section 4 explains the results and discussions, and Section 5 concludes this study.

2. Prior literature and hypotheses development

Researchers in this field of study concur on the definition of CS to encompass ESG dimensions (Limkriangkrai *et al.*, 2017). The environmental dimension includes efforts to leave a positive impact on the environment through compliance with existing regulations and recognition of future impacts. The social dimension refers to the equitable treatment of close stakeholders and the protection of the social ecosystem in which a company operates. Meanwhile, the governance dimension incorporates ethics, integrity and principles such as transparency and fair dealing, as well as effective functioning of the board of directors. Consequently, ESG broadly covers numerous issues encompassing the environment (e.g. climate change and carbon emissions), social responsibility (e.g. human rights, product safety, gender equality, health and safety) and corporate governance (e.g. board independence, corruption and bribery and shareholder protection) (Galbreath, 2013).

Numerous researchers have attempted to answer whether investments in CS initiatives provide positive financial returns and/or create values for firms. From the perspective of the stakeholder theory, Jones (1995) indicated that corporate social performance is a manifestation of attempts to establish trust within cooperative firm/stakeholder relationships. However, other evidence revealed that the relationship between CS performance and financial performance is not straightforward, as there is still no clear consensus on whether and how CS performance affects financial performance (Flammer, 2018; Price and Sun, 2017; Oh *et al.*, 2015; Wang *et al.*, 2015). This is because a corporate commitment towards sustainability requires resource consumption (McWilliams and Siegel, 2001; Wang and Bansal, 2012), which may lead to rent dissipation (Blyler and Coff, 2003). Hence, while CS initiatives can promote better financial performance, there are concerns that committing towards sustainability may cause fewer resources to be available for improving core business engagements. This is a concerning issue, especially when CS initiatives are disguised to deceive stakeholders through value-destroying or fraudulent activities, such

as earnings management (Prior *et al.*, 2008) and managerial entrenchment strategies (Surroca *et al.*, 2020; Muriithi, 2021). Several studies attempted to reconcile the relationship between CS performance and financial performance by incorporating firm-specific contexts, such as idiosyncratic risk (Luo and Bhattacharya, 2009) and intangible assets (Surroca *et al.*, 2010) that have been shown to influence the utility value of CS performance.

Accordingly, since CS performance does not always lead to better financial outcomes, the underlying mechanisms of corporate social responsibility (CSR) might require further analysis to understand the sustainability phenomenon that firms are driven to embark on. Considering the firm-level contextual factors, it would be insightful to understand the effect of CS (through ESG commitments) on CCH, as the expectations of upside efficiency enhancement could positively affect a firm's future cash flow and financial performance.

2.1 Environmental, social and governance performance and cash holding

CS engagement is perceived to contribute towards increasing competitiveness in the market, that could effectuate legitimacy in the eyes of various stakeholders (Sharma, 2000). However, CS initiatives demand substantive corporate resources to buffer costs and risks associated with their implementation. Hence, the aspect of CCH has emerged as one of the relevant topics in sustainability-driven strategies. Yet, only a handful of studies have been conducted to examine the relationship between CS performance and cash holdings (Khatib *et al.*, 2021). Thus, this study would further contribute to the ongoing academic discourse by focusing on the link between ESG and CCH.

For firms, the holding of cash allows greater financial flexibility against product market threats (Alimov, 2014) and a buffer against unpredictable shocks, such as economic distress (Acharya *et al.*, 2007). However, the higher the cash reserve, the greater the risk of entrenchment (Myers and Rajan, 1998), as liquid assets are challenging to trace and less costly to convert into private consumptions. From the perspective of agency theory, the dilemma in strategizing cash holdings has triggered more emphasis on the importance of high-quality governance to either motivate or discipline managers on the efficient use of cash (Epstein and Roy, 1998; Frésard and Salva, 2010), as to align managers and shareholders' interests in enhancing firm value (Deb *et al.*, 2017; Cheung, 2016). In this line of view, socially responsible firms are more likely to hold more cash, as previous researchers have linked the commitment to be socially responsible with the aspect of "superior governance". For example, Lu *et al.* (2017) opined that information in CSR reports can facilitate monitoring and thus induce more efficient use of cash holdings. Meanwhile, ESG engagement is a way of mitigating risk-taking (Albuquerque *et al.*, 2019) that could produce better corporate values and performance (Lins *et al.*, 2017).

Several studies have identified that shareholders would assign a higher value to cash holdings for firms with high CSR ratings, which supported the contention that CS does enhance the perception of the shareholders on CCH (Cheung, 2016; Arouri and Pijourlet, 2017; Yang *et al.*, 2019). According to Chang *et al.* (2019), the value of an additional dollar in cash holdings is higher for firms with high ESG than for those with low ESG. Cheung and Pok (2019) found that high CSR firms would extend less credit to potential buyers, as the higher refinancing risk could result in the likelihood of hoarding cash.

More related to this study would be evidence that directly links CS and CCH. CSR performance has a positive impact on CCH (Yang and Susanto, 2021). Nasr *et al.* (2022) documented a positive relationship between CSR and cash holdings. Meanwhile, Harper and Sun (2020) showed that the tendency to hold less cash was greater among firms with inferior environmental performance. Cheung (2016) argued that systematic risks could push firms with high CSR to hold onto more cash. This argument was in line with the conflict resolution

view on CSR, i.e. firms with a high CSR rating allow their managers to gain greater stakeholder commitment, thus leading to more efficient use of financial resources. In this sense, CS is perceived as a robust managerial control for the efficient use of corporate resources; hence, it serves to alleviate the agency cost associated with greater cash holding. Using data from firms based in the USA, Chang *et al.* (2019) reported that firms with better social performance held higher cash balances, and the positive link between social performance and cash was stronger for those with greater product and labour market competition. They indicated that the credibility of CSR engagements has allowed firms to earn the trust of stakeholders, which increased the value of cash.

The basis of this study was that commitment towards CS could resolve the conflict between managers and stakeholders and lead towards favourable corporate outcomes. This argument was based on stakeholder theory that CS can manifest corporate attempts to establish stakeholders' trust (Jones, 1995) and resolve potential conflicts with regard to cash holding. Specifically, CS engagements could lower agency costs and constrain the risks of managerial opportunistic behaviours associated with the holding of cash. The favourable outcomes of commitment towards CS were evidenced in prior studies (Chang *et al.*, 2019; Nasr *et al.*, 2022). This study further explored this proposition by looking at CS proxied by the ESG score of firms using an international data set. This study has posited that firms with higher ESG are those with high cash holdings because they are trusted to be able to manage their financial resources in compelling ways that would benefit the stakeholders. Based on the previous discussions, the first hypothesis was developed to determine whether ESG commitment is associated with the holding of corporate cash:

H1. Corporate ESG commitment is positively associated with cash holdings.

2.2 Shariah-compliant status; environmental, social and governance performance; and cash holdings

According to the trade-off theory, firms hold cash based on their behaviours and motives (Ozkan and Ozkan, 2004). Corporate financial policies and practices, in this case, cash holding, are influenced by external and internal forces, including the institutional context. Hence, based on *H1*, this study established the proposition that ethical precepts through ESG commitment positively determine cash holdings as firms are trusted to be able to manage the cash well. Aside from the ethical views related to CS engagement, ethical values are also sourced from religion. Religion has generally been established as a potential source of ethical behaviours in business organisations (Longenecker *et al.*, 2004).

Thus, this study has also considered religious ethical practices from the lenses of Shariah, the fundamental Islamic law. In the global capital market, the Islamic capital market has been established as a route for investments that comply with Shariah. Shariah investment has widened the focus beyond financial returns to include the overall well-being and welfare of individuals and society at large, as well as environmental preservation. In assisting ethical investors that are concerned with investing in Shariah-compliant firms, Shariah compliance and screening review can be undertaken to assign securities of firms with "Shariah status". The Shariah status assures that the activities conducted by these firms do not involve non-permissible conduct, such as unethical elements and interest-based transactions and that income is generated in accordance with Shariah principles (Tajuddin *et al.*, 2019). Hence, the Shariah status is an important step towards expanding accountability, which ameliorates shareholders' trust in resource accumulation and allocation by a company.

Empirical evidence that mainly compared Shariah and non-Shariah firms generally showed that Shariah-compliant firms outperformed non-Shariah-compliant firms

(Gati *et al.*, 2020; Alam and Rajjaque, 2010; Al-Awadhi and Dempsey, 2017). Using data from the Gulf Cooperation Council (GCC) countries, Akguc and Al Rahahleh (2018) found that Shariah-compliant firms were operationally more profitable than non-Shariah-compliant firms. In this sense, Gati *et al.* (2020) opined that ethical corporate practices have a significant influence on corporate performance. Lee and Isa (2020) have also reported that Shariah-compliant firms that engaged in ESG activities have better performance. In other aspects of corporate practices, Wan Ismail *et al.* (2015) reported that Shariah-compliant firms were more likely to have higher earnings conservatism than non-Shariah-compliant firms. Karimov *et al.* (2020) found that the adoption of Shariah practices has significantly reduced the cost of equity capital of firms since Shariah compliance can provide more liquidity with strict requirements on the leverage rate.

The way Shariah-compliant requirements affect CCH was relevant in this study. Bugshan *et al.* (2021) posited that the restrictions imposed by Shariah differentiate cash holdings between Shariah- and non-Shariah-compliant firms. These restrictions relate to various financial decisions, including investments, financing, operations and risk management decisions. For example, Shariah regulations do not permit the use of interest-bearing debt instruments and loans on which interest is charged. As a result, Shariah-compliant firms have fewer external financing channels than their counterparts. This means that Shariah-compliant firms would be more financially constrained and hence, would be required to hold more cash reserves to meet their financial and operational needs. Bugshan *et al.* (2021) also argued that the external financing transaction cost for Shariah-compliant firms would likely be higher than the same cost for non-Shariah-compliant firms. Hence, Shariah-compliant firms would hold significantly greater cash reserves due to transaction cost savings. Bugshan *et al.* (2021) also found that Shariah-compliant firms held significantly higher levels of cash than their non-Shariah-compliant counterparts. Furthermore, Shariah-compliant firms were quicker than non-Shariah-compliant firms in adjusting the level of cash holdings to reach a target level (Guizani and Ajmi, 2021; Bugshan *et al.*, 2021). Consequently, the accumulation of corporate cash would be stronger for Shariah-compliant firms, as they can respond to the permanent binding-leverage constraints suggested by the Islamic capital market.

This study has analysed both the ethical precepts of ESG and Shariah-compliant status to better understand CCH. From the ESG viewpoint, higher ESG scores would lead to greater risk reduction for Shariah-compliant firms (Hassan *et al.*, 2021). This study perceived the Shariah-compliant status as moderating the relationship between ESG and CCH. This expectation was justified by the fact that Shariah-compliant firms are subject to greater scrutiny by regulators and investors. Hence, they have a greater incentive to manage their cash reserve to meet the objectives of shareholders rather than entrench them. Firms with the Shariah-compliant status also reflect their responsibility to adhere to various religious and social requirements, which include meeting the needs of various stakeholders. Therefore, the restrictions imposed by Shariah serve as additional governance and incentives that ensure the effective management of cash reserves. Thus, this study posited that ESG and Shariah compliance were the ethical precepts underlying the firm-level features that shape the founding conditions for the variations in the CCH. Shariah-compliant firms' commitment to ESG would consequently result in higher cash holding. Accordingly, the following hypothesis was developed:

H2. The positive impact of corporate ESG commitment on cash holdings is greater for Shariah-compliant firms.

3. Methodology

3.1 Data sources

The sample used in this study consisted of 9,244 firm-year observations from 25 countries collected from 2016 to 2020. Data were collected from secondary sources:

- financial information from Thomson Reuters; and
- information on ESG and Shariah-compliant status from Thomson Reuters.

This study also used country-level control variables from the World Bank and Hofstede Insights website. All variables and definitions used in this study are listed in Table 1.

Variable	Definition
Dependent variables	
CCH1	The proportion of cash and equivalents to total assets
CCH2	The proportion of cash and cash equivalents to (total assets – cash and cash equivalents)
Independent variables	
ESG_SCORE	The environmental, social and governance score from Refinitiv database divided by 100
E_SCORE	The environmental score from Refinitiv database divided by 100
S_SCORE	The social score from Refinitiv database divided by 100
G_SCORE	The governance score from Refinitiv database divided by 100
Moderating variable	
SHARIAH	A dummy variable that takes value 1 for a Shariah-compliant firm identified based on Shariah Compliance Flag, 0 otherwise
Control variables (firm level)	
AGE	The natural logarithm of the number of years since the year of incorporation
CINT	The ratio of net book value of property, plant and equipment to total assets
DIVDUM	A dummy variable that takes a value of 1 if the company paid dividends and 0 otherwise
FSIZE	The natural logarithm of total assets
GROWTH	The change of annual net sales over the past year sales
LEV	The ratio of total debts to total assets
RDINT	The ratio of research and development expenditure to total assets
RETA	The ratio of retained earnings to total assets
ROA	The ratio of net income to total assets
SVAR	The standard deviation of the sales revenue per total assets over a lag of a six-year period
Control variables (country level)	
TAX	The annual corporate tax rate
LGDP	The natural logarithm of gross domestic product per capita in US dollar
IDV	The individualism versus collectivism index by Hofstede
MAS	The index for masculinity versus femininity by Hofstede
PDI	The power distance index by Hofstede
UAI	The uncertainty avoidance index by Hofstede
Additional control variables (Heckman two stage)	
BDSIZE	The total number of directors on the board
BDINDP	The proportion of independent directors to the total number of directors on the board

Source: Authors' own work

Table 1.
Variable description

3.2 Regression model

The regression model used for testing the developed hypotheses is as follows:

$$CCH_{it} = \beta_0 + \beta_1 ESG_SCORE_{it} + \beta_2 SHARIAH_{it} + \beta_3 SHARIAH{*}ESG_SCORE_{it} + \beta_k FIRMVARS_{it} + \beta_k COUNTRYVARS_{it} + \theta_{1-n} Fixed\ effects + \varepsilon_{it} \quad (1)$$

where *CCH* represents corporate cash holdings, *ESG_SCORE* is the ESG score, *SHARIAH* represents Shariah-compliant identification, *SHARIAH*ESG_SCORE* represents the interaction between ESG and Shariah-compliant identification, *FIRMVARS* are firm-level control variables and *COUNTRYVARS* are country-level control variables. This model includes *Fixed effects*, which are vectors for industry and year effects, with *i* and *t* denoting firm *i* at the end of year *t*.

In this model, the dependent variable is CCH, proxied by CCH1 and CCH2. CCH1 is the proportion of cash and cash equivalents to total assets (Kusumawardani *et al.*, 2021; Machokoto *et al.*, 2021). Meanwhile, CCH2 is the proportion of cash and cash equivalents to total assets minus cash and cash equivalents (Bugshan *et al.*, 2021; Nguyen *et al.*, 2021). ESG scores were measured using data provided by Thomson Reuters (Refinitiv), as recently used by Khaled *et al.* (2021) and Hassan *et al.* (2021), which was previously known as ASSET4 in prior studies (Cheng *et al.*, 2014; Pekovic and Vogt, 2020). The ESG scores were the cumulative scores from ESG divided by 100. Another test variable was the Shariah-compliant status, which was identified by a value of 1 for a Shariah-compliant firm based on the Shariah Compliance Flag, and a value of 0 otherwise.

This study has also included *FIRMVARS*, which are k-vectors (k equals to the number of controls), referring to the firm-level control variables incorporated by prior studies. More specifically, *FIRMVARS* include the following items: *AGE*, which is the natural logarithm of the number of years since the year of incorporation; *CINT*, which is the ratio of net book value of property, plant and equipment to total assets; *DIVDUM*, which is a dummy variable that takes a value of 1, if the company paid dividends, and a value of 0 otherwise; FSIZE, which is the natural logarithm of total assets; *GROWTH*, which is the change of annual net sales over past year sales; *LEV*, which is the ratio of total debts divided by total assets; *RDINT*, which is the ratio of research and development expenditure to total assets; *RETA*, which is the ratio of retained earnings divided by total assets; *ROA*, which is the ratio of net income to the total assets; and *SVAR*, which is the standard deviation of the sales revenue per total assets over a lag of a six-year period. In [equation (1)], *COUNTRYVAR* refers to the following country-level control variables: *TAX*, which is the annual corporate tax rate; *LGDP*, which is the natural logarithm of gross domestic product per capita in US dollar; *IDV*, which is the individualism versus collectivism index; *MAS*, which is the index for masculinity versus femininity; *PDI*, which is the power distance index; and *UAI*, which is the uncertainty avoidance index.

4. Results and discussions

4.1 Descriptive statistics

The descriptive statistics for the variables, as reported in Panel A of Table 2, show that the average *CCH1* is 0.117 with values ranging from −0.024 to 0.929, while the average *CCH2* is 0.181 with values ranging from −0.024 to 13.13. The mean value for *ESG_SCORE* is 0.426. Table 2 also shows that the mean values for the three proxies of ESG are 0.308 for *E_SCORE*, 0.442 for *S_SCORE* and 0.497 for *G_SCORE*. The mean value of *SHARIAH* was 0.352, indicating that 35.2% of the sample were Shariah-compliant firms.

Table 2. Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
Panel A: Descriptive statistics for the variables					
CCH1	9,244	0.117	0.128	−0.024	0.929
CCH2	9,244	0.181	0.416	−0.024	13.13
ESG_SCORE	9,244	0.426	0.198	0.004	0.939
E_SCORE	9,244	0.308	0.289	0	0.983
S_SCORE	9,244	0.442	0.222	0.005	0.982
G_SCORE	9,244	0.497	0.219	0.006	0.988
SHARIAH	9,244	0.352	0.478	0	1
AGE	9,244	9.101	0.911	3.367	11.025
CINT	9,244	0.269	0.223	0.001	0.904
DIVDUM	9,244	0.631	0.482	0	1
GROWTH	9,244	0.239	2.487	−0.957	73.039
LEV	9,244	0.253	0.213	0	1.719
RDINT	9,244	0.032	0.066	0	0.373
RETA	9,244	0.033	1.372	−41.345	2.576
ROA	9,244	0.028	0.151	−2.558	3.597
SVAR	9,244	0.139	0.148	0.002	1.44
FSIZE	9,244	21.66	1.563	15.672	24.735
BDSIZE	9,244	9.411	2.754	1	26
BDINDP	9,244	0.689	0.241	0	1
TAX	9,244	0.306	0.063	0.165	0.39
LGDP	9,244	10.778	0.684	7.381	11.369
IDV	9,244	79.754	19.599	14	91
MAS	9,244	63.692	14.019	5	95
PDI	9,244	43.273	10.761	11	104
UAI	9,244	52.522	16.227	8	112

(*continued*)

Table 2.

No.	Country	Region	Obs	CCH1	CCH2	ESG_SCORE	E_SCORE	S_SCORE	G_SCORE	SHARIAH
Panel B: Descriptive statistics for country-level scores										
1	Australia	Asia and Pacific	526	0.108	0.209	0.406	0.258	0.409	0.529	0.591
2	Austria	Europe	25	0.118	0.158	0.571	0.552	0.601	0.547	0.000
3	Belgium	Europe	30	0.045	0.049	0.505	0.509	0.552	0.434	0.000
4	Canada	North America	486	0.075	0.115	0.435	0.354	0.434	0.532	0.467
5	Hong Kong	Asia and Pacific	88	0.070	0.084	0.466	0.451	0.417	0.551	0.352
6	Germany	Europe	37	0.097	0.110	0.752	0.740	0.806	0.661	0.838
7	Greece	Europe	20	0.101	0.132	0.479	0.369	0.551	0.457	0.000
8	India	Asia and Pacific	281	0.027	0.032	0.528	0.461	0.566	0.516	0.466
9	Indonesia	Asia and Pacific	19	0.127	0.162	0.386	0.218	0.464	0.446	0.579
10	Israel	Middle east	46	0.136	0.190	0.390	0.191	0.417	0.448	0.000
11	Italy	Europe	9	0.108	0.124	0.470	0.443	0.534	0.433	0.444
12	Japan	Asia and Pacific	1,074	0.162	0.231	0.485	0.504	0.437	0.511	0.000
13	Malaysia	Asia and Pacific	38	0.070	0.080	0.460	0.416	0.527	0.390	0.316
14	The Netherlands	Europe	38	0.074	0.082	0.668	0.591	0.718	0.656	0.211
15	New Zealand	Asia and Pacific	65	0.054	0.080	0.341	0.196	0.326	0.480	0.000
16	Norway	Europe	77	0.085	0.262	0.564	0.531	0.573	0.584	0.000
17	Philippines	Asia Pacific	11	0.054	0.058	0.229	0.171	0.241	0.290	0.000
18	Poland	Europe	43	0.046	0.051	0.464	0.417	0.461	0.465	0.000
19	Singapore	Asia and Pacific	45	0.067	0.076	0.528	0.495	0.558	0.546	0.444
20	Sweden	Europe	45	0.078	0.088	0.727	0.696	0.771	0.683	0.578
21	Switzerland	Europe	205	0.076	0.088	0.541	0.518	0.593	0.489	0.434
22	Thailand	Asia and Pacific	125	0.032	0.043	0.555	0.494	0.625	0.515	0.272
23	Turkey	Europe	2	0.000	0.000	0.432	0.377	0.513	0.395	0.000
24	UK	Europe	19	0.103	0.120	0.680	0.634	0.602	0.875	1.000
25	USA	North America	5,890	0.125	0.195	0.394	0.239	0.421	0.482	0.391

Source: Authors' own work

In terms of the firm-level control variables, the mean for *AGE* was 9.101 with a range between 3.367 and 11.025. *CINT* was shown to have a mean of 0.269, while the mean of *DIVDUM* was 0.631. The average value for *GROWTH* was 0.239, and the average value for *LEV* was 0.253. *RDINT* and *RETA* have mean values of 0.032 and 0.033, respectively. The mean for *ROA* was 0.028 with values ranging from −2.558 to 3.597, while the mean for *SVAR* was 0.139 with values ranging from 0.002 to 1.44. *FSIZE* has a mean value of 21.66 with a minimum value of 15.672 and a maximum value of 24.735.

As for the country-level control variables, the mean for *TAX* was 0.306 with values ranging from 0.165 to 0.39. The mean value for *LGDP* was 10.778 with values ranging from 7.381 to 11.369. The mean values for *IDV* and *MAS* were 79.754 and 63.692, respectively. The mean value for *PDI* was 43.273 (ranging from 11 to 104), while the mean value for *UAI* was 52.522 (ranging from 8 to 112). *BDSIZE* showed an average value of 9.411, while *BDINDP* has an average value of 0.689.

The untabulated statistics for the univariate differences of the variables between Shariah- (n = 3256) and non-Shariah-compliant (n = 5,988) samples showed that the mean for *CCH1* among non-Shariah-compliant firms (0.130) was significantly higher than the mean among Shariah-compliant firms (0.09). *CCH2* also showed a significantly higher mean among the non-Shariah-compliant firms compared to Shariah-compliant firms. The mean for *ESG_SCORE* was not significantly higher for non-Shariah-compliant firms compared to Shariah-compliant firms. In terms of *AGE*, Shariah-compliant firms were not significantly younger than non-Shariah-compliant firms. Meanwhile, the means for *TAX* and *GROWTH* have higher values among the Shariah-compliant firms. The means for *LEV*, *RDINT*, *FSIZE*, *BDSIZE*, *MAS*, *PDI* and *UAI* were significantly higher among non-Shariah-compliant firms compared to the means among Shariah-compliant firms, but not for *CINT*, *DIVDUM*, *RETA*, *ROA*, *SVAR*, *BDINDP*, *LGDP* and *IDV*.

The descriptive statistics for country-level scores in Panel B of Table 2 indicate that the sample is heavily represented by firms in the USA (n = 5,890) and Japan (n = 1,074). Meanwhile, firms in Turkey (n = 2) and Italy (n = 9) have the lowest number of observations.

4.2 Main analysis

Table 3 presents the regression results of the effect of corporate ESG performance (*ESG_SCORE*) on CCH in different subsamples. Column (1) shows the results for the Shariah

Sample	(1) Shariah	(2) Non-Shariah	(3) Pooled	(4) Pooled
Intercept	0.034 (0.383)	0.343*** (5.931)	0.234*** (5.288)	0.234*** (5.311)
ESG_SCORE	0.046*** (4.553)	0.039*** (3.938)	0.040*** (5.351)	0.016* (1.943)
SHARIAH			−0.027*** (−10.531)	−0.057*** (−10.126)
*SHARIAH*ESG_SCORE*				0.069*** (5.924)
Control variables	Included	Included	Included	Included
Fixed effects	Included	Included	Included	Included
Adj.R^2	0.19	0.37	0.33	0.34
N	3,256	5,988	9,244	9,244
F-stat	26.222	110.662	141.891	139.260

Notes: * and *** represent significance at $p < 0.10$ and $p < 0.01$, respectively, *t*-values are reported in the parentheses. See Table 1 for the variable definitions
Source: Authors' own work

Table 3. Regression estimates of ESG, Shariah-compliant status and cash holdings

sample, while Column (2) shows the results for the non-Shariah sample. Significant coefficients of *ESG_SCORE* were found in both samples. The results indicated that *ESG_SCORE* was associated with CCH. The positive signs suggested that higher corporate ESG can be associated with higher CCH for both samples of Shariah- and non-Shariah-compliant firms. Column (3) shows the results of the pooled sample to test *H1* on the association between ESG and CCH. The results showed that the coefficient for *ESG_SCORE* was significant and positive, indicating that firms with higher ESG were those with higher CCH. These results supported *H1*, in line with the proposition that firms with greater CS were trusted to manage their financial resources in effective ways that benefit the stakeholders. Nevertheless, the coefficient for the Shariah-compliant variable (*SHARIAH*) was found to be significant but with a negative sign. These results indicated that *SHARIAH* was negatively associated with CCH, which supported the notion that firms with higher Shariah compliance were associated with lower cash holdings.

The results of the joint effect of Shariah-compliant status and corporate social performance (*SHARIAH*ESG_SCORE*) are presented in Column (4). The result showed that the coefficient for *SHARIAH*ESG_SCORE* was positive and significant, which supported *H2*. Thus, Shariah-compliant firms with higher ESG scores were more likely to hold higher cash reserves. Both *ESG_SCORE* and *SHARIAH* have affected CCH differently. However, the joint effect of *SHARIAH* and *ESG_SCORE* was positively affecting CCH. Firms with high ESG performance and Shariah-compliant status have higher cash holdings than their counterparts. Thus, Shariah-compliant status was found to moderate the association between *ESG_SCORE* and CCH.

For control variables (untabulated for brevity), *RDINT*, *ROA*, *SVAR*, *TAX*, *LGDP*, *PDI* and *UAI* have positive relationships with CCH, while *CINT*, *DIVDUM*, *LEV*, *RETA* and *FSIZE* have negative relationships with CCH.

4.3 Robustness analyses

To ensure the robustness of the main results, this study performed several robustness tests. The results are presented in Tables 4, 5 and 6. Table 4 presents the regression results of the

Sample	(1) Pooled	(2) Pooled	(3) Pooled
Intercept	0.235*** (5.237)	0.219*** (4.985)	0.205*** (4.707)
E_SCORE	0.009 (1.518)		
S_SCORE		0.014* (1.917)	
G_SCORE			−0.010 (−1.445)
SHARIAH	−0.043*** (−11.826)	−0.049*** (−9.331)	−0.052*** (−8.764)
*SHARIAH*E_SCORE*	0.050*** (6.069)		
*SHARIAH*S_SCORE*		0.050*** (4.798)	
*SHARIAH*G_SCORE*			0.050*** (4.754)
Control variables	Included	Included	Included
Fixed effects	Included	Included	Included
Adj.R^2	0.34	0.34	0.33
N	9,244	9,244	9,244
F-stat	139.167	138.499	137.530

Table 4. Regression estimates alternative measurement for corporate ESG

Notes: * and *** represent significance at $p < 0.10$ and $p < 0.01$, respectively, *t*-values are reported in the parentheses. See Table 1 for the variable definitions
Source: Authors' own work

Sample	(1) Pooled	(2) Pooled	(3) Pooled	(4) Pooled
Intercept	0.866*** (5.422)	0.869*** (5.354)	0.791*** (4.981)	0.760*** (4.813)
ESG_SCORE	0.086*** (2.835)			
E_SCORE		0.046** (2.076)		
S_SCORE			0.046* (1.777)	
G_SCORE				0.020 (0.825)
SHARIAH	−0.153*** (−7.489)	−0.119*** (−9.140)	−0.135*** (−7.053)	−0.135*** (−6.237)
*SHARIAH*ESG_SCORE*	0.172*** (4.061)			
*SHARIAH*E_SCORE*		0.133*** (4.432)		
*SHARIAH*S_SCORE*			0.128*** (3.415)	
*SHARIAH*G_SCORE*				0.112*** (2.941)
Control variables	Included	Included	Included	Included
Fixed effects	Included	Included	Included	Included
Adj.R^2	0.18	0.18	0.18	0.18
N	9,244	9,244	9,244	9,244
F-stat	60.002	59.885	59.348	59.004

Notes: *, ** and *** represent significance at $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively, *t-values* are reported in the parentheses. See Table 1 for the variable definitions
Source: Authors' own work

Table 5. Regression estimates alternative measurement for corporate cash holdings

effect of corporate ESG on CCH using alternative measures for *ESG_SCORE*. The *ESG_SCORE* was divided into Environmental (E_SCORE), Social (S_SCORE) and Governance (G_SCORE). Then, the model was regressed using pooled samples. The results of the alternative analyses using E_SCORE, S_SCORE and G_SCORE are presented in Columns (1), (2) and (3), respectively. This study found that E_SCORE and G_SCORE showed no association with CCH, while S_SCORE was positively associated with CCH. In all columns, SHARIAH has a negative association with CCH. Meanwhile, the coefficients of all interaction variables are positive and significant, as shown by SHARIAH*E_SCORE in Column (1), SHARIAH*S_SCORE in Column (2) and SHARIAH*G_SCORE in Column (3). Overall, the results for *H1* were inconsistent with the main results, as only E_SCORE was positive and significant. However, the results for *H2* were similar to the main results in terms of the moderating effect of Shariah-compliant status on the association between ESG and CCH.

Table 5 presents the regression results of the effect of corporate ESG on CCH by re-estimating [equation (1)] using different measures of CCH. The proportion of cash and cash equivalents was used to total assets minus cash and cash equivalents (CCH2) as the dependent variable. The estimation results are reported in Column (1), and the coefficients for *ESG_SCORE* and *SHARIAH*ESG_SCORE* are shown to be positive and significant, while the coefficient for *SHARIAH* is negative and significant. These results implied that firms with better *ESG_SCORE* have higher cash holdings, and this relationship was stronger for Shariah-compliant firms. The unweighted environment (E_SCORE), social (S_SCORE) and governance (G_SCORE) scores are also used as independent variables, as shown in Columns (2), (3) and (4), respectively. Overall, these results are similar to the estimated results of *ESG_SCORE* [Column (1)] and are consistent with the main findings. These results supported the prediction that Shariah-compliant firms that have higher ESG commitments were those with higher cash holdings.

	First stage (1)		Second stage (2)	(3)
Intercept	0.701** (2.548)	*Intercept*	0.236*** (5.346)	0.220*** (5.015)
CINT	0.320*** (3.944)	*ESG_SCORE*	0.016* (1.870)	
DIVDUM	0.034 (0.935)	*S_SCORE*		0.013* (1.803)
LEV	−2.162*** (−23.087)	*SHARIAH*	−0.058*** (−10.322)	−0.050*** (−9.436)
RDINT	−5.259*** (−14.383)	*SHARIAH*ESG_SCORE*	0.072*** (6.106)	
RETA	0.206*** (7.073)	*SHARIAH*S_SCORE*		0.051*** (4.904)
ROA	−0.319** (−2.195)	*AGE*	−0.004*** (−2.709)	−0.003** (−2.440)
SVAR	0.045 (0.442)	*CINT*	−0.086*** (−13.617)	−0.086*** (−13.680)
FSIZE	−0.058*** (−4.358)	*DIVDUM*	−0.006** (−2.054)	−0.005* (−1.733)
BDSIZE	−0.029*** (−4.105)	*GROWTH*	0.001 (1.245)	0.001 (1.303)
BDINDP	1.418*** (20.899)	*LEV*	−0.107*** (−8.837)	−0.100*** (−8.334)
		RDINT	0.463*** (13.317)	0.482*** (13.989)
		RETA	−0.004** (−2.359)	−0.005*** (−2.992)
		ROA	0.039*** (4.245)	0.040*** (4.372)
		SVAR	0.029*** (3.715)	0.029*** (3.678)
		FSIZE	−0.019*** (−17.649)	−0.018*** (−17.749)
		TAX	0.132*** (4.127)	0.127*** (3.970)
		LGDP	0.027*** (9.005)	0.027*** (8.996)
		IDV	−0.000*** (−3.063)	−0.000*** (−3.248)
		MAS	0.001*** (5.163)	0.001*** (5.219)
		PDI	0.000** (2.261)	0.000** (2.205)
		UAI	0.000*** (3.070)	0.000*** (3.197)
		IMR	0.008 (1.262)	0.004 (0.584)
Fixed effects	Included	*Fixed effects*	Included	Included
Pseudo R^2	0.1598	Adj.R^2	0.34	0.34
N	9,203	*N*	9,203	9,203
LR chi^2	1,910.55	*F*-stat	139.322	138.503

Table 6. Regression estimates using propensity score matching procedure

Notes: *, ** and *** represent significance at $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively, *t-values* are reported in the parentheses. See Table 1 for the variable definitions
Source: Authors' own work

Endogeneity problem in this study was related to selection bias due to the likelihood that firms with higher cash holdings were more likely to engage in ESG activities. Hence, firms that were committed towards high ESG might have been self-selected into the sample of Shariah-compliant firms. To correct this problem, the propensity score matching developed by Rosenbaum and Rubin (1983) was used to control firm-level characteristics. Firms with high *ESG_SCORE* were matched to a set of control firms with low *ESG_SCORE* based on the characteristics with the closest forecast propensity score. The results in Table 6 show the logit regression estimates of the probability of *ESG_SCORE*. These results showed that *CINT*, *RETA* and *BDINDP* were positively associated with *ESG_SCORE*, while *LEV*, *RDINT*, *ROA*, *FSIZE* and *BDSIZE* were negatively associated with *ESG_SCORE*. No relationship was found between *DIVDUM* and *SVAR* with the *ESG_SCORE*. In Column (2), the regression estimates of *ESG_SCORE*, with CCH as the dependent variable, show that the inferences of the main results remain unchanged. Similarly, in Column (3), estimations of S_SCORE with CCH show similar results to the main results in Table 3. For both Columns (2) and (3), Shariah-compliant status moderates the relationship between ESG and cash holdings.

5. Conclusions

These results supported the hypothesis that Shariah-compliant status moderates the relationship between corporate ESG and CCH. The joint effect of these precepts of ethical conduct was justified to influence corporate liquidity management. Overall, the findings were consistent with the stakeholder theory that Shariah-compliant firms with higher ESG practices were motivated by ethical considerations of pursuing the goals of reducing risk-taking activities and following value-increasing activities to resonate with the values of ethical business models. The evidence of high cash holdings for firms that are focused on ensuring ESG performance and complying to Shariah requirements would be a valuable signal to convince the capital market of this unique value system that can lead to a path of improved stakeholder engagement.

This study has several implications. In terms of practical implications, the findings implied that firms with strong ethical conduct might be able to foster the trust of investors and other stakeholders. Hence, they can disentangle the dilemma between the benefits and risks of holding high cash reserves. This study offers input for the decision-making process by the providers of finance, mainly the investors, by implying that ESG practices and being Shariah-compliant are important features of a potential portfolio. In terms of the stakeholders, these findings provide them with the perspective that ethical corporate practices serve as social capitals, which can help firms towards gaining wider and more sustainable stakeholders' trust. These findings are a relevant and timely contribution to the capital market development and sustainability, whereby corporate ethical features are sought after, as seen in the growth of socially responsible investments. In terms of social implications, the highlights on ethical corporate practices through ESG commitment and Shariah-compliant status offer input in the development of policies by regulators or strategies by firms which can subsequently benefit the society. Policies and strategies that could form strong, well-functioning and efficient institutions through the reduction of unethical conducts in the capital market would be conducive for positive businesses and economic growth. The society would ultimately benefit from the achievements in the Sustainable Development Goals 16 through policies and strategies that promote just, peaceful and inclusive societies.

The findings of this study also need to be considered within the purview of several limitations that could benefit future research. Firstly, this study relied on CCH as a performance measure because it proxied how well a company manages to reserve its liquid resources in preparation of impending unexpected crises and promotes high corporate performance in the restoration of stakeholders' trust. Future research could compare different short-term or long-term financial indicators that reflect quantified corporate performance measures. Secondly, even though this study observed 25 countries, this sample was restricted to firms that provided data on ESG information. This sample only included listed firms; hence, the findings cannot be generalised to reflect all types of firms in those countries. Thirdly, future research could perform an analysis based on regional areas (e.g. Asia, the USA and Europe) by using appropriate research techniques to extend the understanding on possible variations of the link between ESG, Shariah-compliant status and CCH across these regions. Attempts could also be made to use firms from countries with huge market for Islamic assets, as highlighted by Tlemsani (2020), to be an approach that is representative of the Islamic finance industry. Despite the limitations mentioned here, this study shall be an impetus to future studies, which would be able to gather wider variations of data and/or capture more CS performance data by using different types of firms and various research methods, such as data triangulation that includes survey and interview.

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DOES ENVIRONMENTAL, SOCIAL AND GOVERNANCE PERFORMANCE INFLUENCE ECONOMIC PERFORMANCE?

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Abstract. The purpose of this paper is to evaluate the influence of environmental, social and governance performance on the economic performance of the Standard & Poor's 500 companies. Structural equation modeling and linear regression have been utilized to measure the overall and individual influence of environmental, social and governance (ESG) performance on economic performance using longitudinal data comprising the years from 2010 to 2015. The overall ESG model had a significant relationship on economic performance. Furthermore, the findings of this study show that social and governance performance significantly affects economic performance in all regression models. However, environmental performance failed to show a significant relationship. The research contributes to the literature by providing insights for investors, managers and employees about the influence of ESG performance on company performance.

Keywords: corporate social responsibility, economic performance, environmental performance, governance performance, social performance, structural equation modelling.

JEL Classification: E00, G3, Q0.

Introduction

Financial crises and disputes have increased apprehensions over companies' transparency, reputation, ethical, social and environmental performance (Galbreath, 2013; Nicholson & Kiel-Chisholm, 2011). In addition, media pressure has played a critical role in motivating companies towards increased ESG transparency and disclosure (Garcia-Sanchez et al., 2014). Customers, investors, government, and employees are the key stakeholders which contribute to the growing interest on the socially responsible aspects (Schwartz & Carroll, 2003). Beyond that, sustainability issues have attracted intensified attention by the stakeholders and scholars. Therefore, firms' ESG disclosures have substantially increased to meet the stakeholders' demands and create more accountability for firms (Eccles et al., 2014; Tamimi & Sebastianelli, 2017). Over the 21st century the competitive nature of the business environment requires a

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range of practices to achieve a competitive advantage. Furthermore, the Principles for Responsible Investment (PRI) make the link between environmental, social and governance (ESG) and investment performance prominent. Firms from more than 150 countries agree on the United Nations' Global Impact Signatory which covers topics such as human rights, environment, transparency, and worker rights. It is stated that Northern Europe makes up most of the signatories in the UN Global Compact, however; U.S. was the most represented country as a single country. Socially responsible investment reached higher levels in the U.S. with $3.74 trillion with philanthropic activities and use of codes of ethics being higher in the U.S than in other countries. There is a growth in the demand and emphasis placed on the socially responsible aspects by the stakeholders (Tamimi & Sebastianelli, 2017). In line with these arguments, stakeholder theory argues that firms must operate by considering the needs of all stakeholders that are involved in the business activities of the firm. ESG performance is a way of considering the needs of stakeholders in terms of environmental, social and governance initiatives and providing them with the information they demand regarding these issues. Thus, satisfaction and dissatisfaction among stakeholders and influence the economic performance of the companies (Clarkson, 1995).

Discussions of ESG performance have shifted from the traditional financial perspective to a more sophisticated perspective of socio-economic outcomes (Wang et al., 2016). ESG information offers relevant information regarding non-financial performance of a company. Companies provide information about their technology, raw materials, adherence with regulations, strategies and contributions to the society (van Duuren et al., 2016). Within the sustainability and business ethics literature the concept of ESG and its consequences had been intensely researched. Results on the relationship between ESG and firm performance yield different findings. Some studies concluded that there is a positive relationship between ESG and firm performance (Fatemi et al., 2018; Yoon et al., 2018; Zhao et al., 2018); while others concluded a negative relationship or no relationship at all (Atan et al., 2018; Duque–Grisales & Aguilera-Caracuel, 2019; Malcolm et al., 2007). Furthermore, geographical area makes a difference amongst firms with research conducted in different regions yielding different findings which make it challenging to present a decisive conclusion (Forte, 2013; Lambooy, 2010). Despite the intense attention paid by scholars on financial outcomes of the ESG (Gallego-Alvarez et al., 2014; Lo & Kwan, 2017; Mervelskemper & Streit, 2017), the inquiry to find evidence for the impact of ESG on the economic performance remains unanswered. Thus, economic performance has received less attention than financial performance. There has been an increase in the multiplicity of regions and countries appearing within the research samples. This can be both explained by globalization and the use of institutional view while analyzing the ESG aspects (Pache & Santos, 2013; Surroca et al., 2010). There is a gap within the subject as the causality between economic performance and sustainability performance is still a complex subject (Friede et al., 2015; Margolis & Walsh, 2003; Taliento et al., 2019). Furthermore, several studies investigated the association between ESG performance and financial performance of the companies; however, the results were ambiguous and inconclusive (Horváthová, 2010; Landi & Sciarelli, 2019; Revelli & Viviani, 2015; van Beurden & Gössling, 2008). This study aims to fill these gaps by providing an evaluation of the causal effect of ESG on the economic performance of firms and to provide conclusive findings on the subject.

In this respect the purpose of this study is two-fold: first, investigating the influence of ESG performance on the economic performance of U.S. firms; second, investigating the individual influences of environmental, social and governance performance on the economic performance of the firms. The stakeholder theory is used as a framework to explain the proposed relationship between the variables. The empirical analysis was carried out using longitudinal data (2010–2015) from the U.S. Structural equation modelling (SEM) and multiple regression analysis were employed using lagged values for ESG performance to claim causality.

The remainder of the paper is organized as follows. Section 1 consists of the theoretical and hypotheses development in light of the literature. Section 2 presents the methodology of the research and the results are presented in section 3. Discussion is carried out in section 4 and the final section concludes the paper.

1. Hypothesis development

The concept of ESG covers operations and behaviors of a company on environmental, social and governance matters (Bassen & Kovacs, 2008). Furthermore, ESG disclosure increases transparency within the company about their environmental, social and governance practices (Eccles et al., 2014; Li et al., 2018). Disclosure of these aspects creates more incentives for managers, investors and stakeholder to make better decisions and evaluations. Therefore, ESG disclosure causes an increase in the availability and quality of the information (Cheng et al., 2014). This is expected to reduce the information asymmetry between firm and stakeholders (El Ghoul et al., 2011). ESG investing is not the same as strategic management; however, successful management and accounting of ESG requires a strategic point of realization of the concept. According to van Duuren et al. (2016) ESG management affects the technology, resources, employees, and society in the long-term.

ESG information is used by investors in making decisions about the companies' economic performance (Amel-Zadeh & Serafeim, 2018). In addition, ESG information is claimed to be a measure of opportunities and risks (Limkriangkrai et al., 2017). According to Russo and Perrini (2010), from the stakeholder theory view, stakeholders' primary interests are environmental, social and governance issues. There is a link between ESG performances of organizations and their economic performances which has been created by the perceptions of the stakeholders (Barnett, 2007). According to Fisman, Heal, and Nair (2006), social performance can boost companies' ability in gaining competitive advantage and increasing market value. Clarkson (1995) claimed that companies' ability in contributing to stakeholders' demands is the key to economic performance. Given the concept of ESG studied as a single construct the previous findings are rather inconclusive or misleading. Some scholars suggested that there is a positive relationship between considering the needs of stakeholders and financial and economic performance (Nekhili et al., 2019; Richardson, 2009; Tarmuji et al., 2016). El Ghoul, Guedhami, and Kim (2017) analyzed the relationship between ESG performance and firm value in 53 countries and found a positive relationship. Furthermore, Friede et al. (2015) conducted a meta-analysis indicated that vast majority of the research found a positive association between ESG and financial performance. Therefore, the following hypothesis is proposed:

H1 ESG performance has a positive influence on economic performance.

Environmental issues caused by companies such as greenhouse gas emissions, water management, and air pollution have gained the attention of all countries (Li & Green, 2011). There are several arguments on the relationship between environmental performance and economic performance. To start with, carrying out business operations that comply with environmental regulations would minimize the future costs of not complying with the regulations (Hart, 1995; Shrivastava, 1995). Likewise, considering an environmentally friendly business strategy, operating costs can also be reduced (Russo & Fouts, 1997). In a normative stakeholder perspective, customers would perceive firms' products and services in a positive way (Donaldson & Preston, 1995). In general, employees, customers and government, which are key stakeholders, can positively react to the environmentally friendly image created by firms and therefore develop positive attitudes (Berman et al., 1999; Hart, 1995). Al-Najjar and Anfimiadou (2011), found a positive relationship between environmental performance and market-based performance in a sample of 350 UK companies. Wang, Li, and Gao (2014) analyzed the effect of greenhouse gas emission disclosure on the Tobin's Q and found a negative effect in Australia through the perspective of stakeholder theory. This suggests that stakeholder respond negatively to activities which harms the environment such as greenhouse gas emissions. Furthermore, Yadav, Han, and Rho (2016) found a positive relationship between environmental performance and abnormal stock returns on a sample of 394 US companies using efficient market theory. Therefore, companies that engage in environmentally responsible business operations can create affirmative stakeholder perceptions resulting in improved economic performance (Baumgartner, 2014; Branco & Rodrigues, 2007; Epstein & Schnietz, 2002). In line with the previous arguments the following hypothesis is proposed:

H2 Environmental performance has a positive influence on economic performance.

Stakeholders consider the social initiatives of companies such as employee and customer related aspects (Rhouma et al., 2012). Concepts such as human rights and supply chain issues have gained attention due to the globalized companies and supply chains and the U.S is one of the leading countries in this field (Darragh, 2011; Tschopp, 2005). For instance, California applied the California Transparency in Supply Chains Act of 2010 and at the federal government level a similar act is aimed to be proposed (Darragh, 2011). According to Gao and Bansal (2013) benefits of such practices include economic and financial advantages. Employees are one of the major groups of stakeholders; therefore, firms' way of managing and maintaining relationships with employees can influence their economic performance (Delery & Doty, 1996). Furthermore, investing in human resource management practices can assist a business to realize human resource related benefits and enhance competitive advantage for firms (Greening & Turban, 2000). Another human resource related benefit is lower turnover, absenteeism and increased productivity (Berman et al., 1999).

Moreover, economic performance can be affected by any socially irresponsible activity of companies. According to Frooman (1997) companies faced with skeptical market reactions when they show social behaviors which might be deemed as socially irresponsible by the customers and investors. The market reactions are found to be significantly negative for these companies (Bromiley & Marcus, 1989). According to Waddock and Graves (1997) economic performance of a company can be increased through customer perceptions on product qual-

ity and safety. Garcia-Sanchez, Prado-Lorenzo, Rodriguez-Dominguez, and Gallego-Alvarez (2008), analyzed the effect of social performance on the sales growth though a stakeholder theory perspective and found a positive effect in Spain. In addition, Mishra and Suar (2010) analyzed the effect of social performance on the return on asset as a financial performance indicator and found a positive effect in India. However, Surroca and Tribó (2008) analyzed 22 different countries and found a negative relationship between social performance and return on asset and Tobin's Q. Even though contradictory results exist, on the whole it can be said that social performance contributes to the overall economic performance of companies (Dhaliwal et al., 2011). Therefore, the following hypothesis is proposed:

H3 Social performance has a positive influence on economic performance.

The corporate governance structure of a company includes, among others, board functions and structure, compensations policy, company vision and strategy and rights given to shareholders. Moreover, companies show voluntary disclosures of corporate governance information to increase transparency and minimize agency issues (Allegrini & Greco, 2013). Corporate governance performance is associated with many economic performance indicators including resource usage, attracting investment capital, and promoting investors' trust. In addition, corporate governance performance enhances firms' ability to pay attention to societal issues and stakeholder demands which contribute to the long-term economic performance of firms (Yoon et al., 2018). Furthermore, Gill (2008) argued that governance activities can influence and shape stakeholders' perceptions and behaviors towards the company. Corporate governance practices also contribute to the reputation and image of a company. Therefore, managers and CEOs are willing to invest in positively perceived governance related activities to enhance sympathy towards the company and achieve a good prestige (Barnea & Rubin, 2010). According to Klettner, Clarke, and Boersma (2014), corporate governance has an economic influence on the firms. The studies which focused on the corporate governance and the firm performance nexus, found a positive relationship between governance performance and firm performance (Bhagat & Black, 1998; Li & Yang, 2012; Monda & Giorgino, 2013). Monda and Giorgino (2013) found a positive link between governance performance and financial performance indicators such as market valuation and return on asset for companies in France, Italy, UK and US. In addition, cost of equity is also reduced when companies showed improved governance performances in the US (Li & Yang, 2012). Soana (2011) found a positive relationship between governance performance and return on assets of Italian banks. According to Driffield, Mahambare, and Pal (2007), a more shareholder-oriented governance strategy has a positive influence on capital structure and firm value. Accordingly, the following hypothesis is proposed:

H4 Governance performance has a positive influence on economic performance.

2. Materials and methods

In this study, longitudinal data have been used for environmental, social, governance and economic performance. The longitudinal approach was utilized because it can help analyze the causal relationship between ESG and economic performance of firms (Allouche & Laroche, 2005). Annual data has been collected from the ASSET4® database provided by

Thomson Reuters Inc. It is adhered as one of the most credible and objective sources of data (Galbreath, 2013; Ortas et al., 2015). Thomson Reuters ASSET4® provides a database about ESG performance measures. Seventy key performance indicators are classified into 18 groups which measures each of the ESG. Due to the socio-historical differences across different countries, it is inevitable to conduct a study in the U.S. ESG data have been adopted as 1-year, 2-year and 3-year lagged data therefore, and the data selected is for the years between 2010 and 2012. The chosen period is important for the U.S. companies as the assets managed under the socially responsible and sustainable investment criteria rose by 22 percent from $3.07 trillion disclosed in 2010 to $3.74 trillion in 2012. In order to measure the impact, economic performance data have been selected for the years between 2011 and 2015 which allows to measure up to 3 years of lagged data for each ESG year. Therefore, for each firm 5 years of relevant data have been obtained. Global financial crisis can be adhered as a cornerstone for the ESG research and prior research about the relationship between ESG and economic performance is limited. Thus, the period after the crisis when the companies have started placing more importance and due conscience on their ESG performances considerably to enhance a strong image is an important period to analyze (Miralles-Quirós et al., 2019).

ESG is a non-financial performance measure; therefore, it differs from the traditional measures of firm performance. ESG covers a considerable amount of material non-financial information and provides additional perspectives for the investment community (Li et al., 2018). According to Eccles and Viviers (2011) there is an increasing demand for additional information which is particularly material. ESG incorporates a broad range of constructs such as environmental issues (climate change, pollution), social issues (e.g. quality, safety, human rights) and corporate governance issues (e.g. auditing, board functions, transparency, reporting). Therefore, ESG concept is an aggregated three-factor model of these dimensions. It is argued that the ESG constructs should be considered in a single study as they are interconnected with each other (Galbreath, 2013; van Duuren et al., 2016). ESG performance was measured using more than 280 performance indicators by Thomson Reuters experts. A total of 372 U.S. companies from mixed industries (e.g. technology, financial, manufacturing, logistics, and oil) listed in S&P 500 involved in the data have been attributed a score from a scale of 0 (lowest) to 100 (highest) for their environmental, social, governance and economic performance. Environmental performance refers to firms' influence on the environmental indicators such as carbon emission, resource consumption, and product innovation. Social performance refers to firms' influence on the social indicators such as human rights, equality, health and safety, community and product responsibility. Governance performance refers to firms' influence on the board functions, structure, compensation, policy, vision and strategy. Economic performance is measured as client loyalty, shareholders loyalty and overall performance which imply the company's ability to generate long term shareholder value and sustain financial health. Previous studies mostly focused on the financial performance indicators such as return on asset, market value, share price (Taliento et al., 2019; Velte, 2017; Yoon et al., 2018). It is necessary to evaluate the financial indicators as well as non-financial indicators to provide stronger conclusions for the causality between the ESG performance and firm performance (Goyal et al., 2013). Thus, this can help to make an evaluation and generalization based on the influence of

ESG performance on the overall economic performance of the companies (Ferrero-Ferrero et al., 2016; Goyal et al., 2013).

The data analysis consists of two parts. First, structural equation modeling was used to test H1 (whether ESG influence the economic performance). ESG is constructed as a latent variable from the manifest environmental, social and governance performance variables. Model fit, and the beta coefficients have been tested and the regression coefficients for the impact of ESG performance on the economic performance are also tested. In addition, structural relationships among latent variables can be analyzed by using SEM (Bollen & Long, 1993). ESG is constructed as a three-factor model and its influence on the economic performance have been tested. The SEM model based on hypothesis 1 is depicted in Figure 1.

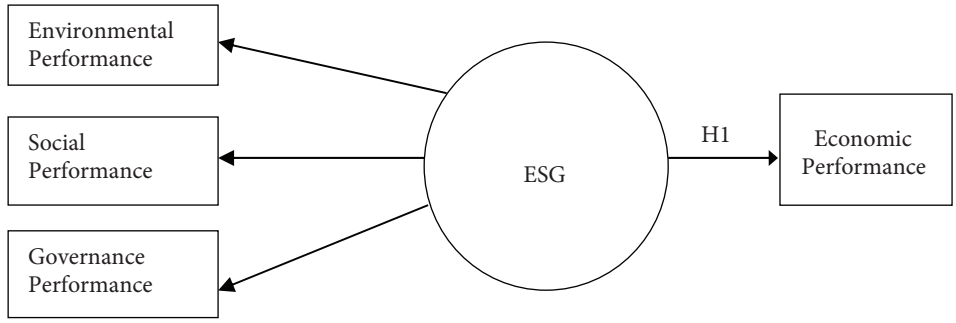

Figure 1. SEM Model

Second, multiple regression analysis was used to test the individual effects of the environmental, social and governance on the economic performance (Frooman, 1997; Horváthová, 2010). Within the regression model, the dependent variable was the economic performance and the independent variables were environmental, social and governance performance. Considering the multidimensionality of the concept (Brammer et al., 2009), there is a need to analyze the individual effects of each ESG variable. Three years of lagged ESG data were used for each year of the economic performance variable. To test the hypotheses H2, H3, and H4, nine regression analyses have been conducted as three models. The models 1–3 test the relationship between 2010–2013 ESG measures on the three consecutive years of economic performance measures.

The multiple regression models are as follows:

$$\text{Economic performance}_t = \beta_0 + \beta_1 \text{Environmental performance}_{t-1,\,2,\,3} + \beta_2\,\text{Social performance}_{t-1,\,2,\,3} + \beta_3 \text{Governance performance}_{t-1,\,2,3}\,.$$

3. Results

In Table 1 below, the descriptive statistics for the U.S. companies' environmental, social, and governance performances are summarized for the years between 2010 and 2013. In addition, descriptive statistics for economic performance has been provided for the years 2011 to 2015. The U.S. companies' governance performance was significantly higher than their

environmental and social performance over the years. However, a negative trend can be observed for governance performance from 2010 to 2012. Further, environmental performance showed a positive trend from 2010 to 2012. Social performance showed a stable trend over the period. On the other hand, economic performance of the U.S. companies showed a drop in 2011 from a mean score of 66.76 to 61.91 in 2012. From 2012, a positive trend can be observed with a mean score of 72.77 in 2015. Moreover, governance performance showed lower standard deviation values than environmental and social performance. This indicates that governance performance of the U.S. companies was stable; however, their environmental and social performances were more volatile. Economic performances of the companies were more stable in 2015 than in other years.

Table 1. Descriptive Statistics of the U.S. based companies

	N	Min.	Max.	Mean	Std. Deviation	Skewness
ESG 2010						
GOV	372	4.85	96.42	77,0742	16,17014	–1.498
ENV	372	9.40	94.96	57,8988	32,14394	–0.377
SOC	372	3.74	97.29	59,5466	27,47565	–0.381
ESG 2011						
GOV	372	5.42	96.62	76,8359	16,61201	–1.318
ENV	372	8.77	94.65	60,0239	31,99475	–0.470
SOC	372	5.01	97.26	60,7345	27,55730	–0.457
ESG 2012						
GOV	372	6.03	96.38	74,5997	16,74263	–1.133
ENV	372	8.29	94.21	60,1922	31,40999	–0.501
SOC	372	3.60	97.00	59,1322	28,03563	–0.386
ECN 2011–2015						
ECN 2011	372	2.82	98.09	66,7592	24,75135	–0.712
ECN 2012	372	3.20	98.52	61,9117	27,04446	–0.424
ECN 2013	372	3.39	98.55	64,0072	26,03603	–0.599
ECN 2014	372	7.36	98.17	67,3089	23,44055	–0.664
ECN 2015	372	17.37	97.03	72,7678	18,97732	–0.814

Notes: **, $p < 0.01$; *, $p < 0.05$; ECN, economic performance; ENV, environmental performance; SOC, social; GOV, governance performance.

Table 2 below shows the correlation coefficients for ESG and economic performance variables. The correlation coefficients implied that variables used are not highly correlated with each other. The ESG variables showed relatively higher correlations with each other however, this does not imply a multicollinearity problem. The correlations and variance inflation factor (VIF) between the variables for each of the years were tested and multicollinearity is not an obstacle in this research.

Table 2. Correlation statistics for variables

	GOV	ENV	SOC	ECN
GOV	1			
ENV	0.64**	1		
SOC	0.63**	0.79**	1	
ECN	0.37**	0.44**	0.50**	1

Notes: **, $p < 0.01$; *, $p < 0.05$*; ECN, economic performance; ENV, environmental performance; SOC, social; GOV, governance performance.

For a SEM analysis, it is important that the model fits the data. The model-fit indices and the impact of ESG on economic performance are shown in Table 3 below. Hu and Bentler (1999) suggested the cut-off criteria for a good model-fit as a value closer to 0.95 for comparative fit index statistic (CFI) and a cut-off value closer to .06 for root mean square error of approximation statistic (RMSEA). In addition, a cut-off value closer to 0.95 for goodness-of-fit statistic (GFI) has been suggested. A good model fit would be expected to provide results for Chi-square test to be insignificant (Barnett, 2007). Table 3 below summarizes the model-fit indices for the nine models formed and the factor loadings of the three-factor ESG model on the economic performance. Considering the criteria, the models 1 to 8 showed good fit indices. Thus, the model-fit of the 8 models were accepted. However, model 9, showed

Table 3. SEM Results and Model Fit Indices of the U.S. based companies

Model Fit Indices	CFI	GFI	RMSEA	CMIN/ df	Factor Loadings of Lagged ESG on ECN	R^2	Sig.
Model 1 2010 ESG–2011 ECN	0.995	0.992	0.077	3.159	0.66	47.4%	**
Model 2 2010 ESG–2012 ECN	0.999	0.996	0.031	1.352	0.72	46.3%	**
Model 3 2010 ESG–2013 ECN	0.999	0.997	0.027	1.271	0.59	32.9%	**
Model 4 2011 ESG–2012 ECN	0.997	0.995	0.050	2.088	0.74	47.4%	**
Model 5 2011 ESG–2013 ECN	0.997	0.995	0.050	1.970	0.50	31.8%	**
Model 6 2011 ESG–2014 ECN	0.994	0.991	0.079	3.323	0.50	24.6%	**
Model 7 2012 ESG–2013 ECN	0.997	0.995	0.049	1.975	0.59	34.3%	**
Model 8 2012 ESG–2014 ECN	0.997	0.995	0.048	1.884	0.52	27%	**
Model 9 2012 ESG–2015 ECN	0.998	0.987	0.101	5.183	0.48	23.4%	**

Notes: **, $p < 0.01$; *, $p < 0.05$; ECN, economic performance; ESG, environmental, social and governance performance.

RMSEA value above 1 which indicates a poor fit. Although CFI, GFI and CMIN/df showed good model fit, RMSEA is accepted as the most informative goodness of fit indices; therefore, model 9 was rejected (relationship between 2012 ESG and 2015 economic performance).

To test hypothesis 1, whether ESG has an impact on economic performance, structural equation modelling is used. The results showed that ESG and economic performance showed significant loading coefficients over the proposed years. Moreover, the R^2 for each model showed that three-factor ESG explained a considerable variance in economic performance. It should be noted that the highest amount of variance in economic performance is explained in the 1-year lagged models. Therefore, hypothesis 1 was accepted (ESG performance has a positive influence on economic performance).

Table 4. Multiple Regression Results of the U.S. based companies

Model 1 Predictors *2010 ESG*	2011 ECN (1-Year Lag)	2012 ECN (2-Year Lag)	2013 ECN (3-Year Lag)
GOV coefficient	0.178**	0.146*	0.145*
ENV coefficient	0.086	0.145*	0.112
SOC coefficient	0.460**	0.421**	0.348**
F statistic	96.138	90.451	53.064
F sig.	**	**	**
R^2	44.3%	42.8%	30.5%
Adjusted- R^2	43.9%	42.4%	30%
Model 2 *2011 ESG*	2012 ECN (1-Year Lag)	2013 ECN (2-Year Lag)	2014 ECN (3-Year Lag)
GOV coefficient	0.143*	0.146*	0.159*
ENV coefficient	0.128	0.077	–0.004
SOC coefficient	0.443**	0.367**	0.366**
F statistic	93.838	50.926	37.508
F sig.	**	**	**
R^2	43.5%	29.4%	23.5%
Adjusted- R^2	43%	28.9%	22.9%
Model 3 *2012 ESG*	2013 ECN (1-Year Lag)	2014 ECN (2-Year Lag)	2015 ECN (3-Year Lag)
GOV coefficient	0.120*	0.084	0.145*
ENV coefficient	0.049	0.023	–0.094
SOC coefficient	0.438**	0.425**	0.451**
F statistic	57.314	41.331	36.067
F sig.	**	**	**
R^2	31.8%	25.2%	23.3%
Adjusted- R^2	31.3%	24.6%	22.7%

Notes: **, $p < 0.01$; *, $p < 0.05$; ECN, economic performance; GOV, governance performance; SOC, social performance; ENV, environmental performance.

To test the individual impacts of environmental, social and governance on economic performance multiple regression analyses have been employed. Table 4 below shows the regression results for the influence of 1-year lagged, 2-year lagged, and 3-year lagged environmental, social and governance performance on the economic performance for the years 2011–2015. F-statistics indicated that the models were significant ($p < 0.01$). For each lagged ESG performance, 3 regression analyses were conducted to test the influence on the economic performance.

Environmental performance only showed a significant ($p < 0.05$) relationship in the 2010 ESG and 2012 ECN. However, environmental performance did not show a significant ($p < 0.05$) relationship with the economic performance in the other models. Therefore, hypothesis 2 is not accepted (Environmental performance has a positive impact on economic performance). Further, 1-year lagged, 2-year lagged, and 3-year lagged social performance showed a significant ($p < 0.01$) relationship with economic performance measures. Therefore, hypothesis 3 is fully supported and accepted (Social performance has a positive influence on economic performance). Moreover, governance performance showed a significant ($p < 0.05$ and $p < 0.01$) influence on the economic performance in 8 of the 9 regression analyses. Therefore, hypothesis 4 is accepted (Governance performance has a positive influence on economic performance). In model 1, the adjusted R^2 was 43.9% with 1-year lag, 42.4% with 2-year lag, and 30% with 3-year lag. In model 2, the adjusted R^2 was 43%, 28.9% and 22.9% respectively for 1–3 years lagged data. In model 3, the adjusted R^2 was 31.3%, 24.6% and 22.7% respectively for 1–3 years lagged data. It can be observed that as the number of lagged years increased, the amount of variance explained in economic performance decreased in all models. Overall, environmental, social and governance performance explain a considerable amount of variance of the economic performance of the U.S. companies.

4. Discussion

The key driver behind the move towards the interest in ESG performance is the perceived need to provide stakeholder with a complete picture of companies. Stakeholders' awareness and demand on the ESG is growing and they incorporate ESG information with other investment information. Companies are consolidating ESG information into their managerial and operational initiatives (Adams & Frost, 2008). In addition, satisfying the needs of the stakeholders would yield better economic and financial performance measures (Donaldson & Preston, 1995). Economic performance includes employee-related aspects such as motivation and retention (Greening & Turban, 2000), customers satisfaction, loyalty (Dawkins & Lewis, 2003), increased reputation (Whooley, 2004) and better access to capital (Roberts & Downing, 2002). In fact, Wagner and Schaltegger (2004) discovered that companies which adopted a long-term value-oriented approach had a stronger relationship than companies without a value-oriented approach. The findings of this study showed that social and governance performance had a positive influence on economic performance of the S&P 500 firms. However, environmental performance of the firms did not show a significant effect.

In the context of the U.S. firms listed in S&P 500, descriptive statistics implied that, there is a negative trend in the governance performance of companies, a stable trend for

social performance and a positive trend for environmental and economic performance. In addition, governance performance was the most stable measure in comparison with social and environmental performance measures. This implies that the S&P 500 firms may share a similar agenda for corporate governance however, different for environmental and social operations (Nollet et al., 2016). The findings of this study indicated that environmental, social and governance performance loaded significantly on the construct of ESG performance. Therefore, ESG is confirmed as a significant construct and showed a significant influence on the economic performance between the period 2010 and 2014. A substantial amount of empirical studies found a significant relationship between ESG and economic performance (Ambec & Lanoie, 2008; Ferrero-Ferrero et al., 2016; Velte, 2017; Yoon et al., 2018; Zhao et al., 2018) while some found an insignificant relationship (Landi & Sciarelli, 2019; Margolis & Walsh, 2003). Thus, the findings are in-line with previous results that found a positive association between ESG performance and economic performance measures (El Ghoul et al., 2017; Friede et al., 2015).

In the context of the U.S. environmental performance is found to have a positive influence on the financial performance of firms (Al-Najjar & Anfimiadou, 2011; Gallego-Alvarez et al., 2014; Yadav et al., 2016). However, the findings of this research found that environmental performance did not have a significant effect. The findings of this research failed to provide support for the previous studies which found a significant positive or negative effect of environmental performance on the economic performance (Al-Najjar & Anfimiadou, 2011; Wang et al., 2014; Yadav et al., 2016). Muhammad, Scrimgeour, Reddy and Abidin (2015) found a significant relationship between environmental performance prior to the financial crisis in 2008 and an insignificant relationship during and after the financial crisis in Australia. The findings of this study on economic performance are in line with the finding of Muhammad et al. (2015). In addition, the findings supported the studies which concluded that social performance has a positive influence on the economic performance (Dhaliwal et al., 2011; Mishra & Suar, 2010; Surroca & Tribó, 2008). The results also indicated that governance performance is a significant contributor of the economic performance of firms. This is in-line with the previous studies that found a positive association between the governance performance and economic performance (Klettner et al., 2014; Monda & Giorgino, 2013; Soana, 2011).

There are various findings within the literature considering the nexus. For instance, Tarmuji et al. (2016) concluded that governance performance was the only ESG construct which showed a relationship with economic performance in Malaysian companies. In an Australian context, Sila and Cek (2017) found a significant relationship of two dimensions of the ESG namely social and environmental performance with economic performance. Governance performance of companies listed in Australia did not show a significant relationship with economic performance (Sila & Cek, 2017). Velte (2017) found a positive relationship between ESG performance and return on assets of firms from Germany. For instance, Galema, Platinga and Scholtens (2008) found an insignificant relationship between sustainability indicators and financial risk and return over 289 companies in the U.S. Mixed results have been found in a meta-analysis study consisting of empirical research about environmental performance and economic performance (Wagner et al., 2002). According to Holder-Webb, Cohen, Nath,

and Wood (2009) U.S. companies consider social aspects more than other aspects and tend to disclose social performance information more. In line with this finding, social performance showed a stronger influence on economic performance than governance and environmental performance. Furthermore, both the three-factor ESG and individual environmental, social and governance performance explained a considerable amount of variance in economic performance in each period. However, it is observed that 1-year lag explained a higher variance than 2-year and 3-year lag. Therefore, it can be said that the influence of environmental, social and governance performance can be observed in the following year and the extent of influence decreases in the second and third years respectively.

Conclusions

The purpose of this study is two-fold: first, forming a three-factor ESG model and test its influence on the economic performance; second, analyzing the individual influences of environmental, social and governance performance on the economic performance of the U.S. firms. In this study, data from the Asset4® dataset have been utilized to test the proposed effects and relationships. The findings of this study are in line with the proposed influence of ESG on the economic performance. We found significant influence of ESG on the economic performance. Moreover, social and governance performance showed a significant influence on the economic performance. However, environmental performance showed an insignificant influence. Social performance is proven to be a valuable predictor of the economic performance. Another finding of this research is that governance performances of firms are higher than their environmental and social performance.

Thus, ESG is a significant predictor of the economic performance of the companies. However, it could be argued within a stakeholder theory perspective that stakeholders acknowledge social and governance performance of companies more than their environmental performance. Companies should consider the findings of this research and place importance on social and governance performance indicators to see future economic benefits. Findings also reveal that the extent of the influence of environmental, social and governance performance is highest at the year after and decreases thereafter.

This study contributes to the literature by using longitudinal data to claim causality of the findings. Therefore, causality which is a common limitation for studies which use cross-sectional data has been overcome. Previous studies mostly focus on the ESG performance of European or Asia Pacific countries; however, this research focused on the U.S. In addition, another perspective for the ESG and economic performance literature by proposing both a combined three-factor model and separate factor models was provided. Findings also support that firms from different regions have different choices, policies and objectives; therefore, different findings should be expected.

The implications and suggestions for scholars include the need for additional research in different regions using longitudinal ESG data. Moreover, companies should acknowledge the importance of ESG performance and aim to achieve higher performances. For the academics, this is the first study to confirm the three-factor construct of ESG by using confirmatory factor analysis. Thus, this can provide incentives for other researches to conduct the same

analysis across different countries and industries. This study provides insights for the management of companies. The findings are expected to provide an incentive for the companies to increase their ESG performance and enhance the transparency by disclosing ESG performance. Environmental performance of companies should be analyzed in-depth in order to understand why it is not significant in influencing the economic performance. Moreover, companies should focus more on the governance and social performances as they are proven to be significant contributors of the economic performance of companies.

Despite its relevance and contribution, this study also has some limitations. In this study, research was solely focused on the U.S. which is a developed country; this has limited the generalization of the findings to the all developed and developing countries. Last, the issue of "greenwashing" stays as a limitation for all sustainability research which based their data from the ESG information provided by companies. As a future research suggestion a developing country may be selected to compare the findings between developed and developing countries would help overcome the limitations of generalizability. Furthermore, another research suggestion is to analyze the period from 2015 to 2019 and to compare the results with the current studies. In addition, different economic indicators and mediating variables can be used to observe their effect on the relationship.

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Author contributions

Kemal Cek was responsible for writing, data analysis and interpretation. Serife Z. Eyupoglu supervised the research and contributed to the theoretical development and editing of the article.

Disclosure statement

The authors declare that we did not have any competing financial, professional, or personal interests from other parties.

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ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG), CIRCULAR BUSINESS AND SMES

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Environmental, Social and Governance (ESG) disclosure, competitive advantage and performance of firms in Malaysia☆

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ABSTRACT

The objective of this research is to investigate the effects of firms' ESG (Environmental, Social and Governance) disclosures on firm performance, moderated by firm competitive advantage. The sample of the data is 3966 firm-year observations from year 2012–2017 of 661 firms listed in the Bursa Malaysia. To improve the robustness of our analysis we adopt clustering techniques in our regression analysis. The findings of this research indicate that ESG disclosure improves firm performance even after controlling for competitive advantage. We also find consistent evidence that an increase in ESG disclosure by one unit will increase firm performance by approximately 4 percent in Malaysia. The implication of this research is the need to re-examine the level of ESG disclosure and the financing incentive for firms with high ESG disclosure scores as high scores of ESG are associated with higher competitive advantage. Further, policymakers can enhance regulatory frameworks by incorporating ESG across various investment activities and value creation initiatives.

1. Introduction

Enviornmental, Social and Governance (ESG) investing has gained considerable traction in recent years, underpinned by growing interest from investors at both the international and domestic levels. Previous research suggests that investors reward good ESG firms while poorly disclosed ESG is an indicator of idiosyncratic risks. Lack of ESG disclosure by firms can result in poorly-made investments in high-risk sectors that may pollute the environment or discriminate against employees. Integration of ESG into a firm's investment decision will assist investors in making decisions based on overall performance rather than only on financial performance. Further, ESG is defined as a firm's obligation to improve social welfare; and equitable and sustainable long-term wealth for stakeholders (Jamali et al., 2017; Turban and Greening, 1997). ESG compliant firms are found to have better governance, care more for the environment and sustainable development, have less earnings volatility and have access to lower cost funds (Kumar, 2020). The United Nations recommends that firms disclose their ESG practice by year 2030 (SSE, 2015). It is crucial that governments support the implementation of ESG *via* numerous tax incentives for firms to be actively engaged in ESG disclosures that benefit their business value-chain as well as their shareholders (Jallai, 2020). In Malaysia, as part of the initiative, Malaysian Code of Corporate Governance (MCCG, 2012) recommends directors to fully disclose the firm's policies and implementation of ESG in its annual report.

Studies have shown that ESG integration into a firm's valuation model improves its non-financial indicators such as consumer satisfaction, market acceptance, lower cost of debt and the societal values it brings to its stakeholders. Hence, a firm's competitive advantage may grow over the years of its operation (Schramade and Schoenmaker, 2018). Several studies claim that after integrating ESG factors into valuation and firm's investment decisions, there is a significant increase in its equity premium and value (Schramade, 2016). According to a report by Nelson (2017), as firms integrate ESG into their investment decisions, those with competitive advantage are found to have lower investment risk, better governance and increased engagement in good environmental and social practices. For instance, Jasni et al. (2020) find that ESG disclosures in the Malaysian telecommunications industry enable firms to gain competitive advantage amongst its competitors. However, according to Nelson (2017), firms only report ESG matters that meet regulatory requirements

☆ CSR: Corporate Social Responsibility, MCCG: Malaysia Code of Corporate Governance, OECD: Organisation for Economic Co-operation and Development, MENA: Middle East and North African, BRICS: Brazil, Russia, India, China, and South Africa, ESI: Environment sensitive industries, VIF: Variance Inflation Factor.

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and increase their reputation. Porter et al. (2019) argue that ESG disclosures are merely to enhance a firm's acceptance and reputation amongst its investors. Further, some companies use ESG disclosures as a means to reduce regulatory restrictions on their investment portfolios (Porter et al., 2019). When the focus is on firm reputation and investor's acceptance, firms fail to recognize the impact of ESG efforts and the synergy between its vision, ESG value and performance.

The question that remains is whether the efforts in improving ESG disclosure will improve shareholder wealth creation and firm's profitability or is ESG disclosure merely to improve firm's reputation? Our analysis focuses on the interaction effect of competitive advantage and ESG disclosure and its effect on performance. In particular, we focus on resource-based competitive advantage as Gjerde et al. (2010) as the resource-based model of competitive advantage focuses on firm's collection of resources and capabilities. We apply stakeholders' theory and conduct our analysis by using cluster regression analysis, where observations are clustered based on year, industry and also on both industry and year.

The focus of this study is on Malaysian firms. Malaysia is an important sample for ESG research since Malaysian companies started implementing their first Corporate Social Reporting (CSR) Framework in year 2006. The first report on sustainable development in Malaysia was introduced in 1987. Teoh and Thong (1984) find that Malaysian firms appear to be lacking in their corporate social involvement and are focused more on their employees and the profitability of their product offering rather than on the effect these have on the environment and society. The effort is further strengthened by the CSR reporting framework in 2006 which is mandatory for all firms in Malaysia, followed by the Sustainability Framework in year 2015 which required ESG disclosures of the firms. The Malaysian government's effort in integrating CSR into its Tenth Malaysia Plan also highlights the government's involvement in ensuring the implementation and success of CSR. From a legal perspective, the Companies Act 2016 also enforced CSR disclosures resulting in very high scores for CSR in Malaysian firms. Furthermore, the introduction of the FTSE4Good Bursa Malaysia Index in 2014 and the adoption of the Sustainable Development Goals (SDGs) which came into effect in January 2016 resulted in an apparent increase in ESG disclosures, underlining their objectives of reducing information asymmetry, improving transparency and providing non-financial voluntary disclosures that are beneficial for investor decision-making. Recently, Malaysia has been ranked as the top pioneer in CSR reporting globally with around 97 per cent of the top 100 companies in Malaysia reporting their corporate sustainability performance as compared with the global average of 72 per cent (Peng, 2018). Malaysia is also one of the few countries in the world to introduce the Malaysian Code for Institutional Investors in 2014, which integrates and develops policy to incorporate sustainability issues into their investment analysis portfolios. The latest announcement of the MCCG (2012) Recommendation 1.4 (page 12) recommends that directors give attention to ESG to meet the long-term interests of various stakeholders.

Our findings indicate that ESG disclosure, as measured by both environmental disclosure scores and ESG disclosure score, has a positive association with performance. We then use competitive advantage to moderate the effect of ESG disclosure on performance. We find consistent evidence of positive moderating effect of competitive advantage on the association between ESG disclosure and performance. The results are robust after we use cluster regression for both time and industry effect. We observe that the relationship is still positive and significant at the 1% significance level. We conclude that increased ESG disclosure results in an increase in firm performance. Competitive advantage is found to have a negative relationship with ESG disclosure, implying that firms with competitive advantage disclose less ESG-related matters. However, when firms have competitive advantage, increased disclosure results in improved firm performance while in firms with no competitive advantage, increased ESG disclosure decreases firm performance.

The remainder of the paper is organized as follows: Section 2 discusses the underlying theories and prior literature on ESG disclosure and performance, leading to the formation of the two hypotheses in this study. Section 3 presents the models for this study, data collection procedure and the measurement of variables. Section 4 presents the various empirical analyses conducted on the data with a discussion of the results of the analyses. Finally, section 5 provides the practical implications of the study while section 6 concludes the study.

2. Theoretical framework

Jensen (2002) argues that the maximization of stakeholder wealth will increase firm value in the long run. The increase in firm value is a product of the ethical and responsible behavior of firms aimed at improving societal well-being. Therefore, a successful business is a component of a greater society. Porter and Kramer (2006) discuss the interrelationship between society and the corporation and how responsible and ethical behavior improves firm performance. They argue that a firm's aim to maximize profits should not be at the expense of lower product quality and negative health effects. Firms that focus on profit maximization are not held responsible for all of society's and the environment's issues but the role of these firms in improving economic and societal values which are sustainable in the future is imperative.

Friede et al. (2015) examine more than 2000 empirical studies on ESG disclosures and firm performance and find that 90% of the studies report a positive association between ESG and performance. Although ESG leads to better performance, few studies focus on how firm's competitive advantage and ESG interact. Competitive advantage can be defined as a firm's ability to earn more economic profit in comparison to its competitor and measured by the difference in the economic profit of the firm and its rival (Saurabh, 2019). Engaging in ESG disclosures whilst improving firm's competitive advantage may increase investors' acceptance, firm's reputation and improve future performance. Previous studies fail to disassociate the interpretation of a firm's competitive advantage and performance. Both measures are not interchangeable and rooted in two different constructs (Ma, 2000). Activities adopted by a firm *via* its ESG disclosure should increase with its value and performance. However, even though firms wish to engage in ESG disclosures, affordability theory suggests that without sufficient resources, ESG disclosures may not be materialized for small and growing firms (Ren et al., 2020). This is more profound in Malaysia where the majority of firms are small to medium in size and lacking in resources to implement the mandatory environmental disclosures.

2.1. Literature review

In the context of developed markets, firms that engage in ESG disclosures in developed market are associated with lower systematic market risks and idiosyncratic risks due to lower possibility of litigation or negative market reaction (Sassen et al., 2016). Porter et al. (2019) claim that ESG disclosures are associated with a firm's competitive advantage as the firm provides sustainable solutions to environmental and social issues. Further, by engaging in ESG activities, firms can redefine their product offerings in line with the needs of society for better environmental protection and quality of life. However, Balabanis et al. (1998) claim that environmental disclosure is negatively correlated with subsequent financial performance in the UK. In recent studies of S&P 500-listed companies in the US for the period 2009 to 2018, ESG disclosure are found to improve firm performance but environmental disclosure reduce firm performance (Alareeni and Hamdan, 2020). This conflicting finding warrants study on the effect of both ESG disclosures and environmental disclosures on firm performance.

Studies in developed countries find that the positive association between performance and ESG disclosure is due to lower information risk associated with higher disclosure of ESG (Cormier and Magnan, 2007). Apart from better long-term performance, Eliwa et al. (2019) find that based on a sample of firms from 15 EU countries, lending institutions

value a firm's effort in disclosing ESG and reward the firm through lower cost of debt. Using a dataset of 23 Organization for Economic Co-operation and Development (OECD) countries from 2007 to 2012, Crifo et al. (2017) suggest that in countries where ESG disclosures are high, borrowing costs or yield spreads are lower. Lower yield spreads enable firms to gain competitive advantage as a result of lower risks and financing costs associated with their bond issuance (Reznick and Viehs, 2017). Integrating ESG will increase institutional investor's returns and lower the risks (Sherwood and Pollard, 2018). In addition, Cheng et al. (2014) argue that firms which adopt corporate social responsibility (CSR) strategies have better access to finance since they have better stakeholder engagement and transparency. CSR allows firms to engage in activities that allow efficient allocation of resources. Therefore, firm's desire to implement higher disclosure may be associated with its inclination to increase its competitive advantage through lower financing costs, as firms with high ESG disclosures scores will not just seek to optimize the bottom-line but create solutions that improve quality of living leading to long-term competitive advantage. Cai and He (2014) find a positive association between corporate environmental responsibility and long-run stock returns using 20 years' data from year 1992–2011. In a highly-competitive developed market, ESG disclosures will facilitate trust and firm's ability to generate superior performance in comparison to its competitors and motivate firms to actively engage in higher ESG disclosures to meet market expectations (Li et al., 2018). Similarly, CSR/ESG is found to facilitate firm's superior returns through lower equity cost of capital, higher valuation judgements, favorable borrowing terms which lead to better access to finance (Cheng et al., 2014).

Studies on ESG in emerging markets are mixed. There is evidence to suggest that ESG disclosures reduce information asymmetry and improve investor's perception and recognition of the firm's investment strategies (Fatemi et al., 2018). Park's (2017) investigation of 175 emerging Korean firms from 2010 to 2012 shows that CSR has positive effects on long-term firm performance and provides direct and indirect value to firms through positive feedback on its reputation. In an emerging market such as Malaysia, value creation through the integration of ESG in a firm's long-term strategy with the right vision will attract the best talent, build authentic customers *via* effective governance structure and increase shareholder value. ESG or CSR disclosure in Malaysia is poor as disclosure is merely voluntary (Said et al., 2003). Poor disclosure of ESG activities may lead to inconsistencies in the findings on ESG disclosures as researchers rely on very limited information (Atan et al., 2018).

Findings from previous studies also suggest that the increase in CSR disclosures and firm performance is associated with government ownership and the introduction of corporate governance standards (Haji, 2013; Said et al., 2013; Arayssi and Jizi, 2019). Government support in the form of standards setting, facilities and resources is imperative to the development of ESG disclosures in Malaysia given the effect these have, both directly and indirectly, on firm's long-term performance and competitive advantage. The recognition by the government and financial institutions will boost investor confidence and improve firm's competitive advantage in the form of lower weighted average cost of capital (Wu et al., 2014). In addition, initiatives taken by the stakeholders to create greater awareness and recognition of ESG disclosures motivate firms to engage in ESG. In fact, firms that engage in ESG disclosures are recognized as being the leading and most admired firms in the market (Jeffrey et al., 2019). In Taiwan, Wu et al. (2014) find high CSR disclosure to be associated with lower cost of capital as a result of financial institutions recognizing the efforts made by the firms to improve sustainability. However, studies in Malaysia find a positive association between the weighted average cost of capital and ESG disclosure (Atan et al., 2018). The findings reflect the lack of recognition by the financial institutions in recognizing firm's engagement in ESG disclosures or to some extent may reflect firm's ineffectiveness in allocating its resources to improve future sustainability.

2.2. Hypotheses development

Buallay et al. (2020a) find negative impacts of ESG disclosures scores on every performance indicator in both developed and developing countries. On the other hand, Buallay et al.'s (2020b) study of firms in the Middle East and North African (MENA) region finds positive impact of ESG on performance. In another study, Buallay (2019) examine banks in both develop and developing markets and find mixed results on the effect of ESG on performance. Environmental disclosure is found to positively affect performance while negative association is found between corporate social responsibility disclosure and performance. Nollet et al. (2016) study firms in developed markets and find a significant negative relationship between corporate social performance and return on capital. Due to the conflicting results found in the above studies, the first hypothesis is as follows:

H1. Firm performance is positively associated with ESG disclosure

ESG disclosures activities rely heavily on firm's resources, thus a firm's competitive advantage may influence ESG disclosure to reduce information asymmetry, leading to less myopic investment decisions made by investors. ESG implementation solely for the purpose of lowering borrowing costs may not be sustainable if firms fail to recognize the synergy of ESG efforts and how it creates value to its shareholders (Porter et al., 2019). Garcia et al.'s (2017) study on developing countries in the BRICS (commonly known as Brazil, Russia, India, China and South Africa) group finds that listed companies from sensitive industries (industries that are sensitive to social and cultural norms of the society) have higher environmental performance as compared to those in non-sensitive industries. Surprisingly, the sensitive industries are also those industries where the market is very responsive to their firm's operations. Thus, the ability of firms to actively disclose their ESG disclosures activities may reduce information asymmetry and hence myopic decisions made by the investors. El Ghoul et al. (2011) examine the effect of corporate social responsibility (CSR) on the cost of equity capital for a large sample of US firms and their findings indicate that investment in environment sensitive industries (ESI) such as tobacco increases cost of equity. Radhouane et al. (2020) further explain that shareholders assign negative value to voluntary environmental disclosure by firms in environmentally sensitive industries and ESI firms face more challenges in the capital market than non-ESI firms in gaining recognition for their environmental disclosure. Murphy and McGrath (2013) also argue that firms, particularly those in "sensitive" industries, are motivated to produce corporate ESG reports to avoid civil suits rather than to genuinely improve ESG adoption. In fact, Dhaliwal et al. (2011) find that firms with high cost of equity capital in the previous year tend to initiate disclosure of CSR activities in the current year in order to gain lower financing in the subsequent years.

In sum, these earlier findings lead to our second hypothesis:

H2. Firm's competitive advantage positively moderates the relationship between its ESG disclosure and performance

Table 1 provides a summary of the empirical studies that have been conducted on ESG disclosure in relation to firm performance.

3. Materials and methods

Most prior studies use regression as the main analysis tool in analyzing ESG disclosures but these studies fail to discuss how they control for correlation of errors and unbiased coefficients due to omission errors in their regression analysis (Petersen, 2009). We check for heteroskedasticity in the analysis using the Breusch-Pagan test and find that heteroscedasticity is present in our analysis. We also run two-stage least squares regression to test for endogeneity and our analysis indicates no endogeneity issues among the variables. For all our analysis, Variance Inflation Factor (VIF) is below 10, signifying no sign of multicollinearity. When observing residual error, we find the residual error to be correlated

Table 1
Summary of relevant empirical studies.

Author(s)	Sample	Findings	Factor(s)
Noronha et al. (2018)	Sample of 6,151 observations from Chinese Stock Market from 2007 to 2015	Social contribution improves stock price reaction and additional analysis made show corporate governance also improve the extent to which social contribution disclosures of companies are made.	ESG and performance (*H1*)
Chong et al. (2018)	Sample consisting of 290 firm-year observations listed on Bursa Malaysia from 2010 to 2014	ESG practices improve firms' performance and has no effect on firms' risk taking	
Arayssi and Jizi (2019)	A sample of 67 firms was extracted in the MENA region from 2012 to 2016	ESG activities in Mena region improves firm's profitability ratios.	
Duque-Grisales and Aguilera-Caracuel (2018)	Data on 104 multinationals from Brazil, Chile, Colombia, Mexico and Peru between 2011 and 2015.	The results suggest that the negative relationship between the ESG score and financial performance even when it is analyzed separately.	
Buallay et al. (2020a)	This study examines 882 banks from developed and developing countries covering 11 years after the 2008 financial crisis.	The results of the sample of the developed countries show that the ESG scores are negatively related to banks' performance measure. Also, banks have less competitive advantage when using their resources for social programme and initiatives.	ESG and Tobin-Q (*H1*)
Radhouane et al. (2020)	A sample of French companies listed on the SBF120 index from 2003 to 2011	Their results indicate negative association between ESG and Tobin' s q for environmental sensitive industries.	
Hickman (2020)	Sample of 239 largest US private companies matched with publicly-traded firms	CSR is found to lower equity cost of capital as firms are able to show future firms' profitability, higher valuation judgements and favorable borrowing terms. Also, due to this factor more public companies report CSR activities (23.8 per cent) than private firms (13.8 per cent).	ESG and cost of capital *(H2)*
Bhattacharya and Sharma (2019)	Samples are 122 firms from (BSE) 500 Stock Exchange	It was found that ESG performance improved firms' creditworthiness based on the credit rating.	
Dhaliwal et al. (2011)	Sample contains 213 disclosing firms in KLD STATS and Compustat databases.	They found that firms with a high cost of equity capital in the previous year tend to initiate disclosure of CSR activities in the current year to achieve lower cost of capital in the subsequent years.	
Goss and Roberts (2011)	Using a sample of 3996 loans to US firms.	Lenders penalize borrowers with bad CSR initiatives through higher borrowing. However, banks recognize and punish CSR initiatives that are unlikely to add value. The findings suggest efforts to manipulate CSR initiatives to reduce borrowing costs are unsuccessful.	
Battisti et al. (2019)	Sample of 40 companies listed on the Italian stock market from 2009 to 2017	Firms ability to innovate and gain competitive advantage increases its ability to generate superior performance and maximize its shareholders' wealth.	EVA and firm's competitive advantage *(H2)*
Chen et al. (2014)	The sample includes firm-year pairs from a total of 49 countries across the world from 2002 to 2009	CSR have the potential to improve long-run value creation by firms and assist firms in allocating scarce financial capital to more productive uses.	
Gjerde et al. (2010)	The sample consists of 3051 firm-year observations over the 20-year period (1986–2005) of companies listed on the Oslo Stock Exchange in Norway.	Industry-based competitive advantage has a minor significant impact on the variability of superior stock market performance as compared to resource based competitive advantage. A firm has a resource-based competitive advantage if it is able to earn a return on its resources that is larger than the industry's average return or/ and if the firm has a cost of equity capital below the industry's average cost of equity capital. The resource-based competitive advantage is almost 4 times more important than the industry based competitive advantage.	

across years for a given firm and across time, so we identify the source of dependence in the data. If there is firm effect, clustering by firm will produce unbiased standard error (Petersen, 2009). When clustering by both year and firm, the standard error is calculated based on two dimensions of within cluster correlation (e.g. a firm identifier and a time identifier). Therefore, to control for both dimensions, we cluster the observations based on industry and year.

To achieve the aims of this study, we formulate the following models with ESG:

Model 1 *(Without Interaction Effect)*

$$TOBIN_{it} = \beta_0 + \delta_1 ESGIND_{it} + \delta_2 COMADVANTAGE_{it} + \sum_{j=1}^{J} y_j CV_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (1)$$

Model 2 *(With Interaction Effect)*

$$TOBIN_{it} = \beta_0 + \delta_1 ESGIND_{it} + \delta_2 COMADVANTAGE_{it} + \delta_3 ESGIND^{*} COMADVANTAGE_{it} + \sum_{j=1}^{J} y_j CV_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (2)$$

Model 3*(Without Interaction Effect)*

$$TOBIN_{it} = \beta_0 + \delta_1 ESGSCORE_{it} + \delta_2 COMADVANTAGE_{it} + \sum_{j=1}^{J} y_j CV_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (3)$$

Model 4 (With Interaction Effect)

$$TOBIN_{it} = \beta_0 + \delta_1 ESGSCORE_{it} + \delta_2 COMADVANTAGE_{it} + \delta_2 ESGSCORE^{*} COMADVANTAGE_{it} + \sum_{j=1}^{J} y_j CV_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (4)$$

where CV_{it} is a vector which includes $J = 8$ control variables ($INDEP_{it}$, $GROWTH_{it}$, $PROFITABILITY_{it}$, $LIQUIDITY_{it}$, $CASHFLOW_{it}$,-

$DEBT_{it}$and $TOTALASSETS_{it}$), $\eta_i$is the firm-specific effect, $\mu_t$is the time effect and $\varepsilon_{it}$is the error term.

Following Siew et al. (2016), we use environmental scores (ESGIND) as the independent variable in Models 1 and 2 and ESG Disclosure Score (ESGSCORE) in Models 3 and 4 to measure ESG disclosure. The companies are ranked from 0 to 100, with 100 being the best score. We include overall ESG as some studies argue that very few disclosures are found in the areas of environmental and social. In Malaysia, disclosure of social and environmental issues are voluntary and low (Said et al., 2003).

The dependent variable Tobin's q (TOBIN) is measured as the total of market capitalization, liabilities, preferred equity and minority interest over total assets (Atan et al., 2018; Cai and He, 2014). Tobin's q measures the performance of the company that meets or exceeds the expectation of its stakeholders. It also measures how shareholders return are maximized *via* increase in firms' equity value (López-González et al., 2019). Singh et al. (2018) argue that accounting measures of performance fail to incorporate systematic risks and the use of Tobin's q allows for this, effectively valuing firm performance. Acquaah (2003) argues that firm's value creation will lead to an increase in firm-specific Tobin's q over time.

We measure a firm's resource-based competitive advantage (COMADVANTAGE) using the measurement by Gjerde et al. (2010) where COMADVANTAGE = i – k such that i is the internal rate of return on invested capital and k is the corresponding cost of capital. It measures profit based on excess of return on invested capital over firm's cost of capital. A firm has resource-based competitive advantage if it is able to earn a return on its resources that is larger than the firm cost of equity capital (Gjerde et al., 2010). Jankalova and Kurutova (2019) argue that this measurement is a good measure of firm's competitive advantage as it provides a holistic value of the company by considering both financial and non- financial indicators and its cost of capital. Shareholder's wealth or value is added when firms earn in excess of its cost of capital and value is destroyed when it earns less than its cost of capital (Saurabh, 2019).

We control for firm's governance activities with board independence (INDEP) (Wasiuzzaman and Mohammad, 2020; Mohammad et al., 2016). Firm-specific variables include firm's growth (GROWTH), profitability (PROFITABILITY), liquidity (LIQUIDITY), operating cash flow (CASHFLOW), leverage (DEBT) and firm size (TOTALASSETS). The measurements for all the variables (independent, dependent and control) used in this study are provided in Table 2.

Data for ESGIND, ESGSCORE and COMADVANTAGE are collected from Bloomberg Terminal and Sustainalytics databases. Data for TOBIN is collected from the Bloomberg database. Data is collected from a total of 661 firms after excluding those with incomplete information. This is 71.38% of firms listed in Bursa Malaysia from a sample of 926 firms. Since the data collection process was done in year 2018, the sample is collected from year 2012 to year 2017, with a total of 3966 firm-year observations. Year 2012 is chosen since very few firms disclosed their ESG disclosures activities prior to that. Table 3 presents the sample of the study comprising of 12 industries in Malaysia. The highest number of samples are from the industrial products and services industry at 28.74% while the lowest number of samples is from the utilities industry.

Table 2
List and definition of variables.

Variables	Sign	Definition	References
Dependent Variable – Tobin-q			Atan et al. (2018); Cai and He (2014); López-González et al. (2019)
Experimental Variables			
ESGIND	+	Environmental score	Siew et al. (2016);
ESGSCORE	+	ESG Disclosure Scores	Buallay et al. (2020)a,b; Radhouane et al. (2020)
COMADVANTAGE	+/−	Firms competitive advantage (Return on Invested Capital - Weighted Average Cost of Capital)	Garvey and Milbourn (2000); Gjerde et al. (2010); Cheng et al. (2014); Battisti et al. (2019)
Control Variables			
INDEP	+	Percentage of independent non-executive directors on the board	Wasiuzzaman and Mohammad (2020); Mohammad et al. (2016); El-Bassiouny, and Letmathe (2018)
GROWTH	+	Log10 Market capitalization	Serafeim (2020); Arayssi and Jizi (2019);Cai and He (2014); Mohammad and Wasiuzzaman (2019)
PROFITABILITY	+	Net Income Before Extraordinary Items/ total assets	Mohammad and Wasiuzzaman, S. (2019); Eliwa et al. (2019)
LIQUIDITY	+	Log10 average bid-ask spread percentage	Cai and He (2014); Foo and Mat Zain (2010)
CASHFLOW	+	Log10 cash flow before Depreciation amortization and extraordinary items	Loh and Thomas (2018); Karaman et al. (2018)
DEBT	–	Log10 long-term interest-bearing debt	Karaman et al. (2018); (Mohammad et al. 2016)
TOTALASSETS	+	Log10 of total assets (MYR'000)	Mohammad et al. (2016); Arayssi and Jizi (2019)

Table 3
Data sampling.

No.	Industry	Total no of firms	Total observation	Percentage of samples (%)
1	CONSTRUCTION	39	234	5.90
2	CONSUMER PRODUCTS AND SERVICES	136	816	20.57
3	ENERGY	24	144	3.63
4	FINANCIAL SERVICES	26	156	3.93
5	HEALTHCARE	14	84	2.12
6	INDUSTRIAL PRODUCTS AND SERVICES	190	1140	28.74
7	PLANTATION	33	198	4.99
8	PROPERTY	85	510	12.86
9	TECHNOLOGY	53	318	8.02
10	TELECOMMUNICATION AND MEDIA	21	126	3.18
11	TRANPORTATION AND LOGISTICS	29	174	4.39
12	UTILITIES	11	66	1.66
	Total	**661**	**3966**	**100**

4. Data analysis and discussion of results

Descriptive statistics for the variables are provided in Table 4.

Based on Table 4, TOBIN has a mean of 1.194. Mean ESGIND is 2.361 while the mean for ESGSCORE is 1.335. The mean for COMADVANTAGE is −27.3664, indicating that most firms on average have low competitive advantage due to lower return on invested capital or higher financing costs. For the control variable INDEP, on average there are only 5.535% independent non-directors on the board, indicating weak governance. GROWTH in this study is measured as the $\log_{10}$ value of market capitalization but in this analysis, the value of market capitalization is provided before its log value is calculated to present a clearer picture. The firms in this sample have an average market capitalization of RM 2.19 billion, while firm profitability, measured by ROA has a mean of 2.71%, with the highest ROA being 83%. The minimum value of ROA is −11.89% indicating losses made by some firms during the financial year end. LIQUIDITY of the stocks (the percentage of average bid-ask spread of the stock) has a mean of 4.56% while the highest percentage is 91.74%. Stock liquidity measures active market participation and volatility of the firm's stock. CASHFLOW has a mean of RM 199 million while the maximum CASHFLOW is RM 8.489 billion. DEBT has a mean of RM 655 million and finally TOTALASSETS as a measure of firm size has a mean of

Table 4
Descriptive statistics.

	Mean	Median	Maximum	Minimum	Observations
TOBIN	1.194	0.942	15.068	0.236	3966
ESGIND	2.631	0	57.851	0	3966
ESGSCORE	1.335	0	53.488	0	3966
COMADVANTAGE	−27.366	−3.723	1998.648	−3147.809	3966
INDEP(%)	5.535	0	88.889	0	3966
GROWTH('000 M)	2192.321	200.651	105527.9	2.228	3966
PROFITABILITY	0.027	0.0315	0.837	−11.890	3966
LIQUIDITY	4.557	2.110	91.741	0	3966
CASHFLOW('000 M)	199.025	23.187	8489.464	−1700.261	3966
DEBT('000 M)	651.268	15.972	58120.42	0	3966
TOTALASSETS('000 M)	5761.334	441.122	765301.8	0.328	3966

RM 5.76 billion.

Before running further analysis, the presence of multicollinearity among the independent variables is examined. Tables 5 and 6 present the correlation matrix for TOBIN, ESGIND and ESGSCORE. Tables 5 and 6 show that most variables have correlation values below 70% and therefore show no sign of multicollinearity (Hair et al., 2010). Also, we observe positive association between TOBIN, ESGIND (p-value = 1%), COMADVANTAGE (p-value = 1%) and INDEP (p-value = 1%) in both correlation tables. The findings suggest positive and significant associations between firm performance, ESG disclosure score, competitive advantage and corporate governance. Additionally, we also run Variance Inflation Factor (VIF) to investigate multicollinearity. The VIF is reported in each regression analysis table and all are lower than 10, further showing no signs of the existence of multicollinearity (Li et al., 2018). Following Li et al. (2017), we test for endogeneity by running an instrumental variable (IV) on two-stage least square regression and the results are insignificant at 10% level (H0: Variables are exogeneous).

Tables 7 and 8 present the results of the cluster regression analysis of ESGIND and ESGSCORE (with and without moderating effect) and its effect on performance. We first run cluster regression analysis of ESGIND and its effect on TOBIN and then we run analysis for the effect of ESGSCORE on TOBIN.

For each part of the analysis, we cluster the regression for year and industry effects. In the first regression (results in Panels A and B), both year (β = 0.04398; p-value = 1%) and industry (β=.04398; p-value = 10%) clustering indicates that ESGIND is positively associated with TOBIN. When the moderating effect of COMADVANTAGE is introduced in the regression (results in Panels C and D), the relationship of ESGIND and TOBIN is still positive when clustering is done by year (β = 0.0420737; p-value = 1%) and industry (β = 0.0420737; p-value = 5%). The moderating variable (ESGINDWACC) also indicates a positive association with TOBIN when clustering is carried out for both year (β = 0.0000649, p-value = 1%) and industry (β = 0.0000649, p-value = 1%). The R-squared values for the regression analyses carried out with (59.94%) and without the moderating variable (56.10%) indicate high explanatory power of the independent variables. Our findings are consistent with Fatemi et al. (2018) who found an R-squared value of approximately 60% for the regression analysis between ESG disclosure and Tobin's q. Our findings support the claim that ESG disclosure improves stakeholder's trust and eventually firm's value and this is more pronounced when firms have higher competitive advantage (Li et al., 2018).

Our findings support the results of Siegrist et al. (2020) whereby we find that firm's disclosure of its sustainability efforts can help facilitate

Table 5
Pearson Correlation Matrix (Dependent variable: ESGIND).

	TOBIN	ESGIND	COMADVANTAGE	INDEP	GROWTH	PROFITABILITY	LIQUIDITY	CASHFLOW	DEBT	TOTALASSETS
TOBIN	1.000									
ESGIND	0.385 0.000	1.000								
COMADVANTAGE	0.254 0.000	−0.063 0.000	1.000							
INDEP	0.290 0.000	0.874 0.000	−0.139 0.000	1.000						
GROWTH	0.375 0.000	0.632 0.000	−0.097 0.000	0.641 0.000	1.000					
PROFITABILITY	0.142 0.000	0.076 0.000	0.068 0.000	0.065 0.000	0.162 0.000	1.000				
LIQUIDITY	−0.301 0.000	−0.421 0.000	0.058 0.000	−0.442 0.000	−0.707 0.000	−0.122 0.000	1.0000			
CASHFLOW	0.339 0.000	0.132 0.000	0.150 0.000	0.116 0.000	0.289 0.000	0.296 0.000	−0.302 0.000	1.000		
DEBT	−0.025 0.113	0.335 0.000	−0.150 0.000	0.346 0.000	0.543 0.000	0.027 0.096	−0.380 0.000	−0.047 0.003	1.000	
TOTALASSETS	0.038 0.017	0.559 0.000	−0.195 0.000	0.587 0.000	0.872 0.000	0.118 0.000	−0.589 0.000	0.037 0.020	0.688 0.000	1.000

Table 6
Pearson Correlation Matrix (Dependent variable: EGSCORE).

	TOBIN	ESGSCORE	COMADVANTAGE	INDEP	PROFITABILITY	ROA	LIQUIDTY	CASHFLOW	DEBT	TOTALASSETS
TOBIN	1.000									
ESGSCORE	0.384 0.000	1.000								
COMADVANTAGE	0.254 0.000	−0.009 0.553	1.000							
INDEP	0.290 0.000	0.656 0.000	−0.139 0.000	1.000						
GROWTH	0.375 0.000	0.503 0.000	−0.097 0.000	0.641 0.000	1.000					
PROFITABILITY	0.142 0.000	0.073 0.000	0.068 0.000	0.065 0.000	0.162 0.000	1.000				
LIQUIDTY	−0.301 0.000	−0.325 0.000	0.058 0.000	−0.442 0.000	−0.707 0.000	−0.122 0.000	1.000			
CASHFLOW	0.339 0.000	0.127 0.000	0.150 0.000	0.116 0.000	0.289 0.000	0.296 0.000	−0.302 0.000	1.000		
DEBT	−0.025 0.113	0.276 0.000	−0.150 0.000	0.346 0.000	0.543 0.000	0.027 0.096	−0.380 0.000	−0.047 0.003	1.000	
TOTALASSETS	0.038 0.017	0.423 0.000	−0.195 0.000	0.587 0.000	0.876 0.000	0.118 0.000	−0.589 0.000	0.037 0.020	0.688 0.000	1.000

Table 7
Cluster Regression Analysis Output- ESG Disclosure Index, Firms' Competitive advantage and Tobin-q (with and without moderating effects).

Model 1 and 2

	ESG Disclosures Index - No Moderating						ESG Disclosures Index - With Moderating					
	Panel A (Year Effect)			Panel B (Industry Effect)			Panel C (Year Effect)			Panel D (Industry Effect)		
	Coefficient	t	VIF	Coefficient	t	VIF	Coefficient	t	VIF	Coefficient	t	VIF
ESGIND	0.044***	12.31	4.56	0.044*	2.06	4.56	0.042***	9.06	4.57	0.042**	2.55	4.57
COMADVANTAGE	0.001***	11.96	1.11	0.001***	3.49	1.11	−0.001***	−4.81	5.06	−0.001***	−3.42	5.06
ESGIND* COMADVANTAGE							0.000***	9.96	4.88	0.000***	4.36	4.88
INDEP	−0.007***	−4.93	4.69	−0.007	−1.33	4.69	−0.006**	−3.73	4.70	−0.006	−1.69	4.70
GROWTH	1.684***	16.92	7.71	1.684***	7.98	7.71	1.620***	15.70	7.77	1.620***	8.33	7.77
PROFITABILITY	0.291**	2.78	1.12	0.291***	6.60	1.12	0.264**	3.07	1.12	0.264***	8.87	1.12
LIQUIDITY	−0.000	−1.03	2.07	−0.000	−0.74	2.07	−0.000	−1.43	2.07	−0.000	−1.00	2.07
CASHFLOW	−0.000***	−5.26	1.54	−0.000**	−2.87	1.54	−0.000**	−3.82	1.56	−0.000	−1.68	1.56
DEBT	0.000***	9.50	2.00	0.000*	1.96	2.00	0.000***	5.41	2.01	0.000	1.43	2.01
TOTALASSETS	−0.733***	−16.65	7.14	−0.733***	−6.75	7.14	−0.724***	−14.79	7.15	−0.724***	−6.73	7.15
IND	−0.016***	−5.49	1.03	−0.016*	−2.01	1.03	−0.015***	−4.99	1.03	−0.015*	−1.81	1.03
YEAR	0.015**	2.92	1.04	0.015	1.46	1.04	0.020**	3.61	1.04	0.020*	1.86	1.04
_CONS	−28.553**	−2.76		−28.553	−1.38		−37.957**	−3.46		−37.957**	−1.79	
R-squared	0.5610			0.5610			0.5994			0.5994		

the efficient management of its resources and increase its value. ESG allows firms to run the business effectively and provides solutions to societal issues (Porter et al., 2019). This study claims that Malaysian firms that disclose their ESG efforts are found to generate long-term performance over the period of this study. Previous studies also suggest that the increase in CSR disclosure and performance is associated with government ownership and engagement in CSR activities, introduction of corporate governance standards, stakeholders' pressures on CSR adoption, and higher managerial ownership Haji (2013); Said et al., 2013; Arayssi and Jizi (2019).

In contrast to Serafeim (2020) who argues that ESG performance is due to market sentiments or public opinions, our findings indicate that ESG disclosure in Malaysia interacts positively with COMADVANTAGE, hence it creates better value for shareholders rather than being merely a result of public sentiment to generate firm's recognition.

Our results also indicate that firm's competitive advantage is positively associated with Tobin's q when there is no moderating variable (year effect $\beta = 0.0006985$, p-value = 1%; industry effect $\beta = 0.0006985$, p-value = 1%), however a negative association is observed when we include the moderating variable into the analysis (year effect $\beta = -0.0009614$, p-value = 1%; industry effect $\beta = -0.0009614$, p-value = 1). COMADVANTAGE interacts positively with ESG disclosures across all analyses, indicating that firm's competitive advantage increases as firms increase their ESG disclosures. Since ESG disclosures focus on non-financial information, such as consumer satisfaction, market acceptance, and societal values, it encourages firms to focus on activities that support the communities at large and reduces their focus on only the bottom-line financial figures (Schramade and Schoenmaker, 2018; Porter et al., 2019).

Table 8 presents the cluster regression analysis of ESGSCORE (with and without moderating effect) and its effect on performance (TOBIN). For each part on the analysis, we cluster the regression for year and

Table 8
Cluster Regression Analysis Output – ESG Disclosure Score, Firm Competitive Advantage and Tobin-Q (with and without moderating effect).

Model 3 and 4	ESG Disclosures Score - No Moderating						ESG Disclosures Score - With Moderating					
	Panel A (Year Effect)			Panel B (Industry Effect)			Panel A (Year Effect)			Panel B (Industry Effect)		
	Coeff	t	VIF	Coeff	T	VIF	Coeff	t	VIF	Coeff	t	VIF
ESGSCORE	0.041*	2.15	1.91	0.041**	2.15	1.91	0.035***	6.47	1.94	0.035**	2.97	1.94
COMADVANTAGE	0.001***	3.47	1.10	.001***	3.47	1.10	−0.000***	−5.55	2.59	−0.000***	−3.96	2.59
ESGSCORE*COMADVANTAGE							0.0000797***	18.11	2.51	0.0000797***	6.81	2.51
INDEP	0.002	0.61	2.38	0.002	0.61	2.38	0.002	1.91	2.38	0.002	0.87	2.38
GROWTH	1.742***	7.13	7.71	1.742***	7.13	7.71	1.688***	14.55	7.74	1.688***	7.14	7.74
PROFITABILITY	0.299***	6.83	1.12	.299***	6.83	1.12	0.254**	3.02	1.12	0.254***	8.53	1.12
LIQUIDITY	−0.000	−0.91	2.09	-.000	−0.91	2.09	−0.000	−1.52	2.09	−0.000	−1.08	2.09
CASHFLOW	−0.000**	−2.97	1.56	-.000**	−2.97	1.56	−0.000**	−3.90	1.57	−0.000*	−2.18	1.57
DEBT	0.000	1.58	2.00	.000	1.58	2.00	0.000**	4.07	2.01	0.000	1.23	2.01
TOTALASSETS	−0.743***	−6.17	7.16	-.743***	−6.17	7.16	−0.725***	−14.35	7.18	−0.725***	−6.00	7.18
IND	−0.015	−1.63	1.03	-.015	−1.63	1.03	−0.013***	−4.19	1.03	−0.013	−1.41	1.03
YEAR	0.014	1.28	1.04	.0144	1.28	1.04	0.018**	3.64	1.04	0.018	1.67	1.04
_CONS	−27.247	−1.21		−27.247	−1.21		−35.484**	−3.48	1.94	−35.484	−1.61	
R-squared	0.5994			0.5617			0.6105			0.6105		

industry effect. We first regress ESGSCORE on performance without the moderating effect of COMADVANTAGE with both year (β = 0.0412907; p-value = 10%) and industry (β = .0412907; p-value = 5%) clustering. The results in Panels A and B indicate that ESGSCORE is positively associated with TOBIN. For cluster regression analysis without the moderating variable the R-squared is 59.14% (Panel A) and 56.17% (Panel B) while the R-squared value with the moderating variable is 61.05% for both year and industry effect. When the cluster regression is moderated with COMADVANTAGE, the results indicate a positive association between ESGSCORE and TOBIN for both year (β = 0.0347121; p-value = 1%) and industry effect (β = 0.0347121, p-value = 5%). The moderating variable (ESGSCORE*COMADVANTAGE) indicates a positive association with firm's performance (TOBIN) when clustered by year effect (β = 0.0004672, p-value = 1%) and industry effect (β = 0.0004672, p-value = 1%). The findings indicate that firms with higher competitive advantage and ESG disclosures have higher performance. Their competitive advantage is attributed to lower investment costs as a result of firms' long-term sustainability plans (Crifo et al., 2017). Firm's engagement in ESG disclosures activities and sustainable activities such as the phasing out expensive coal energy to renewable energy source increases firm value and performance over the long run (Porter et al., 2019).

In all our analysis, most firms also have high growth and profitability. This may suggest that firms in Malaysia that are effective in implementing ESG disclosures are firms that recognize the importance of sustainable development. Governments should intensify their efforts in providing resources and technical expertise to small and medium enterprises (SMEs).

Similar to our earlier analysis in Table 7, our results again indicate that firm's competitive advantage (COMADVANTAGE) is positively associated with ESG disclosures when there are no moderating variables (year effect β = 0.0007114, p-value = 1%; industry effect β = 0.0007114, p-value = 1%), however negative association is observed when we include moderating variables into the analysis (year effect β = -0.0004672, p-value = 1%; industry effect β = -0.0004672, p-value = 1%). Our analysis supports previous studies that firms that have competitive advantage have more resources to implement their ESG disclosures activities to meet shareholder's expectation and recognition (Li et al., 2017). As mentioned earlier, better incentives and support are needed to ensure that ESG is incorporated into firm's value chain.

We run cluster regression analysis simultaneously for both time and year effect next. Table 9 presents the cluster regression output of ESGIND (both with and without moderating variable) and its effect on TOBIN. In the first regression when the moderating variable is not considered (Panel A), ESGIND is positively associated with TOBIN (β = 0.04398; p-value = 5%). Similarly, a positive association (β = 0.04207; p-value = 1%) with TOBIN is found when the moderating variable is included in the analysis (Panel B). The R-squared values are 56.10% (without moderating variable) and 59.94% (with moderating variable). The moderating variable (ESGIND*COMADVANTAGE) has a positive association with TOBIN (β = 0.00006, p-value = 1%)

Table 9
Panel Cluster analysis controlling for both year and industry.

Models 1 and 2 (Independent Variable: ESG Disclosure Index)	Panel A (Without Moderating)		Panel B (With Moderating)	
	Coefficient	t	Coefficient	T
ESGIND	0.044**	2.25	0.042***	2.74
COMADVANTAGE	0.001***	3.85	−0.001***	−3.25
ESGIND* COMADVANTAGE	–		0.000***	4.61
INDEP	−0.007	−1.46	−0.006*	−1.82
GROWTH	1.684***	8.11	1.620***	8.32
PROFITABILITY	0.291***	5.32	0.264***	6.42
LIQUIDITY	−0.000	−0.72	−0.000	−0.97
CASHFLOW	−0.000***	−2.96	−0.000*	−1.93
DEBT	0.000**	2.28	0.000	1.6
TOTALASSETS	−0.733***	−7.04	−0.724***	−6.89
IND	−0.016**	−2.16	−0.015*	−1.98
YEAR	0.015**	2.09	0.020**	2.57
_CONS	−28.553*	−1.99	−37.957**	−2.49
R-squared	0.5610		0.5994	

Table 10 presents the cluster regression output of ESGSCORE (both with and without moderating variable) and its effect on TOBIN. The results in Panel A shows that ESGSCORE is positively associated with TOBIN when the moderating variable is not included in the analysis (β = 0.0412907; p-value = 5%). A positive association is also found in Panel B when the moderating variable is included in the analysis (β = 0.0347121; p-value = 1%). The R-squared values are 57.17% (without moderating variable) and 61.05% (with moderating variable). The moderating variable (ESGSCORE*COMADVANTAGW) has a positive association with TOBIN (β = 0.0000797, p-value = 1%).

The findings reaffirm previous studies that firm's competitive advantage is an important factor in encouraging high ESG disclosures. García-Sánchez et al.'s (2019) study show that the existence of a CSR committee facilitates adoption and promotes sustainable management policies and systems and enhances communication with stakeholders. Arayssi and Jizi (2019) reports ESG improves firm' s positive image and participation among women serves as a catalyst to strike an effective balance between firms financial targets and social responsibilities. Ayuso

Table 10
Panel Cluster analysis controlling for both year and industry.

Models 3 and 4 (Independent Variable: ESG Disclosure Score)				
	Panel A (Without Moderating)		Panel B (With Moderating)	
	Coefficient	t		Coefficient
ESGSCORE	0.041**	2.29	0.035***	3.06
COMADVANTAGE	0.001***	3.83	−0.000***	−3.91
ESGSCORE* COMADVANTAGE			0.000***	7.69
INDEP	0.002	0.62	0.002	0.90
GROWTH	1.742***	7.28	1.688***	7.20
PROFITABILITY	0.299***	4.93	0.254***	5.89
LIQUIDITY	−0.000	−0.86	−0.000	−1.02
CASHFLOW	−0.000***	−2.97	−0.000**	−2.28
DEBT	0.000*	1.82	0.000	'1.36
TOTALASSETS	−0.743***	−6.47	−0.725***	−6.22
IND	−0.015*	−1.76	−0.013	−1.55
YEAR	0.014**	2.08	0.018***	2.74
_CONS	−27.247*	−1.98	−35.484**	−2.65
R-squared	0.5717		0.6105	

et al. (2020) find that integrated social values improve economics, financial accounting indicators and social values.

5. Practical implications of the study

Based on the findings of this study, engagement in ESG activities is proven to improve firm performance and competitive advantage due to better access to financing. The study therefore implies that promotion of responsible investing results in better engagement of ESG activities and improvements in firm performance. This can benefit various stakeholders in an emerging market such as Malaysia as firms start to focus on the environment and the effect it has on the society in general. In addition, the emphasis on ESG in Malaysia through the introduction of the FTSE4Good Bursa Malaysia Index in 2014 has encouraged firm participation in ESG activities, resulting in improved competitive advantage and lower cost of capital due to better reputation and shareholders' acceptance. The study therefore calls for rigorous effort by the government *via* structural and legal reforms which can boost investor's confidence in firms that engages in ESG activities. As part of United Nations recommendation for firms to disclose ESG practice by 2030, regulatory bodies need to assist firms that have lower competitive advantage *via* tax incentives, training or financial support for them to be actively engaged in ESG disclosures activities that benefits the value- chain of their business from customers, suppliers as well as their shareholders (Jallai, 2020). In addition, growth in corporate governance and firm's transparency facilitate better understanding on how non-financial disclosures such as ESG drives firm's value (Ho, 2020).

6. Conclusions

According to the evidence presented in this study, our findings suggest that firm's sustainability efforts can help facilitate it to manage resources more efficiently and allow it to run its business effectively while providing solution to societal issues. In contrast to previous studies, ESG disclosure in Malaysia is found to deliver better value to shareholders and is not merely to gain market acceptance. The findings also support the stakeholder's theory that ESG increase firm's competitiveness. Therefore, ethical and responsible behavior of firms in improving the societal well-being leads to better value and performance. Our findings also suggest that firms that have lower competitive advantage may need support from the government to increase their ESG disclosures activities and improve their performance.

The findings also support for more responsible business conduct as firms with better ESG disclosures have been found to have better performance. Since some countries do not make it mandatory for firms to have ESG disclosure, the findings from this study may encourage firms to look at non-financial disclosures as an important indicator for firm's long-term sustainability. When ESG is viewed as an integral factor in firm's future performance, the eventual result is higher shareholder's return. Firms that are managed ethically have stronger market acceptance and elicit greater trust from the public. Correspondingly, when investors trust the management, ESG integration in firm's investment portfolio tends to lead to more effective and resiliently-managed portfolios.

Currently there are no strict regulations on ESG disclosures in Malaysia. Developed countries such as the United States have made it mandatory for companies to disclose certain ESG information. However, most companies in the United States report ESG independently without any reference to detailed guidelines which provide standardized information for shareholder's understanding. The growth of shareholder's activism has resulted in attention given to non-financial disclosures of ESG in the firms' annual reports which will help facilitate better understanding on how ESG disclosures activities drive firm value. In Europe, the European commission has issued directive on the non-financial reporting of ESG in their effort to create a more competitive and sustainable business environment. Since ESG disclosure is still very new in Malaysia, more research is needed to understand how ESG disclosure should be made for different industries in Malaysia.

Future studies should also explore how different types of ESG disclosures such as climate change, diversity, human rights, health and welfare of employees affects firm performance. Also, regulatory frameworks for SMEs are still in the nascent stage and regulators should incentivize SMEs to incorporate ESG disclosures activities into their operating activities. Since SMEs make up about 90% of the firms in Malaysia, future studies can be conducted on SMEs concerning issues related to the firm's resources and technical expertise in implementing ESG disclosures activities.

There are several limitations of this study. Firstly, we narrowed down the definition of competition advantage only to firms' resource-based competitive advantage. Our focus for competitive advantage is on the firm's ability to earn a return on its resources that is larger than its cost of equity capital. Futures studies can explore the effect of firm's industry average, consumer's acceptance or trust and types of ESG disclosures and its effect on firm performance. Secondly, the data collection period of this study has very limited disclosures by most firms so we were unable to collect other components of ESG disclosures. Future studies should focus on the three different pillars of ESG to understand their effects on firm performance and how competitive advantage can affect this relationship.

Thirdly, our data is limited to Malaysia only and further studies should explore the growth of ESG across Asian and other developing countries to integrate the findings of this study and formulate regulatory frameworks that allow better transparency and hence contribute to long-term stakeholder value.

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Impact of Organisational Factors on the Circular Economy Practices and Sustainable Performance of Small and Medium-sized Enterprises in Vietnam

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ABSTRACT

Internal organisational factors have been identified as barriers to adopt circular economy (CE) practices in prior research. However, empirical evidence is limited to support this claim. Additionally, their impact on sustainable business performance, especially for the emerging economies and within the small and medium sized enterprises (SMEs) have not been studied adequately. This research bridges these knowledge gaps drawing on from CE, human resource management, innovation and sustainability literature to develop and validate a theoretical model that examines the relationships between organisational factors (leadership, innovation, culture, and skills) and their impact on adopting CE practices to enhance sustainable performance of SMEs. A survey was conducted among 205 SMEs' employees in Vietnam, and responses were analysed using employing Structural Equation Modelling. Our findings reveal that organisational leadership will facilitate developing the culture and innovation capability to adopt CE practices through a 'hub and spoke' strategy for enhancing sustainable performance among the SMEs in Vietnam. In this vein, we recommend creating knowledge sharing strategies, collaborative and cooperative CE working groups within and between SMEs, and information systems capabilities to build sustainable business organisations.

1. Introduction

The Circular economy (CE) concept is restorative and regenerative through advocating reduce-reuse-recycle of materials, compared to the traditional linear 'take, make, dispose' model, which uses vast quantities of non-renewable resources (Dey et al., 2022; García-Quevedo, Jové-Llopis, & Martínez-Ros, 2020; Mangla et al., 2018; Saha, Dey, & Papagiannaki, 2020; Schroeder, Anggraeni, & Weber, 2019). The existing business and management literature has discussed CE practices as a combination of lean practices (which emphasises on achieving resource efficiency through responsible consumption of materials and waste reduction), and sustainable oriented innovation (focuses on optimising business processes to achieve economic benefits) and sustainable practices (reduce, reuse and recycle philosophy to increase environmental performance by reducing greenhouse gas emissions and social performance through the creation of new jobs) (Dey et al., 2019b; 2020). According to World Economic Forum PACE report, CE adoption will lead to GDP growth by 0.8–7%, adding 0.2–3% more jobs and reduce carbon emissions by 8–70%, therefore, resulting into economic growth and business productivity in the developing economy [SDG8] (WEF, 2017).

Many large organisations have launched sustainability and low-carbon initiatives. However these are still uncommon in SMEs plagued by resource and financial constraints (Dey et al., 2019a, 2019b; 2020). In the last few years, academic literature has turned its focus towards understanding the drivers and barriers for adopting CE in the SMEs, because these organisations make up around 90% of the world

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businesses, employing 50–60% of the world population, and significantly contributing up to 70% of global pollution collectively (Bonner, 2019). CE adoption is being increasingly studied in the operations management literature to help reduce GHG emissions resulting from business processes and practices, and advocate green operational strategies (Bhatia, Jakhar, Mangla, & Gangwani, 2020). Although, the adoption and implementation of CE has been widely studied in developed economies such as UK (Dey at al., 2019b; Dey at al., 2020), USA (Lonca, Lesage, Majeau-Bettez, Bernard, & Margni, 2020; Vunnava & Singh, 2021), Australia (Payne, Nay, & Maguire, 2021; Halog, Balanay, Anieke, & Yu, 2021), European countries (Leipold, Weldner, & Hohl, 2021; Mazur-Wierzbicka, 2021; Dey et al., 2022), China (Pesce et al., 2020; Kuo & Chang, 2021), and few developing economies such as Mexico (Rodríguez-Espíndola et al., 2022), and India (De, Chowdhury, Dey, & Ghosh, 2020), empirical research for factors impacting CE adoption in emerging (low and middle-income) economies (Tura et al., 2019) are still scant.

With an annual GDP growth rate of 7% in recent years, Vietnam is among the world's fastest growing middle-income developing economies (Hai et al., 2020). According to the Vietnamese General Statistics Office, SMEs represented more than 97% of the total enterprises in 2020, creating livelihood for 60% of the Vietnamese workforce in sectors such as trading, repair of motor vehicles and household goods, manufacturing (especially food and beverage sector), and construction (Nguyen et al., 2020; Dinh & Nguyen, 2018). However, sustainable growth within these enterprises in Vietnam is curtailed by environmental degradation, plastic waste, depletion of natural resources and high carbon emissions (VN, 2020). In that context, a shift to CE has been acknowledged by both Vietnamese stakeholders and governmental policy makers as a way to overcome the limitations of the traditional linear economic model (CEV, 2018). Different initiatives and reforms (e.g., introducing carbon pricing tools to reduce greenhouse gas emissions, carbon tax for businesses and economic incentives for low carbon businesses) have thus been made by the Vietnamese government to minimize the resource utilization and emissions (VNT, 2019). Irrespective of the government initiatives, carbon emissions are growing faster in Vietnam compared to any other country in the region (South East Asia), and according to the MIT green future index Vietnam is ranked 70th out of 78 countries for GHGs emissions (Green, 2021).

1.1. Research problem and questions

The existing literature (Grafström & Aasma, 2021; Jaeger & Upadhyay, 2020) and recent research reviews (Kumar, Singh, & Kumar, 2021; Agyemang et al., 2019; Govindan & Hasanagic, 2018; Mangla et al., 2018) have identified several barriers inhibiting the adoption of CE within business organisations: financial constraints, lack of reliable information and business cases, lack of awareness among businesses and consumers, skills-gap pertaining to green strategy and management, technology adoption, lack of coordination between the stakeholders and beneficiaries when new laws promoting CE adoption are passed, lack of awareness and support from senior management and lack of coherent strategy to adopt innovative and eco-friendly practices within the business operations. Internal factors within the organisations such as leadership, skills and competencies, organisational culture and innovation mindset will limit the scalability and adoption among businesses, in any economy (Jaeger & Upadhyay, 2020; Mangla et al., 2018). The adoption of CE practices to achieve sustainable business performance will require overcoming organisational barriers posed by internal factors, which is less researched empirically within the academic and practitioners' literature (Kirchherr et al., 2018).

A study in Vietnam [commissioned by the The Netherlands Department/Ministry of Foreign Affairs] had discussed that lack of leadership, CE awareness, skills and experience among both the managers and workforce and organisational culture inhibit business model innovation (VNB, 2018), resulting in lack of effective strategies and actions to adopt CE. According to European Academies' Science Advisory Council, skills gap and lack of leadership and CE skills-based programmes promoting organisational innovation culture are potential barriers to adopting CE. Skills development and vocational training for SMEs managers will contribute significantly to upscaling CE practices and achieving goals of economic pillar (MacArthur, 2015).

Considering such conceptual, empirical, and contextual developments, the overarching aim of this paper is to bridge this knowledge gap in the business and management literature concerning the adoption of CE in Vietnam (a developing economy), which leads us to the following research questions motivating our current empirical investigation.

- RQ1: How does leadership influence innovation mindset, skills and competencies and organisational culture within Vietnamese SMEs for adopting CE practices?
- RQ2: How does the innovation mindset, skills and competencies, and organisational culture within employees of Vietnamese SMEs influence the adoption of the CE practices, and how do these practices impact on the SMEs' sustainable business performance?

1.2. Theoretical lens

We use the theoretical lens based on the tenets of dynamic capability theory (DCT) drawn from the organisational management literature to examine the research questions. The seminal article by Teece, Pisano, and Shuen (1997) and further literature (Alsawafi, Lemke, & Yang, 2021; Zahra, Sapienza, & Davidsson, 2006) on DCT have highlighted that the ability of a firm to implement new practices and strategies, and effectively manage these in a rapidly evolving environment will depend on the internal resources, skills and competencies, leadership, processes and organisational routines. Therefore, leadership, internal competencies and culture within the organisations are critical to reconfigure business model and operations to achieve sustainable business performance and competitive advantage (Prieto-Sandoval, Jaca, Santos, Baumgartner, & Ormazabal, 2019). The existing literature has also discussed that adoption of CE requires changes within the organisation to reconfigure business operations that will help in achieving corporate sustainability (Khan, Daddi, & Iraldo, 2020; Amui, Jabbour, de Sousa Jabbour, & Kannan, 2017), and internal organisational challenges will inhibit the adoption of CE business model (Scarpellini, Marín-Vinuesa, Aranda-Usón, & Portillo-Tarragona, 2020; Mousavi, Bossink, & van Vliet, 2018). Therefore, in our study DCT will help to conceptualise and examine the interplay between organisational factors (leadership, culture, innovation mindset, skills and competencies), and CE adoption (new business model) to achieve sustainable business performance (outcome variable).

1.3. Contributions

Answering these questions are important as management scholars and practitioners have indicated and acknowledged the importance of adopting CE practices in facilitating sustainable development at the micro (enterprises and consumers), meso (economic agents integrated into symbiosis) and macro (cities, regions and governments) levels (Geissdoerfer, Savaget, Bocken, & Hultink, 2017; Kalmykova, Sadagopan, & Rosado, 2018). This research contributes to the literature on green management strategy, operations and supply chain management (OSCM) and SMEs' sustainability in developing economies, to develop SMEs' capability and strategies for adopting CE. This will help to combat the negative impact of industrial practices in developing economies on the environment, which can address the grand challenges posed by climate change from a business perspective (Reimann, Xiong, & Zhou, 2019; Bhatia et al., 2020). The key contributions of this research as further outlined below.

- Firstly, we shape our theoretical contributions by integrating the principles of dynamic capability theory, CE and sustainability to add important insights on the influence organisational factors such as leadership, innovation mindset, culture, skills and competencies (which are often reported as barriers to CE implementation in developing economies) have on the CE adoption and sustainable performance of the SMEs. Therefore, this study will provide OSCM community, Vietnamese SMEs, and government policy makers with empirical evidence that will help to comprehensively understand and mitigate the organisational barriers.
- Secondly, our results extend the general findings of Dey et al. (2019a, 2019b; 2020) pertaining to the impact of circular economy practices on sustainable business performance of the SMEs (in the UK), enriching the management literature related to the highly relevant and understudied interaction between organisational barriers, CE adoption and sustainable business performance of the Vietnamese SMEs. Accordingly, our research contributes to past conceptualisations (Savaskan, Bhattacharya, & Van Wassenhove, 2004), and recent empirical work (Dey et al., 2019b; 2020), by including new constructs (i.e., leadership, culture, innovation mindset and skills) to examine CE adoption, and achieve sustainable business performance.
- Finally, the paper also contributes to enriching the OSCM literature by providing a set of recommendations to government policy makers and SMEs managers drawing from the organisational socialisation framework (Bush, 2016) and knowledge-based view theory (Grant, 2006), which will facilitate in enhancing the capability of Vietnamese SMEs to effectively adopt CE practices within their business operations by overcoming internal organisational barriers.

1.4. Summary

Accordingly, to answer our research question: Firstly, we consolidate the literature on CE practices, sustainable business performance, drivers and barriers to CE adoption (in Section 2). Secondly, we derive theoretical constructs from the literature to develop a conceptual model that will examine the relationships between the organisational constructs, CE practices, and sustainable business performance (in Section 2). Thirdly, we describe the research methodology in section 3. Fourthly, we employ Structural Equation Modelling (SEM) statistical technique to process the data and test the hypothesis derived from the proposed conceptual model (Section 4). SEM analysis shows the casual relationships between the research constructs (Section 4). Next, we discuss the results in the vein of the literature and conceptual model (Section 5), followed by the theoretical and practical implications of the research (Sections 6 and 7), and finally the conclusions and future research direction (Section 8).

2. Literature review and model development

Despite the traditional focus on economic performance as a measure for the survival of companies, there has been an increasing discussion in the literature about the role of sustainability in organisations (Kiefer, Del Rio Gonzalez, & Carrillo-Hermosilla, 2019), and recent research has been looking at the application of these factors to SMEs (García-Quevedo, Jové-Llopis, & Martínez-Ros, 2020). This section will provide a brief overview of background literature concerning CE and sustainability, followed by the development of the hypotheses supported by arguments drawn from the literature, and finally summarising the knowledge gaps addressed through our empirical investigation.

2.1. Circular economy and sustainability

The introduction of the Sustainable Development Goals (SDGs) by the United Nations has shed some light on the need to look beyond financial objectives to account for the impact of human activities (UN, 2015). The idea of sustainability was encapsulated by Elkington (1998) using the concept of the triple bottom line, which is underpinned by three pillars: the economic, social and environmental. Along with the traditional focus on financial success, sustainability involves looking at the perspective of society and the impact of human activities on the environment (Gunasekaran & Irani, 2014). The movement towards sustainability represents significant challenges for SMEs. It requires placing less attention on financial results and considering the social and environmental impacts, which can be daunting for risk-averse companies operating with constrained resources (Games & Rendi, 2019). Hence, SMEs are struggling to introduce sustainability practices (Dey et al., 2020), which leads to a delay in the development of these companies. SMEs have a key role on the implementation of the circular economy because of their combined contribution to the economy of different countries (Woodard, 2020). Hence, research is needed to understand the aspects impacting the implementation of sustainable practices and which aspects need to be enhanced to facilitate their transition. This section provides an analysis of the literature of sustainability and particularly the impact of circular economy practices to enhance sustainability performance.

The main aim of circular economy is to reduce waste and increase energy and resource efficiency (Navarro, Cantero, Valls, & Puig, 2020, Willersinn, Mack, Mouron, Keiser, & Siegrist, 2015, Katz-Gerro & López Sintas, 2019). This can be achieved through closing loops of nutrients that can re-enter the biosphere or materials that can be circulating in the economic activities, along with the reduction of overall resource consumption through the transformation of processes (Haas, Krausmann, Wiedenhofer, & Heinz, 2015). That is the origin of the concept of the 3Rs – reduce, reuse and recycle. Reduce involves finding opportunities to modify raw materials, improving production and consumption processes, and modifying process design (Goyal, Esposito, & Kapoor, 2018, Geng & Doberstein, 2008). Reuse comprises of practices through the reintroduction of end-of-cycle products to reduce the use of raw materials along with other resources involved on the design, manufacture and use of products or components (Goyal et al., 2018). In cases in which the products cannot be reused or reduced, recycling becomes a useful alternative. It is the most widespread strategy because it allows reduced exploitation of limited resources through the transformation of end-of-life items into useful materials (Haas et al., 2015, De Corato, 2020). The combination of the 3Rs with approaches such as eco-innovation (Kiefer et al., 2018) enables the efficient use of resources leading to economic, environmental, and social benefits (Stewart & Niero, 2018, Prieto-Sandoval, Jaca, & Ormazabal, 2018, Govindan & Hasanagic, 2018).

There have been valuable contributions in the literature about the factors affecting the adoption of CE practices. Govindan and Hasanagic (2018) undertook an in-depth analysis of the drivers, barriers and practices supporting circular economy adoption in supply chains. The content analysis of 60 articles included in their systematic literature review found drivers and barriers associated to the internal and external environment. The drivers can be classified into policy and economy, health, environmental protection, society and product development, whereas the barriers are clustered in issues related to government, economy, technology, knowledge and skill, management, CE frameworks, culture and society, and market. The findings highlight the importance of job potential, climate change, and population growth as motivators for the implementation of CE, whereas technological limitations seem to be the most common barriers. The emphasis on the importance of economic factors affecting the adoption of CE has been reflected in different studies. Gusmerotti, Testa, Corsini, Pretner, and Iraldo (2019) use cluster analysis to look at the level of implementation of CE practices and logit regression to highlight the most relevant drivers for implementation in the manufacturing industry. They identify economic efficiency as the most influential factor, commonly trying to find CE practices that address environmental concerns at the same time as these provide financial benefits. Additionally, they conclude that organisations using natural resources are more prone to adopt CE practices.

Using the context of automobile manufacturing in Pakistan, Agyemang et al. (2019) highlight the importance of economic factors driving the implementation of CE practices. They apply a combination of interviews and surveys to explore the drivers and barriers affecting the implementation of CE. They gathered 112 survey responses and complemented them with 28 interviews to identify profitability, cost reduction and environment appreciation as the main factors driving the implementation of CE in companies.

Additionally, it is important to consider the context surrounding the company, as found by Tura et al. (2019). Their comprehensive categorisation of drivers and barriers affecting the implementation of CE uses reports from the literature to create a framework tested in four organisations using 36 interviews. They state that individual drivers are context-specific, and that information technology plays a crucial role in the introduction of CE practices. From the perspective of emerging economies, Patwa et al. (2021) use a sample of 183 consumers to identify the need for extending the lifetime for products using the 3Rs, the use of big data to improve information flows, and government policy as significant factors for the adoption of circular economy in developing countries.

Despite the potential of CE practices to support the SDGs (Kristoffersen, Blomsma, Mikalef, & Li, 2020), Liu and Bai (2014) express that organisation have several concerns about the potential barriers for implementation. In fact, Gusmerotti et al. (2019) stress that several companies are barely aware of most of the potential benefits of CE. This has been reflected on the low adoption rate of circular economy practices in companies (Fehrer & Wieland, 2021), particularly in the case of SMEs despite the large consumption of resources attributed to these organisations globally (Meath, Linnenluecke, & Griffiths, 2016). It is important to consider the conditions and the context of these organisations to provide insights to support their implementation of CE practices.

Looking into the factors affecting adoption for SMEs, Prieto-Sandoval et al. (2018) employ a Delphi panel to assess the degree of CE implementation for SMEs classified in three categories: circular economy fields of action (take, make, distribute, use, and recover), industrial symbiosis, and environmental certifications. Their findings suggest recover is the most important field of action for managers, followed by sustainable design strategies. Bassi and Dias (2019) use multilevel orbital probit models to analyse data from 10,618 interviews from the Flash Eurobarometer 441 to explore different CE practices in European countries. They found that, among organisations introducing CE practices, variables such as size, turnover, percentage of turnover devoted to R&D, and type of activity affect the intention to adopt green behaviour. At the same time, they mention that SMEs can implement practices such as reduction of waste, but they might be unable to introduce more ambitious redesigning practices. García-Quevedo et al. (2020) use the same Flash Eurobarometer Survey 441 from 2016 to conclude that regulatory obstacles, cost of meeting regulations and limited human resources are barriers for the adoption of CE in SMEs.

2.2. Hypothesis development

Leadership has been identified as a crucial aspect to achieve successful innovation (Lukoschek, Gerlach, Stock, & Xin, 2018, Busola Oluwafemi, Mitchelmore, & Nikolopoulos, 2020), which can have an effect on circular economy. Moktadir, Rahman, Rahman, Ali, and Paul (2018) use graph theory with a matrix approach to quantify the impact of CE knowledge, customer awareness, leadership and governmental support on CE practices in the leather industry in Bangladesh. Their findings suggest knowledge about CE from managers is a very important factor, followed by leadership and commitment from top management and customer awareness in large organisations, with less impact on smaller organisations. Moktadir et al. (2020) agree with these findings and identify leadership and top management commitment as key factors affecting the implementation of CE in supply chains. Similarly, Wang, Shen, Chen, and Carmeli (2021) show the effect of environmentally responsible leadership in achieving environmental innovation. Leadership seems to be an influential component affecting individual factors and behaviours in the organisations (Lukoschek et al., 2018, Wood, Logar, & Riley, 2015). Internal factors suggested in the literature affect the implementation of CE and sustainable practices include innovation (Bertassini, Zanon, Azarias, Gerolamo, & Ometto, 2021, Brown, Von Daniels, Bocken, & Balkenende, 2021, Imoniana, Silva, Reginato, Slomski, & Slomski, 2020), skills and competencies (Govindan & Hasanagic, 2018, Gelhard & Von Delft, 2016), and culture (Jerónimo, Henriques, de Lacerda, da Silva, & Vieira, 2020, Veronica, Alexeis, Valentina, & Elisa, 2020). However, more empirical analysis is needed to understand the impact of these organisational factors in CE practices.

The existing organisational studies and management literature has discussed the role of leadership and senior management in enhancing the innovation capability of organisations in achieving competitive advantage, especially in developing economies (Lei, Gui, & Le, 2021). In this context, previous studies have also shown the decisive role of leadership in developing and shaping a positive culture within the organisation, which is conducive to implementing and managing new strategies (Le & Lei, 2019; Le, 2020). Such environment helps to create a supportive culture within the organisation that will enhance motivation and commitment of the employees to embrace innovative ideas, processes and strategies, helping the organisation to dynamically adapt and evolve (Lei et al., 2020; Al-Husseini, El Beltagi, & Moizer, 2021). Therefore, leadership practices within the organisation will influence psychological immunity of the employees (job satisfaction and productivity), which will also enhance the capability of both the employees and organisation to embrace new practices, innovation and business processes (Gui, Lei, & Le, 2021). Leadership plays an important role to intellectually stimulate employees' ability to perform their tasks and embrace change, through career development programmes (Nguyen & Mohamed, 2011). It also helps to develop appropriate conditions, strategies, and resources within the organisation, which will allow employees to harness new skills building on existing knowledge, facilitate access to relevant knowledge and expertise base, and finally encourage sharing this knowledge with peers (Le & Lei, 2018). Considering these perspectives stemming from the literature, we formulate the following hypotheses.

- H1:*Leadership* has a significant impact on innovation in Vietnamese SMEs
- H2:*Leadership has a significant effect on organisational culture in Vietnamese SMEs*
- H3:*Leadership has a significant effect on skills and competencies of employees in in Vietnamese SMEs*

2.3. Innovation

Management innovation involves implementation of new management practices in a firm to enhance business productivity (Mol & Birkinshaw, 2009). Innovation can take various forms and aspects such as business model, service, process, product, technology and human capital. CE involves closed-loop supply chain innovation, which can be defined as the process of designing, implementing, and managing the activities combining the upstream and downstream of supply chain, which will maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time (Reimann et al., 2019; Krug, Guillaume, & Battaïa, 2021). Therefore, CE involves process, product, digital and service innovation across the supply chain spectrum. CSLC innovation will allow using the waste as an alternative resource in the supply chain ecosystem (through waste management and conversion practices), thereby offering new business opportunities to enhance profitability, while at the same time environmentally low carbon friendly practices (Xu & Wang, 2018). The primary goal of innovation is to gain and retain

sustainable competitive advantage in the dynamic business environment, improve the quality of products and services offered to consumers and conceptualising new practices and strategically aligning them to business priorities in order to make sustainable impact through goal-oriented activities (Suchek, Fernandes, Kraus, Filser, & Sjögrén, 2021). Based on these perspectives stemming from the review of literature, we develop the following hypothesis.

H4: Innovation has a significant effect on adopting Circular economy practices in Vietnamese SMEs

The role of organisational culture and its impact on business processes, strategies and productivity has been widely studied in the extant literature (Anning-Dorson, 2021). It represents the deeply seated values and beliefs shared by employees in an organisation. In this context, work practices, how they evolve over time, and how this evolution is managed internally within the organisations are integral to the construct of organisational culture (Martins & Terblanche, 2003). It is also an integral part of how an organisation functions in the business environment. The culture within organisations forms the basis of communication, mutual understanding, and meaningfulness in the context of jobs, tasks and work practices, which will significantly impact the efficiency of an organisation, and its ability to adopt new practices and business model innovation (McLaughlin, Bessant, & Smart, 2008; Barrett, 1998). In this context culture helps to bridge the gap between strategy and its implementation within the organisation using resources and processes to guide and manage change (Anh Vu, Plimmer, Berman, & Ha, 2022; Filipczak, 1997). The importance of leadership to create a suitable and conducive organisation culture has been comprehensively discussed in prior literature (Bass & Avolio, 1993; Ogbonna & Harris, 2000; Sarros, Cooper, & Santora, 2008; Sarros, Gray, & Densten, 2002). Recent work reported in the literature (Anning-Dorson, 2021; Tung & Dung, 2022) shows that organisation culture is critical for human resource orientation to achieve productivity and improvement orientation to evolve management processes, and business operations. Against this background, we formulate the following hypothesis.

H5: Culture has a significant effect on adopting Circular economy practices in Vietnamese SMEs

Skills and competencies of the employees within a firm are considered strategic tangible resources to achieve business productivity and sustainable competitive advantage in the market environment (Mousavi et al., 2018). These attributes make organisations dynamically capable to implement sustainability-driven innovation practices such as CE (Khan et al., 2020). Therefore, human resources within the firm are critical to create, redesign, adapt, and diffuse environmentally friendly practices within business organisations. In this context, there is a need to strike a balance between design-specific knowledge and trans-disciplinary skills (systems thinking) to effectively engage in and implement circular economy practices (Charnley, Lemon, & Evans, 2011). In this context, De los Rios and Charnley (2017) have discussed the significance of skills and competencies within organisations to develop capabilities internally that will help to achieve resource and process optimisation. The skills gap is likely to be even more significant in developing economies, due to limited policies and government strategies to reskill and upskill a workforce in line with green strategies to attain sustainable development within the economy (Mangla et al., 2018). According to Schroeder et al. (2019), the wider adoption and diffusion of CE practices within the business organisations facilitating business model innovation will be influenced by the technical skills of both employees and entrepreneurs. Remanufacturing companies optimising product design (design to make products last longer) and business operations (resource and process optimisation and innovation) will require specific skills training, capacity building programs and multi-stakeholder partnerships, to facilitate adoption of CE in the SMEs (Bourguignon, 2016). Considering these perspectives, we propose the following hypothesis.

H6: Skills and competencies of employees will have a significant effect on adopting Circular economy practices in Vietnamese SMEs.

Traditionally, performance has been linked to financial metrics. However, organisations have increasingly started to balance economic metrics with social and environmental performance (Epstein & Roy, 2003) to account for the different benefits that can be gained in different dimensions (Katz-Gerro & López Sintas, 2019). It is important to link the implementation of CE practices with sustainable performance to ensure real improvements are produced (Harris, Martin, & Diener, 2021), especially to facilitate and guide the transition of SMEs (Nguyen et al., 2020). Reported benefits such as improved business productivity and enhance reputation (Dey et al., 2019, Sarkis, Zhu, & Lai, 2011, Sauvé, Bernard, & Sloan, 2016) can encourage SMEs to invest in CE practices. There has been analysis about the link between CE practices and environmental performance, and the implications of sustainable practices on environmental and financial performance, but literature about the topic remains inconclusive (Lee & Raschke, 2020, Wagner, 2015, van Loon, Diener, & Harris, 2021). It is important to understand more about the overall impact of CE practices on the dimensions of sustainable performance. That impact is key to deliver useful insights for SMEs, especially considering their aversion to risk and the limited resources they have to invest (Games & Rendi, 2019). Accordingly, we formulate the following hypothesis.

H7: Circular economy practices have a significant effect on sustainable performance of Vietnamese SMEs

2.4. Research gaps

The literature review has investigated the current state-of-the art regarding the factors affecting the successful implementation of circular economy practices and the impact of these practices on sustainable performance. As a result, different gaps have been identified. Although Govindan and Hasanagic (2018) recognised the existence of internal and external factors affecting the implementation of CE practices, and there are studies suggesting the value of internal capabilities, most of the research has focused on external factors and pressures. New research could therefore consider the impact of managerial competencies on engagement in SMEs (Lara & Salas-Vallina, 2017, Wood et al., 2015), the value of internal factors such as leadership, culture, innovation and skills and competencies, provide empirical evidence about their role in the implementation of CE practices. Despite claims that the factors affecting CE practices are context-dependent (Tura et al., 2019), less research has been focused on the conditions faced by SMEs (Bassi & Dias, 2019). Research about the factors facilitating the successful implementation of CE practices and their effect on the performance of SMEs is necessary to provide further insights to guide and inform SMEs to make decisions. SMEs need to be aware of the impact of CE practices on the three dimensions of sustainable performance to support decision-making. Nevertheless, the link between CE and performance is still unclear (van Loon et al., 2021) especially focused on sustainable performance. As a result, more research is required to provide insights about the impact of CE practices and sustainable performance for SMEs. Fig. 1 depicts the relationships between the constructs (internal organisational factors, CE practices, and sustainable business performance) covering all the proposed assertions.

3. Methodology

This article investigates the relationship between the organisational internal factor and their impact on CE adoption and achieving sustainable business performance. We have used primary research employing

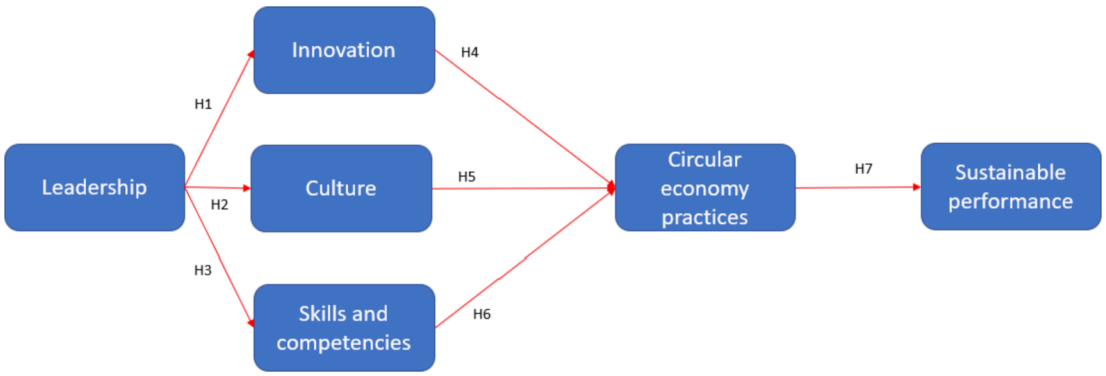

Fig. 1. Theoretical Model.

survey methodology to empirically test and validate the conceptual model, which is presented in Fig. 1. Survey-based primary research methodology has been employed in several studies reported in the contemporary literature investigating the adoption of CE practices, impact of the CE adoption on business productivity and firm performance and factors impacting the adoption of these practices from managers' and employees' perspective in the business organisations (Dey et al., 2020; Saha, Dey, & Papagiannaki, 2020; Dolgui & Ivanov, 2020).

3.1. Sample selection

According to our web search using the key words – (Vietnam AND Circular Economy) in SCOPUS, Web of Science and Google Scholar, research studies examining the CE adoption in Vietnam and its impact of sustainable business performance is extremely limited (five results and these do not report empirical investigation). According to practitioners' literature, government policy makers and Vietnamese Chamber of Commerce have acknowledged the importance of implementing CE practices within the SMEs (98% of all enterprises). In this context, government has introduced several initiatives and reforms such as carbon pricing tools to reduce greenhouse gas emissions, carbon tax for businesses and economic incentives for low carbon businesses (VNT, 2019; CEV, 2018). According to MIT technology review measuring the commitment towards green and low carbon economy of 76 global economies, Vietnam ranked 52nd in Climate policy (effectiveness), ranked 70th for very high carbon emissions, and 12th for adopting sustainable practices to preserve the environment (Green Index, 2021). These ranking shows that although there are policies and initiatives to build a sustainable and low carbon economy, their uptake by the business organisations is questionable and effectiveness is very poor, which warrants further empirical investigation, making the country a suitable candidate for our study. For this study, we included a wide range of sectors in Vietnam, whose business activities and practices contribute to environmental degradation and pollution, according to the UN climate change report.

For the purpose of this study, we have followed the definition of SMEs put forward by the Vietnamese National Assembly (Law 04/2017/QH14 – SME law), i.e., employing not more than 200 employees, total turnover does not exceed VND100 billion (for current and preceding year), and are registered with the state social insurance scheme (VNB, 2018). Inclusion criteria was included as a set of screening questions in the survey to ensure that that all participants: (1) worked in SMEs; (2) had at-least two-five years of experience working in the same organisation (to have a good understanding about the organisational leadership, culture and CE practices); (3) were employed in a full-time/permanent position and in the business operations team; (4) had knowledge and understanding about CE practices, sustainable business performance of the organisation; (5) the organisation was implemented CE practices. The purpose was to have respondents with first-hand knowledge and the capacity to make decisions that could deliver meaningful information for analysis.

3.2. Design of the survey

The data collection instrument took the form of a research survey, which was designed using different constructs derived from the hypothesis, and proxies to measure each construct was derived from the research literature discussed in the sections 2 and 3. Surveys are a useful and economical way to gather information and analyse it using statistical techniques to understand the relationships between different variables (Saunders, Lewis, & Thornhill, 2009). The questionnaire was developed through careful review of the literature to identify the constructs and scales necessary to propose hypothesis and test them. Specifically, information was gathered about organisational leadership, culture, innovation mindset, skills and competencies amongst the workforce in the context of adopting and implementing CE practices and sustainable performance of the SMEs. The proxies were measured using a 5-point Likert scale (1 = completely disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = completely agree). The survey was pre-tested with five academics, and an online workshop was conducted with 15 SMEs employees in the Vietnam, and revised by the research team to incorporate changes suggested by the respondents during the pilot. The aim of the pilot workshop with SMEs employees was to: (1) choose a selected set of proxies to measure CE practices, which are popular in the Vietnamese SMEs; (2) examine whether the statements representing each proxy is clear and can be easily interpreted correctly; (3) the inclusion criteria for the respondents and business sector was sensible and meaningful considering the SMEs classification and distribution in the country; (4) the statement representing performance measures will accurately reflect the economic, social and environmental performance (derived from the academic literature in operations and supply chain management, green supply chain management and CE) of the SMEs.

3.3. Data collection

This research has used purposive sampling involving employees with first-hand knowledge about CE practices in their organisation, similar to the methodology employed in existing studies examining CE adoption, and technology adoption. For data collection an online survey questionnaire was set-up digitally by the authors and administered by Qualtrics (www.qualrics.com), adhering to the inclusion criteria in Vietnam (Oct 2020- Dec 2020). The SMEs were targeted from the pool available through Qualtrics, the existing contacts of Hanoi University of Science and Technology (HUST) collaborating in CE projects, and SMEs' list available from Vietnam Chamber of Commerce and Industry to the academic partners in Vietnam (HUST and VNUK Institute for Research

and Executive Education, the University of Danang). The structured questionnaire used in this research can be seen in the Appendix A. Following recommendations from Wolf, Harrington, Clark, and Miller (2013) and Sideridis, Simos, Papanicolaou, and Fletcher (2014), for a model with strong factor links and medium complexity, the questionnaire was applied to 205 SMEs employees in Vietnam to gather their insights.

The total number of SMEs' organisations (one employee from each SME) targeted was 285 (each from distinct SME in Vietnam). We received 262 responses, and based on our first screening (reverse questions) 235 were deemed as useful (i.e., complete). A second screening was conducted, where we found 30 outliers (pertaining to subjective questions, knowledge about CE, and items measuring performance). Finally, 205 responses were used for validating the model (deemed usable). The data was captured anonymously in the platform and prepared for analysis using SEM. All the responses considered were complete to undertake the analysis without missing values. The demographics of the sample obtained are shown on Table 1. There is a spread across different sectors with most of the companies involved in manufacturing and construction. The majority of SMEs sampled have turnover over 3,200,000,000 (Vietnamese Dong). At the same time, most of the participants have roles involving overseeing other staff, which can be useful to provide insights about their internal operations and the links between different departments of the company.

3.4. Data analysis

Structural equation modelling (SEM) is a statistical modelling method broadly used in social sciences to analyse the relationships between constructs using quantitative information (Dadeliene, Dadelo, Pozniak, & Sakalauskas, 2020). It has the advantage that variables can be measured directly, latent (i.e. not directly measured) or a combination of both (Kalapouti, Petridis, Malesios, & Dey, 2020). SEM has been used to test the different hypothesis presented in the model proposed to identify significant relationships and discuss the findings. For the analysis, maximum likelihood has been used as the extraction method. SEM visualises the relationship between the latent variables (constructs) and the outcome variables (predicted using the latent variables) using intuitive graphs known as 'SEM path diagram', which helps to understand the strength and significance of the latent variables on the outcome variables. The assessment of the model proposed and its fit to the data will be tested using goodness-of-fit measures.

Table 1
Demographics of the sample.

Sector	
Agriculture Forestry and Fishing	10
Mining and Quarrying	5
Manufacturing	26
Electricity Gas Steam and Air Conditioning	9
Water Supply Sewerage Waste	6
Construction	37
Wholesale and Retail Trade Motor Repair	11
Transportation and Storage	14
Public Administration and Defence	6
Human Health and Social Work Activities	17
Other Manufacturing/Production/ Service Operations Activities	64
Turnover (Vietnamese Dong)	
Less than 300,000.000	17
Between 300,000.001 and 600,000.000	21
Between 600,000.001 and 1,200,000,000	22
Between 1,200,000,001 and 3,200,000,000	33
Between 3,200,000,001 and 6,200,000,000	34
Between 6,200,000,001 and 12,200,000,000	20
Between 12,200,000,001 and 30,000,000,000	36
Over 30,000,000,000	22
Frequency managing staff	
Always	88
Most of the time	70
About half the time	19
Sometimes	25
Never	3

4. Results

The sampling adequacy in the study for a statistical power (at least 0.8) to ensure that the empirical insights derived from the statistical analysis is valid was tested using the recommendations in Wolf et al. (2013) and Sideridis et al. (2014), using the package semTools in the R software. The null RMSEA was set to 0.00, alternative RMSEA to reject the null hypothesis was 0.08 for the degrees of freedom of the model (21) and a confidence level of 95%. The results showed that the sample size required to achieve desired statistical power and significance in results is 160, which is smaller than the sample size used in our study (205 respondents), demonstrating adequate sample size is used in our study. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for the model was also calculated showing that the sample size is excellent to conduct SEM analysis (0.9). Bartlett's test rejects the null hypothesis, i.e., the correlation matrix formed by the constructs is an identity matrix, indicating that the constructs are suitable for SEM analysis to model the casual relationships between them. Maximum likelihood has been used as estimation method for structural equation modelling (SEM) in AMOS.

4.1. Reliability

The reliability of the constructs has been tested using Cronbach's alpha (Bollen, 1989). The results presented in Table 2 show very good values of Cronbach alpha (above 0.8) indicating a high level of reliability of the scales used.

4.2. Convergence and discriminant validity

The convergent validity for each dimension was tested using average variance extracted (AVE) calculations using the individual proxy loadings (obtained in the CFA), and the discriminant validity for each factor was obtained using scale composite reliability coefficients (SCR) which were calculated using the AVE values. Table 3 shows the matrix of correlations of the main constructs and the diagonal shows the square root of AVE

The AVE for each construct is greater than 0.5 and CR is greater than 0.7 (Table 4), which are acceptable and reasonable to show validity of the constructs, according to the literature. We also found that square root of the AVE is greater than all the inter-construct correlations, providing evidence of sufficient discriminant validity (Chen & Paulraj, 2004).

4.3. Goodness of fit

Typical thresholds for Goodness-of-fit (GoF) are used in this study. These include goodness-of-fit index coefficients (GFI), Tucker-Lewis Index (TLI), and comparative fit index (CFI) with good fit considered

Table 2
Cronbach's alpha valued of the constructs.

Construct	Cronbach's α	AVE	CR
Leadership (LEADER)	0.857	0.668	0.858
Innovation (INNOV)	0.884	0.720	0.885
Culture (CULTURE)	0.895	0.744	0.897
Skills and competencies (SKILL)	0.864	0.761	0.864
Circular economy practices (CEP)	0.919	0.742	0.920
Sustainable performance (SP)	0.928	0.766	0.929

Table 3
Inter-correlations among major constructs.

	SKILL	LEADER	CEP	SP	INNOV	CULTURE
SKILL	**0.873**					
LEADER	0.81	**0.817**				
CEP	0.535	0.688	**0.861**			
SP	0.612	0.726	0.855	**0.875**		
INNOV	0.848	0.815	0.671	0.781	**0.848**	
CULTURE	0.742	0.759	0.76	0.85	0.807	**0.863**

Table 4
Goodness-of-fit values.

Indicator	Value
CFI	0.967
GFI	0.881
TLI	0.961
RMSEA	0.061
Normed X^2	1.761

for values above 0.9 (Malesios, Dey, & Abdelaziz, 2020, Doll, Xia, & Torkzadeh, 1994), and root mean square error of approximation (RMSEA) values considered acceptable below 0.08 (Hair, Black, Babin, Anderson, & Tatham, 1998). Additionally, reliability of the scales used in the model has been tested using Cronbach's alpha with a threshold of 0.6 as suggested by (Hair, Ringle, & Sarstedt, 2013). The model tested in this research delivered the goodness-of-fit values shown on Table 4.

The values of CFI, TLI, RMSEA and Normed X^2 show very good fit, whereas values of GFI $\geq$ 0.8 are accepted as evidence of reasonable fit (Doll et al., 1994). Overall, the revision of GoF metrics allow us to conclude that the model seems to fit the data well. Hence, it was used to test the hypothesis presented in this research.

4.4. Structural equation model

Given the different types of SMEs included in the study, consideration was given to the use of Industry as a control variable. After running the analysis, this variable did not show any significant relationships with the constructs and the changes in the standardised regression weights were 0.002 or less. Hence, for parsimony the model presented below does not include the control variable. All the items loading to the constructs had coefficients above 0.7, which is considered acceptable in the field (Queiroz & Wamba, 2019). The standardised estimates from the path analysis are presented on Fig. 2. The continuous lines with coefficients show significant relationships, whereas the dashed lines represent non-significant relationships.

The results allow us to provide insights about the different hypothesis tested in this research. The importance of leadership is reflected in the results, showing a significant positive impact on innovation (path coefficient = 0.907, p-value $\leq$ 0.001), culture (path coefficient = 0.839, p-value $\leq$ 0.001) and skills and competencies (path coefficient = 0.875, p-value $\leq$ 0.001), which support hypothesis H1-H3. Innovation has a significant positive effect on circular economy practices (path coefficient = 0.410, p-value $\leq$ 0.01) supporting H4, whereas Culture also affects circular economy practices (path coefficient = 0.687, p-value $\leq$ 0.001) and skills and competencies does not have significant impact on circular economy practices at $p < 0.001$, supporting H5 and rejecting H6, respectively. Circular economy practices have a significant positive effect on sustainable (path coefficient = 0.893, p-value $\leq$ 0.001) performance, supporting H7. The summary of the hypothesis tested in this research and the outcome of the analysis is shown on Table 5.

Table 5
Summary of the hypothesis.

ID	Hypothesis	Significance	Conclusion
H1	Leadership has a significant effect on Innovation	0.907***	Supported
H2	Leadership has a significant effect on Culture	0.839***	Supported
H3	Leadership has a significant effect on skills and competencies	0.875***	Supported
H4	Innovation has a significant effect on Circular economy practices	0.410**	Supported
H5	Culture has a significant effect on Circular economy practices	0.687***	Supported
H6	Skills and competencies have a significant effect on Circular economy practices	Not significant	Not supported
H7	Circular economy practices have a significant effect on sustainable performance	0.893***	Supported

5. Discussion

The findings of the empirical investigation outlined in the preceding section answer the research questions by showing the relationship between internal organisational factors – leadership, innovation, culture, skills and competencies on CE practices and sustainable business performance.

RQ1 (*organisational factors)* - The results show the positive and significant effect of leadership traits and strategy practiced in SMEs' on innovation, culture, and skills and competencies. Existing research both theoretical and empirical have shown that organisational leadership can significantly influences organisations' capability to engage with innovative practices (Shahbazi, Wiktorsson, Kurdve, Jönsson, & Bjelkemyr, 2016; Liu & Bai, 2014). This will be dependent on the knowledge, skills and understanding of the managers with regards to the innovation (Su, Heshmati, Geng, & Yu, 2013), impact of the innovation on the business productivity and employee performance, and its alignment with the business priorities and goals of the organisation (Jawahir & Bradley, 2016). Innovative mindset within the organisation resulting from the leadership practices within the SMEs will significantly and positively influence CE practices. This can be attributed to the fact that the aims of

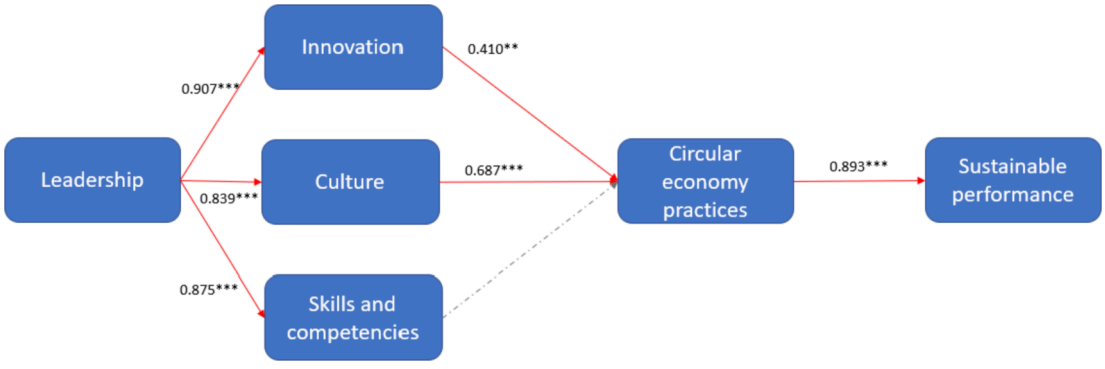

Fig. 2. SEM Model. ***: $p < 0.001$.

CE practices are to optimise the business processes through lean management and achieve resource efficiency through sustainable oriented innovation (Dey et al., 2020). Organisational culture is also influenced by leadership, which will depend on how the employees are involved in the strategic decision-making process, and communication as well as collaboration between the managers and employees to outline the impact of strategic initiatives on business performance and employee productivity (Bakker, Oerlemans, & Ten Brummelhuis, 2016). According to the organisational socialisation framework, leadership, and communication efforts from senior management (or managers) help to develop a collaborative organisational culture and a conducive job environment (Klein & Polin, 2012), which leads to better understanding and adoption of strategic initiatives by the employees. This enhances employees' job satisfaction because of better clarity pertaining to their job roles and minimal apprehension with regards to business model reconfiguration (Bauer, Bodner, Erdogan, Truxillo, & Tucker, 2007). According to Roger's diffusion theory and Hall's Concerns-based adoption model, leadership within the organisations is key to provide knowledge, clarity and relevance on the strategic initiatives, by addressing concerns of the adopters (employees in the organisation who will be affected as a result of the innovation and strategic roadmap) (Straub, 2009). CE practices within SMEs will result in strategic changes aligned to the business priorities of the organisation, incorporate both lean management and sustainable innovation, and these changes and innovative practices are put forward by the senior management (Kirchherr et al., 2018). These theoretical perspectives help to explain our findings with regards to the influence of leadership on innovation, culture and skills and competencies.

RQ2 (*CE adoption*)- According to our findings, skills and competencies among the workforce won't have any impact on the CE practices. The existing research has outlined and reported the importance of skills and competencies within the organisations to adopt CE, however there is no conclusive empirical evidence in this regard (Lieder & Rashid, 2016; Ilić & Nikolić, 2016). SMEs are, by their nature, highly specialised. Especially in the manufacturing sector, employees have specific technical skills which are harnessed from years of training, and on-the-job learning as new processes and technology are deployed within the business ecosystem (Edwards, Delbridge, & Munday, 2005). Moreover, specialised skills gained in one sector (or area of work activity) are often non-transferrable to others, therefore tacit experience (implicit knowledge according to the knowledge-based view theory) possessed by the SMEs employees are highly valuable, provide competitive advantage, imperfectly imitable and cannot be easily replaced (Grant, 1996). Therefore, the skills and expertise of the SMEs employees helps SMEs to achieve sustainable competitive advantage, adapt quickly to emerging and uncertain market conditions through business process reconfiguration and re-engineering. However, CE is a philosophy (i.e. a set of practices) that will help organisations to practice lean management and sustainable-oriented innovation to achieve sustainable performance. The strategy to adopt, practice and manage CE model in the SMEs or any business organisation is laid out by the senior management and managers, which means that the employees will need to follow the strategic goals. Therefore, we believe that skills and competencies acquired through tacit experience and explicit knowledge exchange within the organisations will influence the understanding of CE strategic goals and business model, which will impact the CE practices within the SMEs, and this warrants further investigation. This result does not fully support the existing research studies which have reported limited skills and competencies as potential barriers to effective CE implementation. Therefore, a separate investigation is required to model the relationship between knowledge and skills based antecedents, CE practices, and sustainable business performance. In this context, the influence of knowledge management strategies such as codification and personalisation, processes, platforms, and partnerships (derived from information management and knowledge-based view theories) on the effective implementation of CE practices, can help to understand suitable practices and interventions for developing human resource expertise and competencies within SMEs.

RQ2 (*impact on sustainable business performance*)- CE practices strongly and positively impact sustainable performance of SMEs. Thus, the results of the analysis for the current dataset is fully aligned with the suggestions in previous theoretical and empirical studies on the argument that CE practices (reduce, reuse and recycle) will enhance sustainable performance of business organisations (Geissdoerfer et al., 2017). The strength coefficients (beta values) representing the relationships between CE practices and the performance construct is very high, which can be attributed to the measurement scale, which has used specific items (appropriate for Vietnamese SMEs) to examine sustainable performance. The results clearly showed that through a combination of lean management practices, sustainable process innovation, and resource optimization, i.e., reducing consumption, sustainable performance of the SMEs engaging is CE practices will be enhanced. This is in line with existing CE literature which suggests that lean management leads to high economic productivity, as a result of reduction in operational costs, however to achieve higher sustainable performance, organisations need to adopt environmentally friendly practices, which will not only reduce the negative impact on the climate, but such practices will lead to creation of new jobs, which is beneficial for both economic growth and society. According to van Loon and Van Wassenhove (2018), recycling and waste management will create low skilled jobs in the areas of waste handling, collection and processing, where-as reuse practices will created more jobs requiring higher skills when compared to recycling (MacArthur, 2012). According to a report compiled by European Union press, decrease in resource consumption will lead to 1.4 million −2 million new job opportunities (Ilić & Nikolić, 2016). Therefore, CE will lead to sustainable performance in SMEs organisations' supply chain as it will foster environmental and social well-being in addition to economic productivity.

6. Theoretical implications

The attempt to understand the role of internal organisational factors to adopt circular economy practices within business organisations in developing economies, which will enhance sustainable business performance, is less discussed and empirically examined in the current management literature (Patwa et al., 2021; Kalmykova et al., 2018). While many studies in the research literature and practitioner-based publications have reported the potential of CE to create business value, through process efficiency and achieving sustainable goals in the organisations (Geissdoerfer et al., 2017), very few of them adopt a theoretical lens to provide empirical evidence examining and explaining the relationship between organisational factors in the context of CE (Agyemang et al., 2019).

From a theoretical perspective, firstly our study has developed a robust theoretical model deriving constructs from a wide range of literature such as human resource management, strategic management, innovation management, and operations management. It examines the relationship between organisational factors such as leadership, innovation, culture, human resource skills and competencies, CE practices, and how these impact on the Vietnamese SMEs' sustainable performance. Our findings from the empirical study have demonstrated that CE practices such as eco-design, reuse, recycle and reduce are significantly influenced by organisational culture, skillset, and innovation, i.e., strategy and initiatives from the senior management and the impact of these strategies on job design. These findings complement the literature concerning DCT, and demonstrate how internal organisational factors and resources make firms dynamically capable to implement new business models and pursue innovation, contributing to sustainable development.

Secondly, this study extends CE research in response to the grand challenge (climate change) contributing to the business and management literature by opening a new stream focussing on the role of internal

organisational resources and capabilities to reconfigure and repurpose business operations to achieve sustainable performance. The results obtained through validation of the proposed model bring new empirical insights which are important because adoption of CE and its successful implementation will be significantly influenced by the internal capabilities within the organisation. This echoes the arguments and discussions reported in the existing literature showing that business process reconfiguration is driven by strategic leadership, competencies, innovation and supportive culture within the organisations. In this context, CE and sustainability have emerged as the top priorities for SMEs in both emerging and developed economies. This stems from government initiatives and policies to reduce the negative impact of SMEs' business practices and activities on the environment and reduction in raw materials consumption. According to reports of the Ellen MacArthur Foundation, implementing CLSC innovation in circular business models can reduce the consumption of raw materials, 32% by 2020, and 53% by 2050, when compared to the current use (MacArthur, 2017a, 2017b, 2013 and 2012. The adoption of low carbon practices within SMEs is also motivated by the promise of job growth and community engagement, which are keys to building sustainable societies and economic resilience within the geographical regions, post pandemic.

Finally, our theoretical model thus consolidates three very different concepts— internal organisational capabilities (stemming from leadership, skilled workforce, organisational culture and innovation mindset), CE practices (reduce, reuse and recycle across the upstream and downstream, reduce waste, energy and raw material consumption) and sustainable business performance (business economic productivity, socially responsible practices, and environmentally friendly operations), and findings outline how they collectively can enhance economic performance of businesses through environmentally friendly practices and socially responsible strategies.

7. Managerial implications

By providing empirical insights on the relationship between organisational factors influencing CE practices in the SMEs, and its significant impact on sustainable business performance, this research will help government policy makers, SMEs' managers, and senior leadership to develop an organisational wide strategy for managing and adopting CE philosophy. The existing literature on CE has reported the importance of organisational leadership, commitment from senior management to shape organisational culture and innovation mindset for adopting CE practices, however there is lack of understanding and strategies on how this can be achieved by SMEs (Govindan & Hasanagic, 2018).

Our research findings have several implications which are discussed below.

- Firstly, government policy makers should develop a framework and onboarding plan that will help managers and decision-makers in organisations to develop better understanding about the CE concepts, practices and strategies, which will facilitate in cultivating skills and competencies to manage the adoption and change within the organisation. The existing research has reported that poor leadership and lack of commitment from senior management is a potential barrier to effective CE implementation, and our research has demonstrated that leadership will significantly impact antecedents to effectively adopt CE practices in the SMEs. Therefore, the framework and onboarding plan should include training materials, access to information and coaching (perhaps partnering with higher education institutions). In this context, a hub and spoke framework can support the adoption of CE practices, where 'hub' will determine strategies (business process assessment, business process reengineering, employee training and support, technology selection and interventions), which are aligned to the business priorities and sustainability development goals. While 'spokes' will be responsible for realising these strategies, i.e., employees will be embracing the strategic changes by actively participate in the decision-making processes and implement the CE practices to help SMEs achieve sustainable business performance. Building this culture will require a shift to an organization that enables interdepartmental coordination, interdisciplinary collaboration, data-driven decision making, risk proclivity, and an agile, experimental, and adaptable mentality, through transformative leadership.
- Secondly, managers must create mechanisms that will facilitate knowledge sharing, co-creation and exchange among the employees about CE practices, its purpose, benefits, and contexts of implementation within the business processes and activities. This mechanism should also involve appropriate interventions to store information, which can be accessed by employees conveniently and readily. This will require creating a knowledge and digital platform management strategy that will consider and invest in the technical resources (such as information systems and platforms) necessary to store and disseminate information among employees. The strategy should also help to create new knowledge through the process of restructuring, merging and synthesising, and evolve this knowledge in an incremental and iterative manner (learnings from contemporary practices and successful business cases among other SMEs). These initiatives will help to develop a collaborative and sharing culture, where employees can learn from each other, and therefore dynamically adapt to business process innovation (aligned to strategic priorities) within the SMEs. According to organisational socialisation framework, knowledge sharing and a two-way communication between managers and employees will also help to develop a collaborative and cooperative culture within the organisations. Such a culture will facilitate business model innovation through process re-engineering and optimisation, which according to our findings will effectively influence CE adoption. Furthermore, these initiatives will enhance employee performance due to job satisfaction, positive psychological outcomes and emotional states among the employees.
- Thirdly, SMEs in same geographical locations should form a CE working team, where each SME is represented by one or more employees. The working team will help to foster collaboration between the SMEs (i.e., learn from each other, share knowledge and business cases), which will drive CE adoption and according to academic reviews on CE, this is currently a barrier. Such peer learning can facilitate faster adoption of sustainable practices within the geographical region and provide a forum for early adopters to consult with experienced members (MacArthur, 2015). The working team will also help to strengthen partnership with higher education institutions, and benefit from academic consultation and research underpinning evidence-based strategies to optimise business processes, enhance employee performance, decrease waste and carbon emissions, and increase their social sustainability through job creation, supporting and encouraging entrepreneurial activities, and thus help build a sustainable society.
- Finally, our results have showed that CE practices will positively influence SMEs' sustainable performance. However, lack of information systems often makes it difficult for SMEs organisations to keep track and reflect on the impact of CE practices on sustainable business performance (Kalmykova et al., 2018). Therefore, government policy makers, SMEs managers and higher education institutions in Vietnam should come together and work towards developing a digital decision support system that will facilitate adoption, implementation, evolution and strategizing the Circular Economy (CE) practices within the industry. Such a decision support system (DSS) can include many functionalities, further outlined below:
- Assess the current state of CE practices in the organisation and map the organisation in the CE maturity model;
- Compare the organisational practices with other organisations [through a method of clustering];

- Visualise the strategic interventions and recommendations for the organisation;
- Visualise the pre-implementation and post-implementation (i.e. recommendations) impact on business sustainability, competitiveness, alignment between business goals, priorities and key performance indicators.

The DSS will: facilitate developing case-studies for HE institutions and students to reflect on the current CE practices, maturity within the industry that will facilitate developing and co-creating new knowledge for both industry and policy makers; inform government policy makers to the needs of the SMEs, and help to develop policies and inquiries that will enhance CE practices, by providing a knowledgebase; help SMEs managers and employees to understand and compare the impact of CE practices pre and post implementation, which will facilitate in business process reengineering, modifying job configuration and enhance their reputation among the stakeholders, trading partners and competitive business environment.

8. Conclusion and future work

This study was motivated by the surge of interest to adopt CE practices in SMEs that will help to achieve sustainable development goals, in particular responsible consumption of materials and reducing the impact of SMEs' business practices on environment and society (MacArthur, 2013 and 2015), in line with the Vietnamese government initiatives to reduce carbon emissions (low carbon initiatives) and job creation. Although, the existing literature has reported and, in many cases, empirically demonstrated the impact of CE practices on sustainable business performance, examining the relationships between lean management practices, sustainable oriented innovation, market pressure, digital readiness, government initiatives and information dissemination (related to CE business model and cases), studies focussing on SMEs' business activities (contributing negatively to the environment not individually), maturity of adoption in the emerging economies, and internal organisational factors impacting CE adoption, has been less researched (Panwar & Niesten, 2020; Moktadir et al., 2020). Despite the interest of both practitioners and academics, and government initiatives across the globe, there is still lack of empirical evidence on impact of internal organisational factors in SMEs on CE adoption and achieving sustainable business performance, which will help government policy makers and SMEs' decision-makers to develop appropriate evidence-based initiatives and strategies which will help to overcome organisational barriers (Mura, Longo, & Zanni, 2020; Dey et al., 2020).

Building upon the existing research reported on CE, lean management practices, sustainability, green supply chain management, strategic management, and organisational management literature, we have proposed a theoretical model. The model was validated by designing a survey instrument and conducting primary research with SMEs' employees in Vietnam, demonstrating that organisations can develop their capability to effectively adopt CE practices within the industry through innovation, and a collaborative and enthusiastic culture to adopt change, which are influenced by the leadership and commitment from senior management, and will help them realise gains in terms of business productivity, and sustainability. Our work therefore provides an initial step for researchers to understand how internal organisational factors can be combined to understand and examine antecedents influencing CE adoption in practice, which will result in organisationally valued outcomes.

We believe that including new constructs and corresponding proxies to measure these constructs (Golicic & Davis, 2012) to predict the direct and mediating effects influencing understanding and explicit knowledge of employees and their impact on firm performance, organisational resilience and dynamic capability and absorptive capacity can further enrich our model and provide novel empirical insights for the managers and employees alike. Such variables can include constructs drawn from the technology acceptance model to assess digital readiness– performance expectancy, effort expectancy, technology affinity, social influence, institution theory – market pressure, external influencers, regulations and government guidelines, human resource management theories –job satisfaction, and knowledge-based view – knowledge sharing, creation, dissemination, tacit experience, and training programmes, all of this in the context of impact of CE adoption on sustainable business performance. This will further expand our model, which will open new avenues of research pertaining to job design, organisational structure, task mastery, digital information systems, skills framework for managers and employees, and therefore making a significant contribution to the CE literature.

The type of leadership practiced in an organisation, can have substantial impact on business activities, employees' mindset, adoption of new practices, innovation, culture and change management (Alblooshi, Shamsuzzaman, & Haridy, 2020). The significance of leadership and its impact on organisational practices is well articulated and clear, especially in both academic and practitioner literature. Another limitation of this study is that the impact of leadership types on CE adoption, and organisational factors influencing this adoption is not explored. Future studies can address this gap, by adapting our model by including constructs drawn from leadership, strategic innovation, decision-making and employee motivation literature to provide empirical evidence that will aid in understanding their impact on CE management strategy, sustainable business performance, organisational culture, employees' job satisfaction, employees' psychological outcomes and emotional states and innovation mindset. Such empirical insights will equip managers with information to develop strategies that will help to effectively create a collaborative and conducive working environment for adopting and managing circularity in the business models. Similarly, drivers and barriers to adopt hub and spoke framework in the context of adopting and implementing CE practices within SMEs, can be potentially examined in future empirical investigations through a mixed method approach. In this context, statistical models can help understand and examine the relationships between the constructs (impact of drivers and barriers on sustainable business performance), whereas case-studies can help validate the effectiveness of the proposed framework through real-life pilot projects in the SMEs working environment.

Although we took precautions by employing suitable methods during the data sampling, collection and analysis to minimize the impacts of common method bias and endogeneity (which are limitations of survey-based primary research), we argue that future research can design longitudinal studies drawing samples from more industries, countries, and informants with more diverse backgrounds to address the CMB and endogeneity effects (Jordan & Troth, 2020). Once a model is validated using quantitative data, we suggest case-based research can be used to further test and validate the theoretical outcomes, thus examining CE adoption, and implementation through ethnographic studies, to provide more comprehensive insights.

Our model was tested in a developing economy, and we purposely chose to study the SMEs organisation in manufacturing sectors. Although, purposive sampling and inclusion criteria employed in our study have increased the internal validity of our investigation, this strategy may often limit external ecological validity, i.e., in other geographical locations, and industrial sectors and generalizability (Mweshi & Sakyi, 2020). The issue with generalizability can be addressed by conducting more empirical investigations (surveys, case-studies, and pilot implementation) across the globe in other business sectors, which will aid in comparing the results (further contributing to the research in this area). While comparing these results in different contexts and sample, the recommendations and implications should be applied with caution to ensure applicability and reproducibility. Our study provides a pathway to further develop the research on the interplay between internal organisational factors and CE adoption, which will help SMEs to improve their sustainable performance, adaptive capability, and adsorptive capacity through evidence-based strategies

conducive to the needs (priorities and sustainable goals) of both the organisations and their workforce.

CRediT authorship contribution statement

Soumyadeb Chowdhury: Conceptualization, Data curation, Formal analysis, Writing – original draft, Funding acquisition, Validation, Investigation. **Prasanta Kumar Dey:** Conceptualization, Writing – original draft, Funding acquisition, Validation, Investigation, Supervision. **Oscar Rodríguez-Espíndola:** Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation. **Geoff Parkes:** Writing – review & editing, Project administration, Investigation, Conceptualization. **Nguyen Thi Anh Tuyet:** Funding acquisition, Investigation, Validation, Writing – review & editing. **Dang Duc Long:** Writing – review & editing, Resources, Project administration. **Tran Phuong Ha:** Formal analysis, Project administration, Writing – review & editing.

Declaration of Competing Interest

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

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Appendix A. Survey instrument

Construct	Proxies measuring the construct	
Leadership	• Manager takes risks even when he/she is not certain of the support from senior management • My manager holds me and my colleagues responsible for the way we handle a job • Organisation employs change management through formal and informal communication • Organisation employs creative thinking for faster decision-making in strategic, tactical and operation level	Gelhard & Von Delft, 2016; Geng & Doberstein, 2008; Govindan & Hasanagic, 2018; Lara & Salas-Vallina, 2017; García-Quevedo et al., 2020; Jerónimo et al., 2020
Innovation	• Senior management support the introduction of innovative practices/products/services • Our organisation is often consulted by other organizations for advice and information. • Senior management in my organisation involve employees in the decision-making process. • My organisation is willing and ready to accept outside help when necessary.	Gelhard & Von Delft, 2016; Geng & Doberstein, 2008; Gusmerotti et al., 2019; Kirchherr et al., 2018; Lara & Salas-Vallina, 2017; Nguyen et al., 2020
Culture	• In my organisation significant time is spent planning and thinking things through • Communication from management is clear, transparent and frequent • In my organisation we apply vertical extension of responsibilities (job enrichment), that is, obtain more decision-making authority over activities to be performed. • In my organisation we apply horizontal extension of responsibilities (job enlargement), that is, we are able to perform a broader repertoire of activities (job rotation, increase interchangeability of positions).	García-Quevedo et al., 2020; Gelhard & Von Delft, 2016; Jerónimo et al., 2020; Kirchherr et al., 2018; Lara & Salas-Vallina, 2017; Lukoschek et al., 2018
Skills and competencies	• My organisation provides Circular Economy related training to our employees. • My organisation recruits new employees who have good exposure to Circular Economy practices • Managers in my organisation have strong understanding of the circular economy philosophy. • Managers in my organisation are able to coordinate effectively with all intra departments, suppliers and customers in the context of implementing and adopting circular economy practices.	Govindan & Hasanagic, 2018; Kirchherr et al., 2018; Lara & Salas-Vallina, 2017; Nguyen et al., 2020
Circular Economy practices	• We work with clients/suppliers for ecological design of products/services • During the design stage we consider the possibility to reuse products after they have served their initial purpose • We are using recycled materials as inputs in our processes • We have policy and practices in place to dispose machineries and equipment on time	Dey et al., 2022; Dey et al., 2020; Dey et al., 2019b; Saha et al., 2020
Sustainable performance	• We have reduced our manufacturing costs in recent years • We have increased average return on net assets from green products • We have reduced Inventory carrying cost. • We have reduced Cost of transportation and handling. • We have reduced business waste across our processes • We have improved compliance with environmental standards • We have decreased carbon emissions • We increased revenue from green products and practices • We have improved work safety in recent years • We have improved work environment in recent years • We have commitment from employees and managers towards incorporating environmental management • We have created jobs to support the community and thus contributed to nation's entrepreneurial growth.	Dey et al., 2020; Saha et al., 2020; Epstein & Roy, 2003; Dey et al., 2022; Dey, Malesios, De, Chowdhury, & Abdelaziz, 2019a

Appendix Table R.1 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	11.434	60.177	60.177	11.434	60.177	60.177	8.203
2	1.658	8.727	68.904	1.658	8.727	68.904	9.046
3	0.839	4.416	73.320	0.839	4.416	73.320	7.668
4	0.674	3.546	76.866	0.674	3.546	76.866	7.830
5	0.601	3.164	80.031	0.601	3.164	80.031	8.492
6	0.488	2.569	82.600	0.488	2.569	82.600	6.601
7	0.406	2.136	84.736				
8	0.377	1.987	86.722				
9	0.317	1.669	88.391				
10	0.307	1.617	90.008				
11	0.281	1.480	91.488				
12	0.259	1.361	92.849				
13	0.235	1.234	94.083				
14	0.233	1.225	95.308				
15	0.205	1.079	96.387				
16	0.195	1.025	97.412				
17	0.186	0.980	98.392				
18	0.173	0.910	99.302				
19	0.133	0.698	100.000				

Extraction Method: Principal Component Analysis.

Appendix Table R.2 Comparison of Regression Coefficients

Our results demonstrated that the industry did not affect the results. Initially, as it can be seen in Table below, we compared the model presented in the paper with a model using the industry as a controlling variable. We found that the industry (Sector) does not have a significant effect in any of our endogenous variables, which means the industry does not confound the relationships in our model.

Relationship			Significance model with control (p-value)	Significance model without control (p-value)
INNOV	<—	LEADER	***	***
CULTURE	<—	LEADER	***	***
SKILL	<—	LEADER	***	***
INNOV	<—	Sector	0.072	N/A
CULTURE	<—	Sector	0.162	N/A
SKILL	<—	Sector	0.261	N/A
CEP	<—	INNOV	***	***
CEP	<—	CULTURE	***	***
CEP	<—	SKILL	0.014	0.014
CEP	<—	Sector	0.704	N/A
SP	<—	CEP	***	***
SP	<—	Sector	0.278	N/A

*** $p < 0.001$.

Appendix Table R.3. Comparison of standardised estimates

We also compared the standardised coefficients of the relationships between constructs to find relevant differences about changes that could be generated by the control variable. The comparison can be seen in the Table R.3 below. The difference in the standardised coefficients between both models is extremely small, as expected because of the lack of significant relationships between Sector and the constructs of the study.

			Estimate with control variable	Estimate without control variable
INNOV	<—	LEADER	0.909	0.907
CULTURE	<—	LEADER	0.840	0.839
SKILL	<—	LEADER	0.876	0.875
INNOV	<—	Sector	0.087	N/A
CULTURE	<—	Sector	0.073	N/A
SKILL	<—	Sector	0.058	N/A
CEP	<—	INNOV	0.412	0.410
CEP	<—	CULTURE	0.686	0.687
CEP	<—	SKILL	−0.263	−0.263
CEP	<—	Sector	0.018	N/A
SP	<—	CEP	0.891	0.893
SP	<—	Sector	0.045	N/A

Appendix Table R.4 Pattern Matrix

Initially, the correlation matrix between reliability analysis for each one of the items was undertaken using SPSS to exclude very high correlations. Then, reliability analysis in SPSS was used for each one of the scales to explore the effect of erasing items on the overall value of the scales. Next, exploratory factor analysis was undertaken after deleting redundant variables as shown in table below below. Values above the cut-off point of 0.6 were accepted for further analysis.

Appendix 1. Pattern Matrix[a]

	Component					
	1	2	3	4	5	6
CEP3	0.916					
CEP2	0.890					
CEP1	0.856					
CEP4	0.657					
SP2		0.871				
SP3		0.821				
SP1		0.821				
SP4		0.641				
Lead3			0.857			
Lead1			0.846			
Lead2			0.773			
Innova3				0.841		
Innova2				0.782		
Innova1				0.636		
Culture2					0.871	
Culture1					0.823	
Culture3					0.770	
Skill1						0.873
Skill2						0.788

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Appendix Table R.5 Standardized Regression Weights

The different items delivered adequate loading values, which was posteriorly confirmed through confirmatory factor analysis (CFA) which was also used to remove items with low loadings. The results of the final loadings are shown in Table R.5 below, which were accepted for the analysis:

			Estimate				Estimate
Lead1	<—	LEADER	0.848	CEP1	<—	CEP	0.891
Lead2	<—	LEADER	0.813	CEP3	<—	CEP	0.854
Skill1	<—	SKILL	0.880	CEP4	<—	CEP	0.841
Skill2	<—	SKILL	0.865	SP2	<—	SP	0.880
Innov3	<—	INNOV	0.833	SP4	<—	SP	0.865
Innov2	<—	INNOV	0.828	SP1	<—	SP	0.893
Innov1	<—	INNOV	0.883	SP3	<—	SP	0.862
Culture3	<—	CULTURE	0.842	CEP2	<—	CEP	0.858
Culture2	<—	CULTURE	0.857	Lead3	<—	LEADER	0.790
Culture1	<—	CULTURE	0.888				

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Implementing and Monitoring Circular Business Models: An Analysis of Italian SMEs

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Abstract: The transition from a linear to a circular economy (CE) is at the center of the debate among institutions, enterprises, practitioners, and scholars. Small- and medium-sized enterprises (SMEs), with their high presence in the business environment, play a pivotal role in the successful implementation of CE principles. Therefore, this paper aims to understand the state of the CE among Italian SMEs, considering both their different sizes and sectors. This study investigates CE knowledge and application, strategic relevance, benefits from and barriers to the transition towards circular business models, and the use of CE-related performance indicators in management control and external reporting. Through an online survey carried out in cooperation with the Italian Confederation of Craft Trades and Small- and Medium-Sized Enterprises (CNA), we collected primary data from 623 respondents. Findings revealed the existence of cultural, technological, market and financial barriers, which have hampered the adoption of circular practices among Italian SMEs. Poor understanding of CE potential, combined with difficulty in raising public and private funds to finance the transition from linear to circular, are the greatest problems. To overcome such issues, we recommend serious intervention by public institutions, trade and consumer associations, and the higher education system to develop a climate more favorable to the CE.

Keywords: circular economy; sustainability; SMEs; survey; awareness; benefits; barriers; circular economy-related KPIs; reporting on circular economy

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1. Introduction

The circular economy (CE) is increasingly gaining traction among scholars, supranational political institutions, and practitioners, with obvious implications on corporate business models. In fact, on the one hand, the CE meets the need for companies to reduce their environmental impact [1–9]; on the other hand, it helps achieve sustainability of the planet, as encouraged by the Sustainable Development Goals (SDGs) included in the 2030 Agenda.

Since the industrial revolution, companies have favored the linear economic model, based on "take, make, and dispose", a pattern of consumption in which products are made using raw materials, purchased, used and, at the end of their life cycle, landfilled [10]. The consumption of resources and waste disposal connected to the actual demand for goods have made this traditional model unsustainable for the planet, creating an imbalance between resource supply and demand for goods [11].

Over the years, the international debate on protecting the planet and corporate sustainability [12,13], has emphasized the importance of closing material loops [14], pointing out the need to shift from a "take and discard" logic, typical of a linear economy [15], to a "reuse, recycle, and recover" logic, typical of the CE [16–21].

Corporate social responsibility and sustainability, accompanied by the increase in price volatility, the need to reduce the environmental impact of production, consumption, and disposal, lead to a rethinking of the business model in favor of a CE [22].

A CE reduces resource inputs and waste, emissions and energy losses, through design, maintenance, repair, reuse, regeneration, refurbishment, and recycling.

Socially responsible companies face new business models that focus on effective stakeholder relations and require an unprecedented alignment of technological and social factors. This epochal change reflects the improvement of the environmental impact of companies' activities and products, with responsible design that is based on renewable energy and the reduction in waste and toxic chemicals.

The need for a profound overhaul of production systems to guarantee a sustainable impact on growth is clear to everyone. Water-related and foodborne diseases, wildfires, salination, raised sea levels as well as extreme weather events such as drought, severe rainfall, storms and hurricanes [23] are just some of the effects of climate change produced by a model of development that has been pursued for years and has become unsustainable [24–26].

Climate change causes damage to multiple sources; whilst the direct consequences are clear, the indirect effects, which will become apparent in the coming years, could be even worse. Soil acidification and desertification, acid rain and the scarcity of clean water are rapidly spreading phenomena even in areas of the globe historically accustomed to enjoying only the benefits of traditional industrialization. The social consequences of the proliferation of such events will likely affect the full enjoyment of human rights, including the right to life, health, food, housing, an adequate standard of living, land and employment [27–31].

Currently, the only option to reverse this course is a rapid and effective transition to a more planet-friendly overall system, ranging from sustainable production systems to producing less waste, through a radical overhaul of individual habits. This necessarily requires a huge contribution by the business world, including all actors, in terms of size and geographical location, with a united effort by all countries, starting with those which, in the past, have made greater use of common resources [32].

To ensure the long-term growth of the industrial and productive system and the development of financial markets [33], through the creation of value for all shareholders and stakeholders [34], we need a transition to viable production systems, such as those of the CE.

Ferrero, Barilla and Lavazza constitute successful examples of large Italian groups engaged in the CE transition. Barilla recovers the bran resulting from the processing of cereals, to make it a raw material to produce paper for packaging. Lavazza cultivates mushrooms from coffee grounds and transforms coffee capsules, produced in biodegradable plastic, into compost. Ferrero uses hazelnut shells, deriving from its production processes, as a fuel to produce energy.

However, to be effective and to generate significant impacts on the planet, the shift from linear to circular business models must be comprehensive and not limited to just the biggest and most responsible companies.

Setting up a circular business involves the development of specific skills and sensitivities, together with a clear orientation towards social responsibility and sustainability. To function optimally, it also requires a specific configuration of existing and new capabilities. Corporate planning and strategy must be reviewed and action taken towards product/service innovation and development, as well as sourcing and manufacturing, sales and marketing. To fulfill their mission, companies need to reset their existing business models, reconsidering their development in relation to the conditions of circularity.

In the years to come, the growth of the world population will turn into increased demand for goods, which will result in a shortage of commodities. The CE, basing on reuse and recycle principles, could be an excellent answer to the scarcity of raw materials.

To date, many studies [35,36] and concrete initiatives, such as those presented in Table 1, have tried to encourage the adoption of CE principles in big corporations, while just a few have promoted those principles among small- and medium-sized enterprises.

Table 1. Significant initiatives of the CE.

Initiative	Description
The Circular Economy 100 [37]	A program established to enable organizations to develop new opportunities and fulfill their circular economy ambitions faster. It brings together companies, governments and cities, academic institutions, emerging innovators, and affiliates in a unique multi-stakeholder platform.
Kyoto Club [38]	An organization devoted to the promotion of energy efficiency, renewable energy sources, waste reduction and reuse of resources, sustainable mobility, and climate change.
Circular Economy Club [39]	An international network of the circular economy field, including professionals and organizations with over 280 CEC local clubs in 140 countries.
European Circular Economy Stakeholder Platform [40]	A joint initiative by the European Commission and the European Economic and Social Committee to promote the exchange of ideas and information on the CE.
DigiCirc [41]	A program to bring companies, public bodies, and researchers to work together to make our economy more sustainable.

Therefore, this study will venture into a territory not yet sufficiently studied by academics: the knowledge and application of CE principles within small- and medium-sized enterprises [42–44] and consequent adoption of KPIs to establish objectives, monitor their achievement and inform stakeholders.

This paper investigates the state of the CE among Italian SMEs, considering both their different sizes and sectors. This study focuses on CE knowledge and application, strategic relevance, benefits from and barriers to the transition towards circular business models, and the use of CE-related performance indicators in management control and external reporting [45]. This paper helps scholars understand entrepreneurs' perspectives on the CE. Moreover, this study supports practitioners and managers in turning CE principles into practice. Finally, it clarifies in which specific areas government agencies, trade associations and NGOs engaged in the promotion of sustainability should take future actions to support the spread of the CE.

This paper is structured as follows: this introduction (Section 1); a review of the literature on the CE (Section 2); the methodology section (Section 3); results (Section 4); discussion (Section 5); conclusions, research limitations and future research directions (Section 6).

2. Literature Review

To provide a valid literature review, we adhere to three fundamental principles [46]: *i.* show our familiarity with the major contributions on the CE; *ii.* identify the key issues in the research area and the gaps in the existing literature; *iii.* help the readers understand the principles and theories that have been used by the authors in different parts of this study.

The origin of the CE is not straightforward and shared by scholars, as it is based on a fragmented collection of ideas derived from different scientific fields [47] such as ecological economics, industrial ecology [48–51], cleaner production [52–55], eco-efficiency [56–58], resilience of socio-ecological systems and the Zero Emissions concept [59,60].

Among these different scientific backgrounds, the one that best fits with CE is ecological economics: an established science with a long tradition in recycling and related issues [61–65] and whose fundamental premise that the economic system is an open subsystem of Earth's ecological system with limited resources and environmental capability.

The debate over achieving sustainability of the planet, involving the highest political institutions in the world [66], has underlined the importance of the CE as one of the main instruments to achieve the goal of delivering a sustainable world for future generations. The United Nations have held a leading role in this field since the start of the new millennium: in 2000, they approved the Millennium Development Goals and, in 2015, they launched the ambitious project named the 2030 Agenda for Sustainable Development, which established the Sustainable Development Goals (SDGs). The call for a review of consolidated paradigms to create a more sustainable world has been broadly welcomed by the European Union,

while Germany, Japan, and China are the countries in which the CE has longest been a topic of discussion [67].

At the non-governmental level, the most authoritative source on the CE is undoubtedly the Ellen MacArthur Foundation, which declares the need for "a new economic system in which we design out waste and pollution, keep products and materials in use, and regenerate natural systems" [68].

Studies on the CE date back to the end of the last century [69–73], but it is only in the last decade that scholars have been particularly interested in the phenomenon [74,75].

Despite the fluent literature on the CE, scholars and institutions have not reached a unique definition of the concept [76,77]; however, the fundamental work of Kirchherr et al. [78] has brought some order to the subject. Table 2 contains the most relevant definitions of the CE, in the opinion of the authors.

Table 2. Relevant definitions of the CE.

Author	Definition
European Commission (2014) [79]	"A development strategy that enables economic growth while optimising consumption of resources, deeply transforms production chains and consumption patterns, and redesigns industrial systems at the system level"
European Parliament (2015) [80]	"The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum"
Ellen MacArthur Foundation (2015) [81]	"The circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. This new economic model seeks to ultimately decouple global economic development from finite resource consumption. It enables key policy objectives such as generating economic growth, creating jobs, and reducing environmental impacts, including carbon emissions"
OECD (2016) [82]	"With an expected global population of 9 billion by 2030, including 3 billion middle-class consumers, future consumption demand will create unprecedented pressure on natural resources. The Forum reflected on the importance of the "circular economy" in decoupling economic growth and job creation from the use of natural resources. Turning the ambition of the SDGs into reality will require robust data to capture progress, ensure effective monitoring and provide evidence to inform decision making"
Sauvé et al. (2016) [83]	"Model of production and consumption of goods through closed loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)"
Circular Academy (2017) [84]	"A circular economy is a transformative economy redefining production and consumption patterns, inspired by ecosystems principles and restorative by design, which increases resilience, eliminates waste and creates shared value through an enhanced circulation of material and immaterial flows"
Geissdoerfer et al. (2017) [1]	"We define the Circular Economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling"
Murray et al. (2017) [10]	"The Circular Economy is an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being"
Kirchherr et al. (2017) [78]	"A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operational at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations"
Korhonen et al. (2018) [47]	"Circular Economy is a sustainable development initiative with the objective of reducing the societal production-consumption systems' linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. Circular economy promotes high value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers, and other societal actors in sustainable development work"

Although there are dozens of definitions of the CE, we can group the studies and experiences of the CE into three levels: the micro level (companies and consumers) [85–89], the meso level (industrial districts and manufacturing networks) [90], and the macro level (societies, countries, and overall business systems) [91]. Our research focuses on the micro level. Following the logic that identifies several similarities between the different definitions

of the CE, we are able to establish certain common elements, such as those found by the Ellen MacArthur Foundation in the ReSOLVE framework: *regenerate*, *share*, *optimize*, *loop*, *and exchange* [81], as explained in Table 3.

Table 3. Characteristics of the ReSOLVE.

Action	Description
Regenerate	Shift to renewable energy and materials; reclaim, retain, and restore health of ecosystems; return recovered biological resources to the biosphere
Share	Keep the product loop speed low and maximize the utilization of products by sharing them among users, reusing them throughout their technical lifetime, and prolonging their life through maintenance, repair, and design for durability
Optimize	Increase the performance/efficiency of a product and remove waste in production and the supply chain
Loop	Keep components and materials in closed loops, and prioritize inner loops. In the case of finite materials, this means remanufacturing products or components, and, as a last resort, recycling materials
Virtualize	Dematerialize directly and indirectly
Exchange	Replace old materials with advanced non-renewable materials and apply new technologies

Still, many authors share a type of framework, over and above different aspects of the CE, known as the "*R*" frameworks [92]: the *3Rs* [3,93,94], the *4Rs* [95], the *6Rs* [96], or even the *9Rs* [97] —and these are the most popular frameworks used in discussion of the CE [98]. Each framework is based on different principles—reuse, repair, recycle, refurbish, rethink, remanufacture, repurpose, recover, reduce and refuse—which the authors combine in different ways, according to their research and discussion. For our purposes, we have determined the hierarchy presented in Table 4.

Table 4. The "R" framework.

Framework	*3Rs*	*4Rs*	*6Rs*	*9Rs*
Strategies	*Reuse* *Repair* *Recycle*	*Reuse* *Repair* *Recycle* *Refurbish*	*Reuse* *Repair* *Recycle* *Refurbish* *Rethink* *Remanufacture*	*Reuse* *Repair* *Recycle* *Refurbish* *Rethink* *Remanufacture* *Repurpose* *Recover* *Reduce*

The starting point of our hierarchy is the *3Rs: reuse* (by another consumer of a discarded product which is still in good conditions and fulfils its original functions) combined with *repair* (or maintenance of a defective product so it can be used with its original functions) and *recycle* (processing materials to obtain the same or lower quality). The *4Rs* add *refurbish* (restoring and updating an old product), while the *6Rs* also consider *rethink* (making product use more intensive) and *remanufacture* (using parts of a discarded product in a new one with the same function). The *9Rs* are completed with *repurpose* (using a discarded product or its part in a new product with a different function), *recover* (incineration of material with energy recovery) and *reduce* (increasing efficiency in product manufacture or use by consuming fewer natural resources and material). For completeness, we also mention the concept of *refuse* (making a product redundant by abandoning its function or by offering the same function with a radically different product), indicated in the model by Potting at al. [99], from which the definitions contained in this paragraph are drawn.

Among the various definitions and frameworks available, our research follows the direction set by the European Parliament in 2015, with the adoption of the First Circular

Economy Action Plan by the European Commission. The objectives of this initiative were to stimulate the transition to a more sustainable model of industrial development, boost global competitiveness and create new jobs. The identified concrete and ambitious actions include responsible production and consumption, waste management, the market for secondary raw materials, and a revised legislative proposal on waste [100].

In 2019, the European Commission published a comprehensive report on the implementation of the action plan with the purpose of achieving climate neutrality and minimize the pressure on natural and freshwater resources.

Then, in 2020, the European Commission adopted the New Circular Economy Action Plan (CEAP) with the aim of reducing pressure on natural resources and creating sustainable growth. The new action plan targets product design, promotes the CE, encourages sustainable consumption and aims to prevent waste and ensure that the resources used are kept in the EU economy for as long as possible [101].

The commitment and provisions of the EU concern all companies operating in the Member States. Whilst small- and medium-sized enterprises represent 99% of all businesses in the EU [102], much of the scientific research focuses on the 1% of big corporations. For this reason, we considered it appropriate to focus on SMEs.

In the EU legislation, the characteristics of small- and medium-size enterprises are included in Recommendation 2003/361, which define them as enterprises with: *i.* fewer than 250 employees and *ii.* annual turnover not exceeding EUR 50 million or an annual balance sheet total not exceeding EUR 43 million. By their very nature, SMEs are often characterized by undercapitalization, a lack of highly skilled staff and low investment in research and technological innovation [103–106]. SMEs are usually resource-constrained, in terms of time, staff, and economic resources, compared to larger companies, and they are less likely to undertake transformational changes; moreover, they often have poor awareness of their impact on stakeholders [107–109].

Despite the limits just identified, SMEs have certain strengths [110–112], such as flexibility, creativity and speedy decision-making, which make them the ideal candidates to guide the transition to a CE. Indeed, the path to a more sustainable production system will not reach its targets if it is limited to big corporations. In the European Union, for example, SMEs generate 56% of the total turnover of companies; therefore, their contribution towards an effective transition to a sustainable production system for the planet, through the CE, is not negligible.

As specifically concerns Italy, the existing studies on the CE mainly refer to large companies [113,114], which suggests that SMEs play a merely residual role in the transition towards the desired new business system. Consequently, a broad analysis of the CE in Italian SMEs is appropriate to fill this gap.

The large number of SMEs operating in Italy and their consequent environmental impact stimulate scholars to in-depth analyze the EC phenomenon among enterprises. Therefore, this paper aims to fill in the gap, providing tools to design possible interventions and promoting the spread of best practices.

To investigate the state of the CE among Italian SMEs, considering both their different sizes and sectors, we conducted quantitative research to address specifically the following research questions:

- What is the degree of awareness and knowledge about the CE in SMEs?
- Do SMEs attach strategic importance to the CE?
- Which CE practices are applied in SMEs?
- What are the benefits experienced by SMEs from the implementation of CE practices? Additionaly, what is the opinion of SMEs on the potential of the CE?
- What are the barriers to adopting a CE strategy in SMEs?
- Do SMEs use CE-related KPIs to establish corporate and individual targets and to inform stakeholders about the performance achieved?

This study follows the suggestions for future research provided, among others, by: Mura et al. [13], who propose considering the implementation of a CE in different sectors

(e.g., manufacturing and service-based enterprises); Fonseca et al. [115], who suggest a country-based investigation; Kirchherr et al. [116], who underline the importance of identifying the different barriers to the CE depending on the sector; Rincón-Moreno et al. [117], who recommend cross-sector research on CE performance indicators; and Ferasso et al. [118] who underline the need for studies on processes, such as management control, subject to organizational changes in circular business models.

3. Materials and Methods

As mentioned in the previous section of this paper, the CE in Italian SMEs is still a relatively unexplored field. The need to collect primary data [119] on a significant number of companies led to the choice of conducting an online survey, rather than focusing on companies' reports [45]. This type of research tool presents several advantages [120–122]: first, a web-based questionnaire has the potential to reach many respondents at a very low cost; second, an online questionnaire can guarantee a high response rate because it can be completed at the respondent's convenience (within the deadline communicated by the researchers) using a simple device; third, a computer-administered survey enables automatic branching, with filter questions so that respondents see only the questions that are relevant to them, according to their previous answers.

The questionnaire we used for our research was composed of 20 closed-ended questions and attitude scales, some of which covering multiple items. Closed-ended questions and attitude scales, such as Likert-type scales [120], are very common in questionnaires, because they make it easier to summarize and compare responses than open-ended questions [115,123–125]; moreover, they reduce the risk of inappropriate and ambiguous responses, as may occur when respondents are left completely free to express themselves [120].

To prepare the questionnaire, we conducted an extensive literature review [13,34,64,75,109,117–119], which permitted us to identify the elements of the CE relevant to SMEs. Questions on these elements were organized in a first draft of the questionnaire, which was submitted to the Environmental Policies Department of CNA, the Italian Confederation of Craft Trades and Small- and Medium-Sized Enterprises, to gather comments, observations, and suggestions. The CNA provided invaluable support in our research, as one of the most representative associations of Italian SMEs with a membership base including artisans, business owners, professionals, self-employed and small and micro-businesses in all services and industrial sectors all over the country.

The CNA's direct knowledge of Italian SMEs allowed an in-depth review of the draft questionnaire: the structure, contents and sequence of the questions were assessed by the CNA and partially reformulated, regrouped and improved to assure their completeness, adequacy and clarity. The CNA suggested, and we adopted, terms potential respondents would be more familiar with, and the use of a less technical language. This revision made the questionnaire more consistent with the literacy level of potential respondents [120] and enabled us to avoid pre-testing the questionnaire on a small sample of businesses [126].

To be sure all the respondents shared our concept of the CE, the questionnaire began with the well-known definition of the CE adopted by the European Parliament in 2015 and proposed in Table 2.

After three initial questions on the characteristics of the organization (location, sector and size), the questionnaire addressed the following aspects: awareness and knowledge of the CE (two questions); strategic importance of the CE (one question); implementation of a CE (six questions); benefits obtained and perceived (two questions, articulated in many items); barriers to the adoption of a CE (one question); use of KPIs on the CE (four questions, divided into several sub-questions) and transparency on CE performance (one question).

Certain questions allowed multiple responses. The questionnaire also included some filter questions that automatically guided respondents to the next relevant question, based on the answer to the previous question.

The questionnaire was available online from 5 to 19 July 2021. On the initiative of the CNA Environmental Policies Department, the survey was widely publicized in the CNA newsletter and on its official social networks to reach as many associated businesses as possible. A reminder to complete the survey was also posted ten days after the first announcement. In addition, the CNA's regional and territorial offices, which usually have closer contact with members, were invited to promote the questionnaire further through their websites and mailing lists.

For the CNA, this was the first time it took part in research to explore the actions of its members in relation to the CE, whereas it had already conducted surveys on sustainability. The questionnaire on the CE was completed by 623 respondents, a number in accordance with previous surveys carried out by the CNA and higher than other recent country-based academic surveys on the CE (see, for example, Fonseca et al. [115], who analyzed 99 Portuguese organizations; Oncioiu et al. [42], who considered 384 Romanian SMEs; Mura et al. [13] who focused on 254 Italian SMEs; and Holzer et al. [127], who investigated 183 Austrian SMEs).

Research Protocol

A research protocol is a detailed plan of a study. Typically, the formalization of a research protocol is an essential step in health research, which is carried out by a team of investigators and requires clinical trials of pharmaceuticals, medical devices and other medical products [128–130]. However, a written protocol is useful in any field of research, including business and management studies, because it forces the researchers to carefully design all aspects of the study at the beginning of their project. Moreover, if the study is developed by a research group, the protocol clarifies the contribution expected from every team member in different stages of research and it provides the necessary guidelines all the participants must comply with.

To properly plan and implement our research program, we adopted a specific research protocol, consisting in a long and detailed document, the main parts of which we have already described in this paper. Table 5 summarizes the research protocol that led our study, specifying which activities had to be done in each stage, how many researchers had to be involved, and in which stages the researchers would have required the cooperation of the CNA.

Since the very early stages of research, we considered how to ensure data quality, which depends on reliability of measurement and validity of survey information [131].

Reliability concerns consistency of results obtained at different time, by different researchers/observers, and in different occasions and it is usually assessed through the test–retest method [120]. However, the cooperation of CNA experts in the field of sustainability and CE allowed us to avoid the test–retest. In fact, they meticulously checked all closed-ended questions included in our survey questionnaire to spot glaring flaws, which would have badly affected consistency of findings. Moreover, the use of the internet to administer the questionnaire and the presence of only closed-ended questions ensured high objectivity and prevented accidental, inconsistent behavior on the part of the researchers, which could have determined poor reliability.

Validity is the extent to which a test measures what it is intended to measure [132]. Validity relates to the accuracy of a measure and its subsequent suitability to support the conclusions. To ensure validity of survey information, we based our questionnaire on established theory and findings of previous studies. Moreover, we carefully selected the questions to submit to the participants and we adopted precise wording.

We paid particular attention to construct validity. A construct is an abstract concept that is deliberately created to represent a collection of concrete forms of behavior [120]. Whereas a construct cannot be directly observed, it can be measured by concentrating on other indicators associated with it. As the construct of our study was the companies' inclination to the CE, we assumed CE knowledge, CE application, CE strategic relevance, benefits from CE, barriers to the CE transition, and use of CE-related KPIs as indicators of

the construct. Therefore, every question we inserted in the questionnaire focused on one of these topics.

Table 5. Research protocol.

Rationale for research	• Aim of this study: to investigate the state of the CE among Italian SMEs, considering both their different sizes and sectors. • Literature review, aimed at understanding where to position our study. • Literature gap to be filled: specific studies on the adoption of CE principles in SMEs are still rare; in particular, Italian SMEs have been largely investigated, but not in respect of their inclination to implement CE practices and the subsequent need for improving CE-related performance indicators.	• All the researchers involved in conceptualization. • Two researchers involved in literature review.
Objectives	• Identification of simple, specific research questions.	• Two researchers involved in objective setting.
Methodology	• Selection of the sample: Italian SMEs (specifically, the CNA members). • Selection of the method: quantitative research based on a questionnaire survey, administered through the internet. • Literature review, aimed at identifying all aspects to investigate through the questionnaire. • Preparation of the questionnaire. • Meetings with the CNA's experts to review and improve the questionnaire. • Construct validity, assessed through literature review and CNA experts' judgement on the questionnaire structure and content. • Reliability, ensured by the cooperation of the CNA in distributing the online questionnaire to its members.	• One researcher involved in defining the methodology. • Two researchers involved in preparing and revising the questionnaire. • Cooperation of the CNA's experts in the review and improvement of the questionnaire.
Data management and analysis	• Data verification. • Data processing supported by Excel. • Preparation of tables and figures to represent the survey results.	• Cooperation of the CNA's ICT staff in processing data using Excel. • Two researchers involved in data verification. • One researcher involved in preparing tables and figures.
Ethical considerations	• Need to protect the privacy of respondents, in compliance with Regulation (EU) 2016/679 (GDPR) requirements.	

Construct validity derives evidence from other types of validity, including face validity and content validity [133]. Face validity consists in a subjective judgement of the questionnaire, typically expressed by the researchers considering the relevance, reasonability, unambiguity and clearness of the items [134]. Face validity is an informal assessment of how the content seems to be on the surface, so it is considered a weak form of validity that requires further evaluation. For this reason, we also examined content validity, which relates to the representativeness of all aspects of the construct [135]. As our survey covered all significant aspects of the companies' inclination to the CE that had emerged from an extensive literature review and it was positively assessed by CNA experts, it specifically achieved content validity.

However, some threat to validity still remains. Among others, evaluation apprehension may have affected the answers to the questionnaire. Evaluation apprehension is something similar to the subject effect (also known as the Hawthorne effect) [136] in

experimental research. According to the so called subject effect, people who are conscious of being studied change their behavior to perform better and look smarter. In a survey design like ours, the answers might reflect the wish of some respondents to appear more interested and engaged in the CE transition than they really were.

4. Results

This section presents the results of the survey, starting with the sample composition. This is followed by a description of the results, highlighting the links with the size (micro, small and medium) and sector (manufacturing, construction, and services) of the SMEs.

4.1. Characteristics of Study Participants

Figure 1 shows the composition of the investigated sample, according to three criteria: location, number of employees and activity sector.

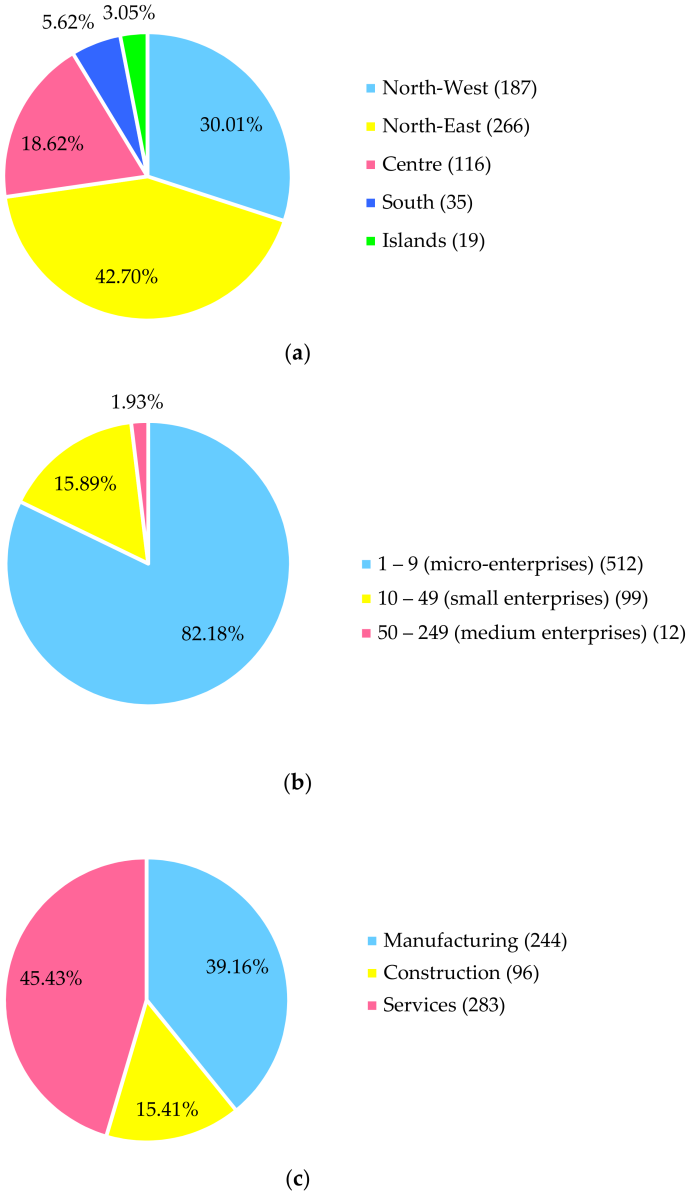


Figure 1. Sample structure: (**a**) location; (**b**) number of employees; (**c**) sector.

Most of the 623 SMEs that completed the questionnaire were located in Northern Italy: more specifically, 187 (30.01%) were located in the North-West and 266 (42.70%) in the

North-East; 116 businesses (18.62%) were located in Central Italy; 35 enterprises (5.62%) were based in Southern Italy and 19 (3.05%) on Italian islands. This composition partly reflects the Italian regional distribution of SMEs that are sensitive to the environmental impact of their activities, according to the ISTAT permanent census [137]. However, while the ISTAT census located only 51% of these SMEs in the north, our survey obtained a higher percentage of responses from that area (72.71%). This could be due to a more intensive promotion of CE practices by the local CNA offices operating in northern regions, and their effective contribution in the dissemination of our questionnaire.

As concerns the staff size: 512 respondents representing 82.18% of the sample we analyzed were micro-businesses with fewer than 10 employees; 99 respondents (15.89%) were small businesses with 10–49 employees; while the remaining 12 respondents (1.93%) were medium enterprises with 50–249 employees. The predominance of micro-businesses in surveys concerning the CE is not new in the literature: micro-enterprises represented almost the 80% of the sample investigated by Mura et al. [13] with reference to the situation in Italy, and 89% of the sample analyzed by Oncioiu et al. [42] in Romania.

Regarding the sector of activity, 244 SMEs operated in manufacturing (39.16%), 96 in construction (15.41%) and 283 in services (45.43%).

4.2. Knowledge and Awareness of the CE Concept

The first matter to be investigated was the respondents' knowledge and awareness of the CE. Respondents were asked to assess their knowledge of the CE as accurate, average, or modest (Table 6).

Table 6. Respondents' self-assessment in knowledge of the CE.

CE Knowledge	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Accurate	55	8.83%	44	8.59%	8	8.08%	3	25.00%	20	8.20%	7	7.29%	28	9.89%
Average	263	42.22%	205	40.04%	50	50.51%	8	66.67%	111	45.49%	47	48.96%	105	37.10%
Modest	305	48.96%	263	51.37%	41	41.41%	1	8.33%	113	46.31%	42	43.75%	150	53.00%
Total	623	100%	512	100%	99	100%	12	100%	244	100 %	96	100%	283	100%

Only 8.83% of the entire sample declared that they have accurate knowledge of the CE, whereas 42.22% assessed it as average; however, the most common response was modest knowledge (48.96%).

The degree of knowledge of the CE seems to be linked to the size of the business: in medium-sized enterprises, modest knowledge is much rarer (8.33%) than in small (41.41%) and micro (51.37%) enterprises. On the other hand, 66.67% of respondents belonging to medium enterprises declared that they have average knowledge of the CE, and 25% considered themselves to have accurate knowledge. This is probably due to the greater complexity of processes implemented in medium-sized enterprises than in the two other groups, which usually requires a larger workforce including higher qualified employees.

In terms of activity sector, accurate knowledge of the CE was declared in similar proportions in manufacturing (8.20%), construction (7.29%) and services (9.89%). SMEs operating in services had the highest percentage of respondents with modest knowledge of the CE (53%), while average knowledge was slightly more frequent in construction (48.96%) than in manufacturing (45.49%). It is probable that the implementation of processes involving the use or transformation of raw materials, which can have significant environmental impacts, stimulated the development of knowledge of the CE.

According to our survey, business experience is the most common way knowledge of the CE is acquired, regardless of the enterprise size and sector, as stated by 156 respondents of the 298 who answered this specific question. In addition, 49 respondents mentioned training and information by trade associations, and 46 cited higher education, university and other advanced courses as sources of knowledge on the CE. Finally, 98 respondents resorted to other means, such as individual and autonomous learning (Table 7).

Table 7. How respondents acquired their knowledge of the CE.

Acquisition of Knowledge on the CE [1]	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Business experience	156	52.35%	68	54.84%	29	58.00%	59	47.58%	118	50.86%	33	57.89%	5	55.56%
Training and information promoted by trade associations	49	16.44%	19	15.32%	11	22.00%	19	15.32%	35	15.09%	13	22.81%	1	11.11%
Higher education, university, advanced courses	46	15.44%	15	12.10%	7	14.00%	24	19.35%	32	13.79%	11	19.30%	3	33.33%
Other	98	32.89%	42	33.87%	12	24.00%	44	35.48%	82	35.34%	13	22.81%	3	33.33%

[1] One or more options allowed. Percentages based on the number of respondents to the question (total: 298; micro: 232; small: 57; medium: 9; manufacturing: 124; construction: 50; services: 124).

4.3. Strategic Importance of the CE

As shown in Table 8, 298 respondents expressed their opinion on the strategic importance of the CE for their business. Overall, the answers were equally divided into those who agreed (50%) and those who disagreed (50%) with the strategic importance of the CE. Respondents from the construction sector were exactly divided between agreement and disagreement, unlike the other sectors, where there was either a tendency to agree with strategic role of the CE, as in the services sector (53.23%), or a tendency to disagree with the strategic importance of the CE for enterprises in manufacturing (53.23%).

Table 8. Strategic importance of the CE.

Strategic Importance of the CE	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	149	50.00%	113	48.71%	31	54.39%	5	55.56%	58	46.77%	25	50.00%	66	53.23%
No	149	50.00%	119	51.29%	26	45.61%	4	44.44%	66	53.23%	25	50.00%	58	46.77%
Total	298	100%	232	100%	57	100%	9	100%	124	100%	50	100%	124	100%

The recognition of the strategic role of the CE seems to be correlated to the size of the company: the larger the business, the greater the recognition.

4.4. Implementation of CE Practices

The survey also investigated the actual implementation of CE practices in the Italian SMEs that completed the questionnaire (Table 9).

Table 9. Implementation of CE practices.

Years of Experience	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1 year	22	3.89%	15	3.23%	7	7.69%	0	0.00%	11	5.00%	3	3.45%	8	3.09%
2–3 years	45	7.95%	32	6.88%	10	10.99%	3	30.00%	15	6.82%	9	10.34%	21	8.11%
4–5 years	27	4.77%	21	4.52%	6	6.59%	0	0.00%	15	6.82%	2	2.30%	10	3.86%
>5 years	77	13.60%	58	12.47%	18	19.78%	1	10.00%	34	15.45%	9	10.34%	34	13.13%
CE will be introduced soon	75	13.25%	56	12.04%	16	17.58%	3	30.00%	38	17.27%	11	12.64%	26	10.04%
Not considering introducing CE	320	56.54%	283	60.86%	34	37.36%	3	30.00%	107	48.64%	53	60.92%	160	61.78%
Total	566	100%	465	100%	91	100%	10	100%	220	100%	87	100%	259	100%

Only 171 respondents managed, or were employed by, a business that had already implemented CE processes; of these, 77 were enterprises with over five years of experience in CE practices (13.60%, a percentage much lower than in Romania, where it reached 62.8% [42]). The survey also revealed that 75 businesses intended to implement CE actions in the short term. On the other hand, 320 businesses representing 56.54% of the 566 respondents were not even considering the introduction of the CE in their activities. In general, the picture emerging from the survey contained contrasting elements: CE was a recent innovation in about one third of the SME respondents and had aroused interest in some others, but there was still large room for improvement in more than half of the sample.

Such scarce involvement was more frequent in services (61.78%) and construction (60.92%) than in manufacturing (48.64%). Furthermore, the investigation proved that CE processes were less widespread in micro-businesses than in small- and medium-sized

enterprises, and that micro-businesses were also significantly less prepared to implement CE practices within the short term.

As illustrated in Table 10, the investigation focused on three principal CE practices, which can be associated with one or more elements of the "R" framework.

Table 10. Implementation of CE practices.

	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Internal recovery of materials in production processes (*reuse*, *recycle*, *recover*)														
Yes	93	60.00%	61	54.95%	30	75.00%	2	50.00%	43	60.56%	12	60.00%	38	59.38%
Will do soon	26	16.77%	21	18.92%	4	10.00%	1	25.00%	13	18.31%	5	25.00%	8	12.50%
No, and not considering in short term	36	23.23%	29	26.13%	6	15.00%	1	25.00%	15	21.13%	3	15.00%	18	28.13%
Total	155	100%	111	100%	40	100%	4	100%	71	100%	20	100%	64	100%
Purchase of recycled materials or products (*reduce*)														
Yes	85	55.19%	58	52.25%	23	58.97%	4	100.00%	35	50.00%	8	40.00%	42	65.63%
Will do soon	37	24.03%	29	26.13%	8	20.51%	0	0.00%	22	31.43%	6	30.00%	9	14.06%
No, and not considering in short term	32	20.78%	24	21.62%	8	20.51%	0	0.00%	13	18.57%	6	30.00%	13	20.31%
Total	154	100%	111	100%	39	100%	4	100%	70	100%	20	100%	64	100%
Redesign of processes, products and services according to CE principles (*refuse*)														
Redesign of production processes	46	32.39%	27	26.47%	19	51.35%	0	0.00%	32	47.76%	3	15.79%	11	19.64%
Redesign of products and services	53	37.32%	43	42.16%	8	21.62%	2	66.67%	12	17.91%	10	52.63%	31	55.36%
Will do soon	22	15.49%	16	15.69%	5	13.51%	1	33.33%	11	16.42%	5	26.32%	6	10.71%
No, and not considering in short term	21	14.79%	16	15.69%	5	13.51%	0	0.00%	12	17.91%	1	5.26%	8	14.29%
Total	142	100%	102	100%	37	100%	3	100%	67	100%	19	100%	56	100%

First, we considered the internal recovery of materials in production processes. Being implemented in 93 out of the 155 respondent enterprises (60%), regardless of their sector, this CE practice was the one most applied at the time of the survey and it was about to be introduced by a further 26 respondents (16.77%). Moreover, it was already largely adopted in small businesses (75%). In detail, the internal recovery of materials includes

- Reuse of packaging and production off-cuts, a practice implemented in 54 companies, with the highest frequency in the manufacturing sector (66.67%) and in small businesses (65.2%);
- Recycle of waste, a process in progress in 50 SMEs, especially in the construction sector (58.33%) and in micro-businesses (57.38%);
- Energy recovery: incineration of residues for energy production, an uncommon operation implemented by only 11 enterprises, none of medium size. A similar result was obtained by Oncioiu et al. [42] for the Romanian context, where only 2.64% of the SMEs investigated had turned waste into energy.

We also investigated the purchase of recycled materials and products to be used in the company's processes. This CE practice, which allows companies to reduce the use of raw materials, was adopted by 85 out of 154 respondents (55.19%) and its introduction had already been planned by further 37 (24.03%). The purchase of recycled materials and products was more common in the services sector (65.63%) than in manufacturing (50%) and construction (40%); the practice was also positively correlated to the size of the company. Purchased recycled materials and products were used in core activities by 51 companies, in auxiliary processes (such as packaging) by 46 SMEs, and in administrative and general services by 56 companies. Manufacturing enterprises showed a preference for using purchased recycled materials and products in core activities (56.25%), whereas companies in construction and services mostly deployed them in administrative and general services (50% and 53.85%, respectively).

Finally, we collected information about the redesign of processes, products, and services in order to produce less waste or prevent it (refuse), according to CE principles. In this regard, 46 respondents out of 143 (32.39%) declared that they had mainly redesigned production processes, while 53 enterprises (37.32%) had primarily rethought products and services. In addition, actions were planned in the short term in a further 22 SMEs (15.49%). In total, 51.35% of small companies made changes to production processes, whereas 42.16% of micro-businesses and 66.67% of medium-sized enterprises redesigned products and services, making the consumers aware of their efforts towards circularity. In manufacturing,

redesign largely involved production processes (47.76%); on the other hand, companies operating in the other sectors focused more on the redesign of products and services, as stated by 52.63% of respondents from construction and 55.36% from services.

Overall, the results described above are not surprising, as they confirm what had already emerged from a previous study of 254 Italian SMEs conducted by Mura et al. [13]. Their research proved that the CE practices were weakly developed among Italian SMEs, except for separated waste collection, as a consequence of strict national regulation in that field.

4.5. Benefits and Potential of the CE

We asked the respondents from the companies that had already implemented CE practices to identify one or more benefits they had experienced (Table 11).

Table 11. Benefits experienced from adopting a CE.

Benefits of the CE [1]	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Improved operating efficiency and cost reduction	63	40.65%	40	36.04%	21	52.50%	2	50.00%	27	38.03%	8	40.00%	28	43.75%
Increase in revenues	22	14.19%	13	11.71%	8	20.00%	1	25.00%	13	18.31%	3	15.00%	6	9.38%
Easier access to credit	3	1.94%	3	2.70%	0	0.00%	0	0.00%	1	1.41%	0	0.00%	2	3.13%
Easier access to public funds	4	2.58%	3	2.70%	1	2.50%	0	0.00%	3	4.23%	0	0.00%	1	1.56%
Tax relief	3	1.94%	3	2.70%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	3	4.69%
Development of partnerships	16	10.32%	10	9.01%	6	15.00%	0	0.00%	11	15.49%	0	0.00%	5	7.81%
Other	17	10.97%	13	11.71%	3	7.50%	1	25.00%	5	7.04%	1	5.00%	11	17.19%
None	55	35.48%	46	41.44%	8	20.00%	1	25.00%	24	33.80%	9	45.00%	22	34.38%

[1] One or more options allowed. Percentages are based on the number of responses to the question (total: 155; micro: 111; small: 40; medium: 4; manufacturing: 71; construction: 20; services: 64).

The survey highlighted that most companies (64.52%) had already experienced benefits from implementing CE actions.

Improved operating efficiency, accompanied by cost reduction, was the most common benefit (40.65%), with higher frequency in small (52.50%) and medium (50%) enterprises, as well as within the services sector (43.75%). Probably, the internal recovery of materials, the purchase of recycled materials and products for internal use and the redesign of production processes have helped reduce operating costs.

An increase in revenues was underlined by 14.19% of respondents, with a higher percentage in manufacturing (18.31%). As concerns the company size, higher revenues were seen in particular in small- (20%) and medium-sized (25%) businesses; sales could have grown in medium-sized enterprises because of the redesign of products and services.

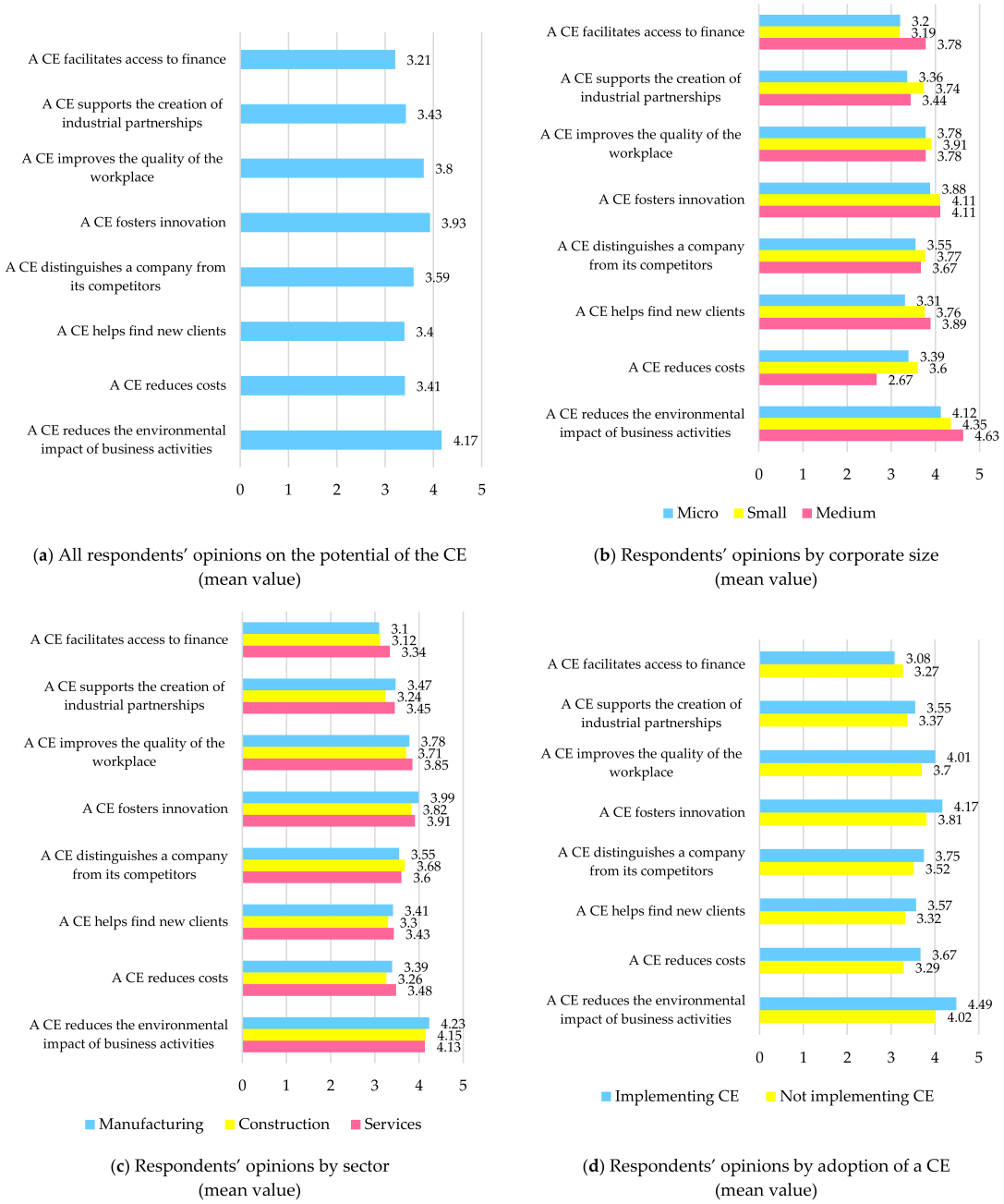
Approximately one-tenth of the respondents also reported the development of partnerships (for example, with suppliers and clients) as an actual benefit of the adoption of a CE, especially in manufacturing (15.49%) and in small enterprises (15%). Conversely, CE practices did not seem to have contributed to building any partnerships in construction and medium-sized businesses.

In addition, few enterprises experienced financial and fiscal benefits. Only three companies associated the implementation of a CE with easier access to credit, which suggests that the banking and financial system fails to recognize the potential of the CE to create value and enable businesses to meet stakeholders' economic expectations in the long term.

Similarly, easier access to public funds and tax relief were mentioned by only four and three enterprises, respectively. This suggests the need for a regulatory change to promote public policies that offer greater support to sustainable businesses and improve the assignment of subsidies to the most deserving enterprises.

Finally, a large proportion of enterprises (35.48%) had already implemented CE practices but had not perceived any benefit from them yet. This unfortunate condition mainly affected the construction sector (45%) and micro-businesses (41.44%).

Through the questionnaire, we also tried to measure the respondents' level of agreement with eight statements about the potential of the CE, as listed in Figure 2. To do so, we used a five-point Likert-type scale, structured as follows: "Strongly disagree"; "Disagree"; "Neither agree nor disagree"; "Agree"; "Strongly agree". Then, we transformed the answers into ordinal data, from 1 ("Strongly disagree") to 5 ("Strongly agree"). Finally, we summarized the respondents' opinions on each statement through a weighted arithmetic mean: this was calculated for all the size- and sector-based categories, as well as distinguishing between businesses that were already adopting a CE and those not yet adopting a CE.



(**a**) All respondents' opinions on the potential of the CE (mean value)

(**b**) Respondents' opinions by corporate size (mean value)

(**c**) Respondents' opinions by sector (mean value)

(**d**) Respondents' opinions by adoption of a CE (mean value)

Figure 2. Respondents' opinions on the potential of the CE (mean value). For each statement, the figure shows the mean value, weighted according to the number of responses obtained from each category of company. Within the same category, the number of responses varies from a statement to another as follows: (**a**) total: 420–424; (**b**) micro: 337–341; small: 73–75; medium: 8–9; (**c**) manufacturing: 163–167; construction: 65–67; services: 190–192; (**d**) companies implementing CE: 133–136; companies not implementing CE: 286–288.

The capacity of the CE to reduce the environmental impact of business activities was the only statement that received full agreement among respondents, summarized by a weighted average higher than 4 (4.17). The capacity of the CE to foster innovation (3.93) and to improve the quality of the workplace (3.80) were also largely agreed upon. For all the other statements, the respondents showed a certain difficulty in expressing a clear opinion, as demonstrated by weighted averages between 3.21 and 3.59.

While no significant differences emerged between the sectors analyzed, the size of the business seemed to affect the respondents' opinions. Indeed, medium-sized enterprises expressed a much higher level of agreement than the sample group as a whole on the following four statements: "A CE reduces the environmental impact of business activities"; "A CE helps find new clients"; "A CE fosters innovation"; "A CE facilitates access to finance". However, medium-sized enterprises were also the only category expressing serious doubts (2.67) about whether the CE helped reduce costs.

Finally, the survey enabled us to distinguish between companies that had already adopted CE practices and those with no actual experience in the field. In the first group, opinions about CE were generally much more positive than in the second group. There was only one exception: the capacity of a CE to facilitate access to finance was rated only 3.08 by respondents operating in companies that were already operating in accordance with CE principles, whereas those without direct experience of a CE expressed a slightly higher agreement with the statement (3.27).

4.6. Barriers to the Deployment of a CE

The questionnaire helped us understand the barriers to the uptake of a CE in Italy. All the participants involved in the survey were asked to select one or more factors that, in their opinion, might impede or restrict the implementation of CE practices within a business. Overall, the survey enabled us to collect the opinions of 483 respondents (Table 12); more specifically, 139 of them represented enterprises that had already adopted a CE, whereas 344 belonged to organizations in which a CE had never been applied.

Table 12. Factors hindering the uptake of a CE.

Barriers to a CE [1]	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Lack of knowledge and expertise	156	32.30%	121	31.03%	31	36.90%	4	44.44%	66	35.11%	24	30.00%	66	30.70%
Difficulty making changes to processes, products and services	78	16.15%	55	14.10%	21	25.00%	2	22.22%	43	22.87%	11	13.75%	24	11.16%
Prohibitive investments	92	19.05%	76	19.49%	16	19.05%	0	0.00%	41	21.81%	13	16.25%	38	17.67%
Lack of incentives and support	118	24.43%	99	25.38%	16	19.05%	3	33.33%	58	30.85%	17	21.25%	43	20.00%
Excessive bureaucracy	91	18.84%	72	18.46%	17	20.24%	2	22.22%	35	18.62%	23	28.75%	33	15.35%
Other	150	31.06%	129	33.08%	21	25.00%	0	0.00%	51	27.13%	27	33.75%	72	33.49%

[1] One or more options allowed. Percentages are based on the number of responses to the question (total: 483; micro: 390; small: 84; medium: 9; manufacturing: 188; construction: 80; services: 215).

The major obstacle was identified as the lack of advanced knowledge and specific expertise to adopt CE practices effectively (32.30%), particularly in small- and medium-sized companies and in the manufacturing sector (35.11%).

The difficulty in making changes to production processes, products, and services in order to convert from a linear to a circular business model was also identified by 16.15% of respondents as a barrier to the uptake of a CE, with higher percentages in medium-sized enterprises (22.22%) and in manufacturing (22.87%).

Barriers to CE can be of a financial nature too. In this regard, 19.05% of respondents mentioned initial or ongoing prohibitive investments, a problem that seemed to affect micro- and small enterprises in all sectors.

Likewise, a lack of incentives and support afflicted one quarter of respondents, with slightly higher frequency among medium-sized businesses (33.33%) and in the manufacturing sector (30.85%).

These results are consistent with those emerged from the already mentioned study involving Romanian SMEs [42]: of the 310 businesses analyzed in that research program, only

10 had financed their CE transition using non-reimbursable government funds, while only 6 had obtained non-reimbursable grants from the EU or supranational financial institutions.

According to 18.84% of respondents, excessive bureaucracy was another significant obstacle to the uptake of a CE, especially in construction (28.75%). This confirms the results obtained by Mura et al. [13] through the analysis of a sample of Italian SMEs, which rated 4.58 on a 7-point Likert-type scale the bureaucratic difficulty in applying the legislation on sustainability.

4.7. Use of KPIs to Monitor CE-Related Performance and Transparency towards Stakeholders

The transition from a linear to a circular business model requires clearly defined targets and related indicators, which enable companies to assess the progress towards the achievement of those objectives [138]. On a micro-level, this entails redesigning the set of KPIs a company adopts in its management control system [139–142] Nevertheless, our findings show that Italian SMEs have thus far failed to give this aspect due importance.

Only 43 respondents out of 424 (10.14%) declared that they had adopted KPIs concerning the circularity of processes or products, with higher frequency among small (14.47%) and medium (22.22%) companies, but without significant differences between the three sectors of activity (Table 13). These results are not surprising if we consider the relative costs a company must sustain in order to invest in improvements to its information system, so that it provides a reliable and constantly updated set of non-financial indicators.

Table 13. Adoption of KPIs to drive and monitor the CE.

Adoption of CE-Related KPIs	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KPIs adopted	43	10.14%	30	8.85%	11	14.47%	2	22.22%	15	8.93%	8	11.94%	20	10.58%
KPIs not adopted	381	89.86%	309	91.15%	65	85.53%	7	77.78%	153	91.07%	59	88.06%	169	89.42%
Total	424	100.00%	339	100.00%	76	100.00%	9	100.00%	168	100.00%	67	100.00%	189	100.00%

More specifically, the survey investigated the usage of a limited number of KPIs regarding recycled materials used in the internal processes of the SMEs surveyed and embedded in the products sold to clients. In addition, the survey considered possible KPIs to monitor employment and job creation in a circular business model. Table 14 highlights the fact that only few businesses had already adopted the CE-related KPIs proposed in the questionnaire: between 11 and 21 SMEs, depending on the specific KPI. The same number of businesses approximately also intended to improve their information system to trace one or more of these indicators.

According to the empirical results presented in Table 15, in approximately two-thirds of the SMEs already adopting CE-related KPIs or of those willing to introduce them, such indicators were, or would be, utilized to establish targets at company level and to measure their achievement. Similarly, the KPIs were, or would be, used to assign targets to staff members and to assess individual performance. In 76.47% of those same companies, the owner or the board of directors periodically examined the KPIs, a practice that underlines the established importance of the CE as a factor in a company's success and that should underpin its future development. In addition, 71.43% of SMEs that used or intended to use CE-related KPIs as a management control tool discussed or intended to discuss them with their employees, in order to improve knowledge and understanding of CE targets and results within the organization. Among the sample investigated, small businesses and the companies operating in the manufacturing sector made the largest use of CE-related performance indicators.

In any case, most enterprises had not adopted any CE-related KPIs at the time of the survey. According to Table 16, 245 out of 415 respondents (59.04%) had met difficulties because of their limited knowledge of KPIs, while 143 (34.46%) were deterred by the costs and complexity of drawing-up CE performance indicators. Finally, 135 respondents (32.53%) perceived no benefit to implementing CE-related KPIs. This reveals a general

lack of management control culture within most Italian SMEs, which negatively affects the planning and monitoring of activities that could be crucial in circular business models.

Table 14. List of CE-related KPIs.

Adoption of KPIs	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Amount of waste recycled within the company [1]														
Already used	21	60.00%	15	57.69%	6	66.67%	0	0.00%	7	58.33%	6	85.71%	8	50.00%
To be introduced	11	31.43%	9	34.62%	2	22.22%	0	0.00%	5	41.67%	0	0.00%	6	37.50%
Quantity of recycled materials purchased externally to be used in internal processes [1]														
Already used	16	45.71%	10	40.00%	6	66.67%	0	0.00%	6	54.55%	4	57.14%	6	35.29%
To be introduced	15	42.86%	13	52.00%	2	22.22%	0	0.00%	5	45.45%	2	28.57%	8	47.06%
Number of industrial, distribution and administrative processes and number of products that have been redesigned according to CE principles [2]														
Already used	15	41.67%	4	33.33%	3	42.86%	8	47.06%	12	46.15%	2	22.22%	1	100.00%
To be introduced	16	44.44%	6	50.00%	3	42.86%	7	41.18%	10	38.46%	6	66.67%	0	0.00%
Revenues from sales of products containing recycled materials or parts, and revenues from direct sales of internally recovered materials [2]														
Already used	13	36.11%	9	34.62%	3	33.33%	1	100.00%	4	33.33%	3	42.86%	6	35.29%
To be introduced	16	44.44%	12	46.15%	4	44.44%	0	0.00%	7	58.33%	3	42.86%	6	35.29%
Quality of products containing recycled materials [2]														
Already used	16	44.44%	13	50.00%	3	33.33%	0	0.00%	6	50.00%	3	42.86%	7	41.18%
To be introduced	14	38.89%	10	38.46%	4	44.44%	0	0.00%	5	41.67%	3	42.86%	6	35.29%
Number of employees devoted to CE processes [2]														
Already used	15	41.67%	11	42.31%	3	33.33%	1	100.00%	5	41.67%	4	57.14%	6	35.29%
To be introduced	11	30.56%	8	30.77%	3	33.33%	0	0.00%	4	33.33%	1	14.29%	6	35.29%
Number of new staff recruited to deal with CE processes [2]														
Already used	11	30.56%	7	26.92%	3	33.33%	1	100.00%	2	16.67%	2	28.57%	7	41.18%
To be introduced	13	36.11%	10	38.46%	3	33.33%	0	0.00%	8	66.67%	0	0.00%	5	29.41%

[1] Percentages are based on the number of responses concerning each specific KPI, as follows: total: 35; micro: 29; small: 9; medium: 0; manufacturing: 12; construction: 7; services: 16. [2] Percentages are based on the number of responses concerning each specific KPI, as follows: total: 36; micro: 29; small: 9; medium: 1; manufacturing: 12; construction: 7; services: 17.

Table 15. Use and analysis of CE-related KPIs.

	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
KPIs are used to establish corporate targets [1]	24	68.57%	18	72.00%	6	66.67%	0	0.00%	8	72.73%	5	71.43%	11	64.71%
KPIs are used to measure corporate results [2]	23	67.65%	15	62.50%	7	77.78%	1	100.00%	9	81.82%	3	42.86%	11	68.75%
KPIs are used to assign individual targets and assess individual performances [2]	23	67.65%	16	66.67%	7	77.78%	0	0.00%	8	80.00%	4	57.14%	11	64.71%
KPIs are periodically examined by the company's owner or board of directors [2]	26	76.47%	17	70.83%	8	88.89%	1	100.00%	9	90.00%	3	42.86%	14	82.35%
KPIs are illustrated to the employees to explain the targets that must be pursued and the results achieved [1]	25	71.43%	16	66.67%	8	80.00%	1	100.00%	10	90.91%	4	57.14%	11	64.71%

[1] Percentages are based on the number of responses concerning the specific KPI, as follows: total: 35; micro: 25; small: 9; medium: 1; manufacturing: 11; construction: 7; services: 17. [2] Percentages are based on the number of responses concerning the specific KPI, as follows: total: 34; micro: 24; small: 9; medium: 1; manufacturing: 11; construction: 7; services: 16.

Table 16. Factors hindering the use of CE-related KPIs.

Factors Hindering the Use of CE-Related KPIs [1]	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Limited knowledge of KPIs	245	59.04%	194	58.43%	45	60.81%	6	66.67%	98	60.12%	35	53.85%	112	59.89%
Excessive costs and complexity of compiling KPIs	143	34.46%	116	34.94%	25	33.78%	2	22.22%	62	38.04%	26	40.00%	55	29.41%
No benefit perceived	135	32.53%	113	34.04%	18	24.32%	4	44.44%	53	32.52%	22	33.85%	60	32.09%

[1] One or more options allowed. Percentages are based on the number of responses to the question (total: 415; micro: 332; small: 74; medium: 9; manufacturing: 163; construction: 65; services: 187).

The concluding part of the questionnaire addressed the external dissemination of corporate data on CE performances. Transparency on CE-related practices, targets and results and other issues of sustainability [140,141] can obviously affect the company's image in a positive way. Therefore, transparency helps strengthen stakeholder trust and

improve financial, human, and technological resources; it also facilitates the creation and development of relationships throughout the supply chain.

Unfortunately, Table 17 shows that very few of the enterprises we investigated in this research have understood the importance of CE-related accountability. Only 66 businesses of 413 disseminated data on their CE-related practices, targets and results; on the contrary, 347 companies failed to disclose this kind of information externally.

Table 17. Transparency on CE-related practices, targets, and performance.

Dissemination of Data on CE-Related Practices and Performance [1]	Total		Micro		Small		Medium		Manufacturing		Construction		Services	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Transparency on CE														
Companies reporting externally on the CE	66	15.98%	44	13.33%	20	27.03%	2	22.22%	31	19.02%	7	10.77%	28	15.14%
Companies not reporting externally on the CE	347	84.02%	286	86.67%	54	72.97%	7	77.78%	132	80.98%	58	89.23%	157	84.86%
Total	413	100.00%	330	100.00%	74	100.00%	9	100.00%	163	100.00%	65	100.00%	185	100.00%
Tools adopted to report about CE [1]														
Sustainability report	10	15.15%	5	11.36%	4	20.00%	1	50.00%	5	16.13%	1	14.29%	4	14.29%
Environmental statement prepared in accordance with a standard of environmental certification	14	21.21%	8	18.18%	4	20.00%	2	100.00%	4	12.90%	4	57.14%	6	21.43%
Management discussion and analysis accompanying the annual report	8	12.12%	6	13.64%	1	5.00%	1	50.00%	3	9.68%	0	0.00%	5	17.86%
Reports for third parties (banks, suppliers, etc.)	17	25.76%	13	29.55%	4	20.00%	0	0.00%	7	22.58%	3	42.86%	7	25.00%
Corporate website	36	54.55%	23	52.27%	13	65.00%	0	0.00%	19	61.29%	3	42.86%	14	50.00%

[1] One or more options allowed. Percentages are based on the number of companies reporting externally about CE (total: 66; micro: 44; small: 20; medium: 2; manufacturing: 31; construction: 7; services: 28).

Among the 66 businesses providing CE-related information to external stakeholders, a corporate website was the privileged means of communication (54.55%), probably due to its high potential to reach the largest audience at low cost [143,144]. Some companies used adopted specific non-financial documents to disclose CE-related information, such as a sustainability report (15.15%) or an environmental statement prepared in accordance with a standard of environmental certification (21.21%). Finally, CE-related information was published in the management discussion and analysis accompanying the company's annual report (12.12%) or in reports for banks, suppliers or other selected third parties (25.76%).

5. Discussion

This study enabled us to understand the current state of the CE in Italian SMEs. As far as we are aware, our questionnaire received the largest number of responses (623) among the country-based surveys carried out in this field of literature; therefore, our findings can be of valid support to interesting observations. Yet, some caution is needed in generalizing the results, given the still low number of SMEs participating in the survey, especially among those of medium size.

In this section we discuss the results described above. Each of the following subsections focuses on one or more types of results, in the same order we already adopted in Section 4. This also reflects the sequence of the research questions this paper aims at addressing.

5.1. Need for Information and Training on the CE

The results of our study concerning the awareness and knowledge of the CE in Italian SMEs suggest that a great deal has yet to be done to replace the traditional business models. To be effective, the transition from linear to circular should rely on in-depth knowledge of CE principles, which is unfortunately lacking in half of the sample analyzed, as reported by the respondents. Insufficient knowledge seems to be a widespread problem among SMEs, as other studies have already revealed. For example, Fonseca et al. [115] discovered a general lack of knowledge on legal, fiscal, technical, and organizational aspects of the CE

among Portuguese businesses. Moreover, Dissanayake and Weerasinghe [145] observed a lack of education of the workforce on corporate sustainability and poor understanding of social and environmental impacts of the company's behavior.

If we refer specifically to the construction sector, which is one of those considered in our study, we note a slightly higher awareness of the CE than in the rest of the sample. This could be due to the need to find ways to manage and reduce the large quantities of discarded materials generated by construction and demolition. Adams et al. [146], who also investigated the construction sector, identified the lack of knowledge on the CE as a barrier to the greater implementation of circular business models. However, this study proved the existence of other more significant factors (such as the failure to consider end-of-life issues) limiting the construction sector's transition to a CE.

According to our research findings, knowledge of the CE mainly derives from business experience, while structured education, training and information programs have played a secondary role until now. Undoubtedly, greater emphasis on the CE is required in different kinds of university courses, from Chemistry and Engineering to Management and Law, as well as in business school programs to ensure solid and extensive knowledge of CE principles and implications. A successful CE transition depends on an adequate education system, which should promote an innovative design education and provide all the necessary skills to develop and manage circular processes and products [145].

In the same way, stronger efforts should be made by trade associations to disseminate information on the CE and to promote and organize training for professionals in order to improve knowledge and understanding of the CE among entrepreneurs and managers, including those in charge of SMEs. Moreover, the collaborative exchange of valuable experience and sharing of successful CE practices, such as workshops and other major events developed at the industry-level or engaging the supply chain [22] can stimulate micro, small- and medium-sized companies to improve and expand their knowledge of circular business models. This should lead to a comprehensive modernization of the non-financial economic system in Italy—in which SMEs accounted for 99.9% of enterprises, 76.1% of value added and 64.3% of employment in 2020 [147], making it more sustainable in the greater interest of all stakeholders.

5.2. Lack of a Clear Strategic Perspective concerning the CE

Enterprises that can count on accurate knowledge of the CE are usually more willing to implement circular practices, because they understand the benefits they can obtain, especially in the long term. In such cases, companies recognize the strategic value of the CE for business success. The literature has underlined that the implementation of a CE is of strategic importance in the mid and long term [148] because it sustains a new business approach that [149,150]:

- Ensures greater resource efficiency,
- Reduces waste,
- Encourages new sources of revenues,
- Enhances corporate image,
- Strengthens employee loyalty,
- Improves investor interest in the company, and
- Attracts new financial resources.

However, the adoption of CE practices can be high risk in the short term, when the increased costs due to the changes made to business processes can deter shareholders from investing [150]. In this sense, risk aversion has been defined as an aptitude barrier to the implementation of a CE [151].

As regards the strategic role of the CE, our empirical results are inconclusive, thus confirming the difference of opinion existing on this point: in fact, half of the respondents agreed on the strategic role of the CE, while the other half disagreed. However, recognition of the strategic importance of the CE tends to grow together with the size of the business; as stated earlier, this could be due to a greater availability of resources, which enables the

recruitment of more qualified staff who better understand the advantages of implementing a circular business model. It could also be evidence of the strategic nature of the CE in meeting the different expectations of stakeholders—economic, social, and environmental—which increase with an increase in company size and require innovative, balanced and sustainable responses in the long term [8,152].

5.3. Sub-Optimal Exploitation of the Potential of the CE

A broad application of circular practices is essential for taking full advantage of the CE, a result that isolated initiatives cannot ensure. However, the findings of this study show that the implementation of CE practices by the Italian SMEs that took part in the survey is quite rare, particularly in micro-enterprises. The adoption of circular models increases with the increase in size of the business, thus reflecting the general attitude of Italian SMEs towards environmental sustainability, according to a trend already observed by ISTAT [147] Overall, just 30.21% of the sample had already undertaken CE-related activities at the time of the investigation: this proportion is much lower than in other countries, such as Romania (where, according to Oncioiu et al. [42], it reached 62.8%). Italian SMEs are significantly behind the other EU Member States average. As early as 2016, 73.18% of European SMEs that had already invested in the transition to a more circular model and had implemented at least one CE practice in the previous three years. This was more than double the result we obtained for Italy in 2021. Based on that same survey in 2016, Italy was ranked 19th among the 28 EU countries, with 66.61% of its SMEs engaged in CE activities [153,154]. Therefore, our study conducted in 2021 appears to show a situation that has worsened in the past five years, although this could be due to the different composition of our sample from that investigated in 2016. However, if the decline is real, it could be caused by the increase in barriers to adopting a CE that our survey also highlighted; these barriers could be discouraging companies to design and implement circular business models, as revealed by the significant proportion of respondents (56.54% of a total of 566) whose enterprises were not even considering the CE in their future strategies.

Where the transition towards a CE has started, it usually consists in the internal recovery of materials, including packaging and production off-cuts, in the company processes and the purchase of recycled materials and products to be used by the business. In both cases, SMEs can benefit from cost savings, which our results identified as the most common advantage of a circular business model, in line with the findings of other studies [115]. Using recycled goods also protects companies from supply chain-related risks, such as those embedded in procurement processes and connected to the price volatility of raw materials, due to the increasing scarcity of non-renewable natural resources [13,155–157].

More complex actions, such as the redesign of processes, products, and services, are adopted much less frequently, probably because they necessitate technical and engineering skills [158] and the investment of financial resources that SMEs do not currently possess. Similarly, energy production from waste, which requires the installation of specific plants, is even rarer, as already revealed by other studies [159], also focused on SMEs [42].

The overall picture highlights sub-optimal exploitation of the potential of the CE. Italian SMEs adopt CE practices to reduce costs, but they do not specifically associate the CE with process and product innovation. In general, innovation is widely recognized as one of the most important benefits of the CE to business [156], and our research findings confirm this opinion: indeed, most of the respondents to our questionnaire agreed with the statement that "CE fosters innovation". Nevertheless, Italian SMEs, which are traditionally renowned for their ability to innovate in-house and develop patents [147], still seem unaware of how to turn words into action when it comes to the CE. We discovered that they do not focus on the CE as a means of product and service diversification, through which they could instead enter new markets, build strategic partnerships downstream, reach different categories of customer and educate consumers to be more sensitive towards environmental issues [160].

The lack of strategic perspective can explain why increased revenues have been reported as a positive effect of the CE by only 22 companies of the 155 that, according to our research, have implemented circular practices. Likewise, only 16 SMEs have built partnerships based on a shared circular approach to business.

Most likely, the continued poor knowledge and understanding of the CE among Italian SMEs leads to a short-term and narrow view of its potential. In this regard, our survey proved that most companies are unable to assess whether a CE helps find new customers, supports industrial partnerships and is a distinguishing factor competitively. Given these nebulous ideas about the potential of the CE, it is not surprising that many Italian SMEs have been reluctant to embrace circular business practices.

5.4. Need to Remove Barriers to the Extensive Implementation of a CE

Our empirical results confirm the existence of different kinds of barriers to an extensive transition from linear to circular business models, as already stated in earlier investigations [116,161,162].

Some obstacles, which are mostly connected to SMEs' internal organization and functioning, are managerial and technological: the shortage of CE know-how and skills and difficulties in rethinking processes, products, and services with the purpose of closing the loop [158]. In addition, a silo mentality that can cause a certain reluctance by some departments to share information with others constitutes a further barrier to the CE transition [161,163,164].

The lack of the necessary knowledge and expertise could be exacerbated by a mismatch between the demand for and the supply of labor [155,165,166] in a market where large companies attract the most qualified workers, thus depriving SMEs of the expertise required to implement CE measures. This could obviously hinder the innovation of industrial processes and the development of more sustainable products and solutions.

However, even enterprises that employ valuable human resources could face barriers to the widespread adoption of a CE; there could be cultural barriers when consumers are neither aware nor interested in the advantages of using products with a longer life cycle [116] and a lower environmental footprint [167,168].

According to Winans et al. [169], the barriers to the CE transition can be actually due to a lack of stakeholder involvement in a shared vision. Similarly, Ratnasabapathy et al. [170], who investigated the construction industry, identified the lack of communication and coordination among stakeholders as a specific barrier to waste trade.

In such an uncertain context, only few SMEs may be prepared to invest large amounts of capital in promoting a CE, especially if this requires borrowing. The lack of financial resources poses serious challenges for the implementation of the CE in small- and medium companies, as already revealed by many studies [35,171,172]. The difficulty for CE-oriented SMEs in accessing finance was also observed [173] with reference to the European context.

In this regard, our study found that financial barriers have been hampering the implementation of circular business models in many Italian SMEs; hardly any of the enterprises participating in the survey have benefited from easier access to credit or public funds as an effect of adopting CE practices. Similarly, respondents expressed little conviction that a CE can help obtain financial resources. In addition, companies adopting CE practices do not benefit from tax concessions and they have to deal with overwhelming bureaucracy, which creates a regulatory barrier aggravating existing difficulties [13,116,174].

In general, we observe the existence of a vicious circle that inhibits the implementation of a CE. In fact, the transition from a linear to a circular model requires the investment of a considerable amount of money. However, as noted by Adams et al. [146], the inclination of companies towards adopting a CE is poorly recognized and appreciated when the enterprise applies for private or public funds to support its transition. This calls for significant actions by national and regional authorities in Italy to support businesses engaged in the transition to a CE. Policy makers should introduce direct measures to promote the CE, such as incentives, tax relief and simplified bureaucracy. All these measures have been

largely advocated in the existing literature [13,35,175,176], which has particularly underlined the need to connect incentives and tax exemption to higher resource efficiency [177]. In this respect, it is worth mentioning that the lack of incentives and public support was reported by the companies participating in our survey as the second most pressing obstacle to the implementation of a CE. Indirect interventions by public institutions, trade and consumer associations and civil society may also help overcome the skepticism that still exists surrounding the CE and makes its adoption difficult for Italian SMEs.

Awareness campaigns could be an important instrument for informing consumers about the lower environmental impact of circular solutions involving reusing, repairing, recycling, and refurbishing, with no negative implication on quality. Such campaigns should encourage the consumers who have not yet embraced the green transition [116,162,178] to purchase products and services provided by CE-oriented businesses and to return used products back to the producer [145]. These changes in consumer behavior can stimulate companies to incorporate eco-design principles [179,180] and reward their efforts towards greater sustainability.

In the same manner, more intense dialogue between business associations and the financial sector could make banks and other financial operators more conscious of the fact that CE-oriented SMEs are exposed to fewer risks and open up new market opportunities. Unfortunately, the investment community has often been accused of operating with "short-term blinkers" [163] looking for rapid return on investment and disregarding projects with wider social and environmental impact but longer financial paybacks [181]. Greater understanding of circular business models should convince the financial institutions that investment in SMEs committed to circularity is a safer option, thus facilitating access to equity capital and credit [182–184].

5.5. Need to Rethink CE-Related KPIs and External Reporting

The final objective of our study was understanding the use of CE-related performance indicators in Italian SMEs. Bocken et al. [185] indeed underlined the need to measure the benefits produced by the CE, but also observed the scarcity of such indicators. Haas et al. [186] emphasized the need for reliable KPIs, as the European Commission [187] did in its Action Plan for the CE.

Key performance indicators (KPIs) are helpful tools for driving and measuring a company's progress towards the CE [188]. In fact, KPIs can be used to translate corporate and individual objectives into quantitative targets, the achievement of which can be monitored and assessed more [189,190]. Moreover, the proper sharing of CE performance indicators from the board throughout the whole organization creates a common vision based on sustainability principles. This should support the improvement of daily operations and promote strategies to extend product life cycles and reduce waste. Therefore, CE-related KPIs can be integrated with the traditional financial indicators of management control and encourage the monitoring of social and environmental issues as part of effective corporate governance [191–195]. In addition, good CE-related indicators provide relevant information for entrepreneurs and managers in their decision-making [196,197].

Enterprises should also disclose CE performance indicators in corporate reports for the general audience of stakeholders or specific groups [198,199]. By doing so, companies demonstrate their commitment to ensuring a lower environmental impact of their operations and products. In a wider perspective, companies should also report on the efforts undertaken to implement an innovative business model, which enables them to manage new types of risks (such as the difficulty in purchasing raw materials at affordable prices) and to promote green careers for longstanding employees and new recruits.

Despite that the above, we discovered that Italian SMEs make little use of CE-related KPIs to set targets and monitor results, on the one hand, and in corporate reporting, on the other. To date, few companies have consciously implemented CE-related indicators or intend to implement them. Where KPIs have been adopted, they are generally used to establish corporate and individual targets, as well as to monitor and assess performance. In

addition, such KPIs are periodically analyzed by those in charge of governance decisions, which demonstrates the importance they attribute to CE for long-term success of their businesses. In these companies, CE-related indicators are usually discussed with the employees too: this approach is fundamental for sharing the vision of a business that creates economic and social value while reducing its environmental impact.

However, the majority of SMEs investigated in this study still have a long way to go in terms of CE planning and monitoring. The situation in Italian SMEs is further complicated by the need to improve the whole management control system, which is often not particularly advanced [200–202], as a condition for a broader adoption of CE-related indicators.

Similar considerations apply to external reporting, which is essential for fostering and managing stakeholders' trust. Transparency in relation to CE performance, as well as on CE-related risks, strategies, and policies, requires improvement in most of the enterprises participating in our survey. In this regard, regulatory and standardization bodies can play a crucial role, as they can stimulate SMEs to publish information on their attitude towards the CE, at least by including it in their annual report.

The willingness to adopt sustainable supply chain can further encourage non-financial corporate reporting: the company's need to present itself as a valuable and trustworthy business partner for suppliers of secondary raw materials and buyers of recycled products can positively affect its external communication on CE-related issues.

Finally, the financial sector can encourage transparency on circular business models implemented by enterprises seeking additional funding: greater availability of information helps the assessment of a business's capacity to reduce operational and environmental risks, with important implications for its creditworthiness.

6. Conclusions

Circular business models can greatly contribute to building a more sustainable world, in which economic progress and business success are integrated with environmental preservation and social wellbeing in a just and effective manner [203,204].

In Italy, the predominance of SMEs means they bear the weight of the responsibility for achieving sustainability in the country, also through the implementation of CE principles. Thus, this study examined the state of the CE among Italian SMEs, considering both their specific size and sector.

This paper sought to fill a gap in the existing literature, as no previous studies have provided a comprehensive analysis of Italian SMEs with reference to CE-related knowledge and application, recognition of the strategic relevance of the CE, and benefits from and barriers to the transition towards circular business models.

Moreover, this paper contributes to the literature on management control and external reporting. Through a micro-level approach, we investigated the adoption of CE-related KPIs as a tool to support setting targets, monitoring and assessing performance and disseminating information to stakeholders in a responsible and transparent way.

The research, based on an online questionnaire, revealed the existence of cultural, technological, market and financial barriers that have doubtless hampered the spread of a 'close-the-loop' culture among Italian SMEs.

The limited knowledge of CE principles and poor understanding of their potential, combined with difficulties in obtaining public and private funds to finance the transition from linear to circular, are the greatest problems encountered by the companies participating in our study. Overcoming such issues requires serious and rapid action by public institutions, trade and consumer associations and the higher education system in order to develop a friendlier environment for the CE.

Policy makers should provide incentives, such as subsidies, tax relief and support, to encourage the implementation of CE practices in SMEs.

In addition, trade associations play a decisive role in making businesses aware of the benefits of adopting circular business practices, thanks to information campaigns and

promotion of professional training. Tangible improvement also requires the commitment in particular of academia and advanced education institutes, which should prepare students for work in different kinds of green professions.

Finally, end consumers and citizens should be educated on the environmental, economic and social advantages of purchasing close-the-loop products. This would lead to support for CE-oriented companies that have undertaken a strategic path to sustainability, generating a positive return on their investment.

Some issues remain unsolved: our research did not provide any clear evidence of the link between the CE and company size; though we expected medium-sized enterprises to be the most committed to a CE, this did not occur systematically. Similarly, we did not identify a sector of activity more devoted to the CE than others.

6.1. Limitations of This Study

Admittedly, this study was constrained by some inherent limitations concerning the research method and the composition of respondents.

First, the use of an online questionnaire made it impossible for us to exercise control over respondents and some questions remained unanswered. However, we were aware of this risk since the beginning of this research project and we decided not to force respondents to answer questions they were not interested in, because this could have led to distorted and misleading data.

Second, the sample used is not strictly representative. It is very likely that the sample over-represents forerunners and other SMEs that consider the CE important and so accepted to answer the questionnaire. Moreover, the online distribution of the questionnaire to all CNA members, with no prior selection of specific recipients, led to a disproportionate composition of the sample analyzed. In particular, the participation of medium-sized businesses in this study was very low, which prevented us from generalizing the findings concerning this kind of enterprises.

Third, we did not meet any entrepreneurs or managers directly. Personal interviews and focus groups would have guaranteed us flexibility and adaptability, allowing us to examine more in-depth relevant matters suggested by the respondents, thus developing a better understanding of their concepts of the CE. On the other hand, the path adopted guarantees greater objectivity of the information collected.

Fourth, our survey of CE practices covered only a part of the "R" framework. We concentrated on activities that can be applied to all sectors; therefore, we did not contemplate practices associated with repair, refurbish, rethink and remanufacture, which we considered more sector-specific.

6.2. Directions for Future Research

To conclude, we suggest some future research directions that emerge from our findings and which could help better understand the drivers of uptake of the CE among Italian SMEs. For example, specific analysis of medium-sized enterprises is required. In addition, future research could investigate selected industries (e.g., textile and clothing, food and beverage, electronics, hotels and restaurants, and transport) to map their CE practices according to the "R" framework. Studies could be undertaken of examples of business excellence in order to establish a benchmark for other companies. Other studies could also focus on the professional profiles required to support the transition from linear to circular business models. Research could explore the impact of public incentives on the uptake of the CE among businesses of different size and sector. Researchers could also examine the extent to which a company's inclination towards the CE effectively affects its creditworthiness. Finally, research is recommended in the field of management control to understand the importance of CE-related KPIs in SME planning and control.

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ARTICLES FOR FACULTY MEMBERS

ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG), CIRCULAR BUSINESS AND SMES

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ORIGINAL RESEARCH

Industry 4.0 and circular economy for emerging markets: evidence from small and medium-sized enterprises (SMEs) in the Indian food sector

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Abstract
The linear economic business model was deemed unsustainable, necessitating the emergence of the circular economy (CE) business model. Due to resource scarcity, increasing population, and high food waste levels, the food sector has been facing significant sustainability challenges. Small and medium-sized enterprises (SMEs), particularly those in the food sector, are making efforts to become more sustainable and to adopt new business models such as the CE, but adoption rates remain low. Industry 4.0 and its associated technological applications have the potential to enable CE implementation and boost business competitiveness. In the context of emerging economies facing significant resource scarcity constraints and limited technology availability, CE principles need to be adapted. CE could create a new job economy in emerging economies, bringing scale and a competitive advantage. This study explores the enablers of and barriers to Industry 4.0 adoption for CE implementation in fruit and vegetable SMEs in India from a resource-based perspective. The purpose is to develop an evidence-based framework to help inform theory and practice about CE implementation by SMEs in emerging economies. Fifteen semi-structured interviews were conducted with experts in food SMEs. The interview transcripts were first subjected to thematic analysis. The analysis was then complemented with sentiment and emotion analyses. Subsequently, hierarchical cluster analysis, k-means analysis, and linear projection analysis were performed. Among others, the findings suggest that Industry 4.0 plays a key role in implementing CE in SMEs in emerging economies such as India. However, there are specific enablers and barriers that need to be considered by SMEs to develop the resources and capabilities needed for CE competitive advantage.

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1 Introduction

The current economic system, which is based on a linear supply chain operating model, is certainly unsustainable (Despoudi, 2019). Due to the need for organisations to become more sustainable by preventing depletion of resources, closing energy and material loops, and facilitating sustainable development, the concept and model of the circular economy (CE) has recently emerged in supply chains (Patwa et al., 2021). The CE concept states that an industrial system is restorative or regenerative by intention and design, and that it replaces the 'end-of-life' concept with restoration, leading to zero waste (Yamoah et al., 2022). The implementation of CE in food supply chains (FSCs) is even more critical due to the sustainability pressures faced by the latter. According to the Food and Agriculture Organisation (FAO, 2019), these sustainability pressures are related to the availability of fewer natural resources, limited agricultural land, population growth, global food insecurity, climatic change, dietary changes, governance of the FSC system, and food waste. CE principles can be applied to prevent food waste in the first place, recover resources from food waste, recycle the materials used for food packaging, and increase food availability (Despoudi, 2020). Many companies are successfully implementing sustainability and CE in their supply chains through improved products/services and processes; however, this is not the case for small and medium-sized enterprises (SMEs) (Dey et al., 2020). SMEs are one of the largest employers worldwide, accounting for more than 90% of all businesses. Emerging economies are critical contributors to national income (GDP), accounting for 40% of total GDP (World Bank, 2021). However, in the context of sustainability practices, SMEs are a major polluter, and only a few of them have environmental management systems and CE practices in place (Johnson & Hörisch, 2022). There has been little research on CE implementation from the SMEs' perspective (Pereira et al., 2022).

Fruit and vegetable SMEs in India are the second largest producers of perishables in the world (IFP Bureau, 2021). However, the linear nature of their supply chains results in significant waster, amounting to approximately £13 million. The lack of proper sustainability practices has resulted in a variety of issues, such as inadequate infrastructure, packaging, and storage facilities, as well as fragmentation and a lack of transparency (Govindan et al., 2014). Further, in the absence of adequate technology, food SMEs are bound to face deterioration in product shelf life, quality issues, improper adherence to safety standards, and an increase in lead time (Lezoche et al., 2020). CE implementation in India's food SMEs will address the aforementioned CE issues (Michelini et al., 2017). Due to resource constraints in emerging economies such as India, CE practices must be tailored to their specific context to achieve their full potential. The CE could enable food SMEs to scale up and grow while also creating a new job economy.

One of the critical issues that companies face when implementing CE is the lack of efficient information systems to effectively manage their CE involvement and objectives (Khan et al., 2021; Vacchi et al., 2021). For CE implementation to be successful, effective data management and a strong underlying technological infrastructure are required. Industry 4.0 may enable CE implementation and boost business competitiveness (Khan et al., 2021). The link between the physical and digital worlds can also be achieved through Industry 4.0 applications, which make CE implementation feasible, robust, and transparent for companies

(Lezoche et al., 2020). This also allows companies to be more sustainable, as they can recycle, reduce, and reuse at a faster rate (Rajput & Singh, 2021). However, the role of Industry 4.0 applications in CE implementation from the perspective of SMEs in emerging economies has not yet been explored.

According to the resource-based view (RBV) theory, resources and capabilities provide firms with a strategic competitive advantage, allowing them to capitalise on opportunities and avoid threats in their operating business environment, and thus become more competitive (Barney, 1991). The term 'resources' refers to physical, human, capital, and organisational resources (Barney, 1991). Industry 4.0 technological applications can be seen as organisational resources that will develop capabilities to support CE implementation. CE implementation could boost the competitiveness of SMEs in emerging countries because the sector can scale up. However, SMEs in emerging countries face unique challenges in terms of technology adoption and CE implementation. Therefore, this study explores the enablers of and barriers to Industry 4.0 adoption for CE implementation in fruit and vegetable SMEs in India from the RBV perspective. This is the first study to explicate Industry 4.0 barriers and enablers in relation to CE implementation at the SME level in an emerging market in the food industry. Interviews were conducted with food experts from Indian SMEs. Their views are used to build a framework for understanding CE implementation in SMEs in developing countries and the role of Industry 4.0. SMEs could utilise the proposed evidence-based framework in other developing countries with similar resource constraints.

The paper is organised as follows: Sect. 2 presents the literature review, Sect. 3 discusses the research methodology, Sect. 4 presents the interview findings, and Sect. 5 discusses the results and findings. Section 6 concludes the paper and provides directions for future research.

2 Literature review

This section presents a review of the existing literature in terms of CE and Industry 4.0. It begins by examining the definition and principles of CE. It then delves into Industry 4.0 and its applications, as well as its relationship with CE, which includes enablers and barriers. The importance of CE to the food sector is outlined, along with the indicators of fruits and vegetables in India.

2.1 The principles of the circular economy

CE is defined as a system that reinstates the 'end of life' theory through sustainability, recycling, and reuse at the macro, micro, and meso levels to attain value, prosperity, environmental protection, and ensure future growth expansion (Henry et al., 2021). CE is primarily based on the main principles known as the 3Rs: reduce, reuse, and recycle (Acerbi & Taisch, 2020; Reh, 2013). The primary goal of the 'reduction' principle is to maximise production and consumption efficiency. This is accomplished by producing higher-value products with a lower economic impact, using fewer resources, and avoiding products that can damage the ecosystem (Acerbi & Taisch, 2020). Eco-efficiency can be achieved by encouraging more frugal methods, such as essential packaging, smaller and lighter raw materials, and the promotion of environmentally friendly technologies (Acerbi & Taisch, 2020; Patwa et al., 2021). The 'reuse' principle refers to practices in which products are not discarded as waste but are reused for the same purpose for which they were designed (Dora, 2019; Fatimah et al., 2020). Reuse can only be successful if the products are designed to be long-lasting for multiple phases

of use (Sumter et al., 2020). This process can be encouraged by providing subsidies and educating customers about the importance of reusing products (Sumter et al., 2020; Vlajic et al., 2018). The 'recycling' principle refers to how used products are not discarded as waste but are instead recycled into functional or usable substances. However, it applies only to natural products and cannot be used with fossil fuels (Dora, 2019). The main benefits of recycling include resource conservation, reduced use of landfills and incinerators, better use of domestic resources, and energy savings (Upadhyay et al., 2021).

2.2 Industry 4.0 enablers and barriers for the circular economy

Vaidya et al. (2018) and Pereira and Romero (2017) defined Industry 4.0 as a tool that uses evolving technology and machine improvement to cope with global changes, making production more efficient, improving quality, and resulting in easier maintenance. By implementing Industry 4.0 applications, companies can improve their operational competence, enhance data flow, increase efficiency, and reduce waste (da Xu et al., 2018; Vaidya et al., 2018; Yin et al., 2018).

There are multiple benefits stemming from the Industry 4.0 paradigm, which have also been highlighted in recent research on CE enablers (Sanders et al., 2016; Schmidt et al., 2015; Vaidya et al., 2018). In terms of the energy used for manufacturing processes, Industry 4.0 technologies have the potential to reduce the levels of consumption and input by leveraging clear and scalable manufacturing expertise (Sanders et al., 2016). There are also opportunities to identify and classify materials and products that can be reused and repaired, as well as waste tracking systems for data collection on the amount of waste and its various types, which support more informed decision making (Chauhan et al., 2021; Fatimah et al., 2020). The applications of Industry 4.0 can provide reliable data to management, reduce potential breakdowns, and avoid manufacturing failures (Gunasekaran et al., 2017). Industry 4.0 is designed for self-restoration, which can benefit CE principles and ensure process continuity (Azadegan et al., 2020). It ensures that various data forms are prioritised for managing resources for CE to improve quality across the entire network. Industry 4.0 can be used to integrate equipment and streamline processes for optimal asset and resource utilisation (Oesterreich & Teuteberg, 2016). Lastly, Industry 4.0 applications have continuous learning processes that can leverage the constant stream of data and provide a tailored experience for consumers' needs, and therefore instantly and simultaneously improve efficiency (Schmidt et al., 2015).

Some of the main issues that CE principles face during implementation are related to disparities and data inconsistencies (Kazancoglu et al., 2021; Khan et al., 2021; Vacchi et al., 2021). The lack of interactive platforms and designs to support circularity are the main reasons for the need to involve advanced technologies (Vacchi et al., 2021). The primary obstacle is that existing materials need to be discarded because they were not developed from the perspective of reuse or recycling due to a lack of technology. Most countries lack the ability to provide high-quality remanufactured products (Henry et al., 2021). The issue of transparency can lead to inadequate data on the product (Henry et al., 2021). This can have an impact on a company's operations due to a lack of knowledge regarding the type of raw materials used in the final product. This becomes even more problematic when many dealers obtain products from unknown sub-dealers (Khan et al., 2021). The lack of adequate expertise on how to use technology and the kinds of skills that should be adopted are also issues that must be addressed (de Angelis, 2021). Further, some linear technologies are well established

in the economy, making the introduction of new circular systems even more difficult (Han et al., 2020).

However, with Industry 4.0, companies can employ CE with the help of three main drivers: knowledge of the location, knowledge of the condition, and knowledge of availability (Dagilienė et al., 2021). Companies can gain an advantage by monitoring the location of assets or data using feedback loops, allowing them to optimise routes, assess storage, and ensure proper maintenance (Spanaki et al., 2021). By obtaining appropriate information about the conditions of their assets, companies can improve their uptime. Lastly, by recognising the capability of a specific asset, companies can ensure optimal resource utilisation, which can also aid in circularity (Mangla et al., 2018). All of the above seemed far-fetched initially, but with the advent of IoT and cloud computing, these drivers can now be easily accomplished (Rajput & Singh, 2021). Thus, a deeper examination of the various Industry 4.0 enablers and barriers can aid in determining the relationship between CE implementation and Industry 4.0 applications (Rajput & Singh, 2021). Table 1 shows the enablers and barriers of Industry 4.0 for CE implementation.

Industry 4.0 technologies have been found to enable CE implementation through improved energy efficiency and waste management systems, enhanced process reliability and uptime, increased resilience, improved quality, improved infrastructure, and self-optimisation. However, companies appear to face challenges when using Industry 4.0 technologies to aid in CE implementation. The analysis of the literature revealed the following barriers to Industry 4.0 implementation for CE: interconnectedness and collaboration issues, data safety and security issues, high investment costs, and infrastructure and incompatibility issues. The present study takes into account all of the identified enablers and barriers and examines their presence at the SME level in emerging countries.

2.3 The circular food supply chain

With growing environmental concerns, it is almost mandatory to apply CE principles to the food supply chain to extend the lifespan of resources and ensure their recycling and reprocessing (Hamam et al., 2021). Prior to the emergence of the CE concept, food waste was commonly disposed of in large quantities. However, since this concept has been introduced, recovered resources have been effectively reused rather than discarded (Batista et al., 2021; Despoudi, 2019). CE not only reduces material costs but also boosts economic growth and operational efficiency. Food waste or loss occurs at various points along the supply chain, and can be divided into upstream and downstream steams (Despoudi, 2019). Losses in emerging countries are referred to as upstream losses, while losses in developed countries are referred to as downstream losses. The loss in upstream food can be further subdivided into production, handling, storage, and distribution losses. Downstream losses include those experienced by retailers, consumers, and post-consumer food (Despoudi, 2020). Food loss is recognised as consumable foods that are abandoned or disposed of and identified as losses or residues (Despoudi, 2019; Irani et al., 2018). To be sustainable in the future, significant efforts must be made to avoid this waste. Therefore, by introducing CE, wasteful products can be converted into raw materials that can be used to produce other products, significantly reducing waste (Dora, 2019; Irani & Sharif, 2018).

The circular food supply chain reduces purchase costs by reusing products that would otherwise be discarded (Genovese et al., 2014). Here, basic raw materials are replaced with recycled goods. If the goods are reprocessed, the overall emission levels will also be significantly reduced. The circular food supply chain process tracks the activities that cause

Table 1 Summary of Industry 4.0 enablers and barriers in relation to CE

Factors	Description	References
Enablers		
Improved energy efficiency and waste management systems	Through clear and scalable manufacturing expertise, Industry 4.0 technologies can reduce energy consumption and input by identifying and classifying materials and products that can be reused and repaired. Waste tracking systems can be developed to collect information on the amount of waste and its various types to enable effective decision making	Chauhan et al. (2021) and Fatimah et al. (2020)
Enhanced process reliability and uptime	Industry 4.0 applications can enable human-to-machine and machine-to-machine communication, which can predict machinery maintenance and breakdown, and resources can be spent only when needed. Interaction between devices is enabled, process reliability is increased, and material waste can be reduced. Before actual changes occur, simulations can visualise the changed processes based on CE. This can provide management with more reliable data, reduce possible breakdowns, and prevent manufacturing failures	Reh (2013), Trstenjak and Cosic (2017) and Zambon et al. (2019)
Increased resilience	CE is designed for self-restoration. The introduction of Industry 4.0 helps build interconnections that will enable the transformation of the current business model to produce value and innovation. Thus, this can benefit the CE principles and ensure process continuity	Behzadi et al. (2020), Brusset and Teller (2017), Gunasekaran et al. (2015), Pettit et al. (2019) and Scholten et al. (2019)

Table 1 (continued)

Factors	Description	References
Improved quality	CE aims to maintain the quality of the materials and processes involved in CE implementation. Industry 4.0 ensures that various data forms are prioritised for resource management in order to improve quality across the entire network. This allows for the transfer of large amounts of data in a reliable and efficient manner, which improves quality. The use of cameras or other visioning software, for example, can monitor and detect deviations in a process. As deviations are detected in seconds, companies can reduce costs while maintaining product safety levels	Batista et al. (2021), Corallo et al. (2018), Giannakis et al. (2019), Rajput and Singh (2021) and Upadhyay et al. (2021)
Improved infrastructure	CE is founded not only on upfront design and asset utilisation, but also on other infrastructures, such as operations, maintenance, and disposal. Industry 4.0 can help with equipment integration and process streamlining. Industry 4.0's autonomous decision-making processes can also improve vertical and horizontal integration with real-time connected value-creation networks. As a result, CE implementation could be achieved by sharing processes for reusing and recovering materials with other businesses in the sector	Edwin Cheng et al. (2021), Fatimah et al. (2020) and Govindan (2018)

Table 1 (continued)

Factors	Description	References
Self-optimisation	Continuous learning processes in Industry 4.0 applications can help companies be highly robust and handle unexpected behaviours and sudden production changes. This not only makes supply chains more resilient but also helps with CE implementation by allowing for different consumer expectations and product service/variations across different territories. The transition to fully automated systems facilitated by a constant stream of data can enable companies to meet consumers' needs instantly while also improving efficiency	Camacho-Otero et al. (2018), Dey et al. (2020), Korhonen et al. (2018), Prieto-Sandoval et al. (2018) and Sumter et al. (2020)
Barriers		
Interconnectedness and collaboration issues	Due to the interconnection of applications in the real and cyber worlds, changes in one world will result in a series of changes in the other. When interacting with humans, precautions must be taken, because even minor changes can lead to physical damage. With high levels of autonomy and authentication, standardisation must be improved to ensure that it can handle unique obligations. Lack of collaboration can impede the implementation of CE principles due to a lack of trust, making it even more challenging to determine when and with whom to collaborate	Despoudi et al. (2018), Dora (2019), Papaioannou et al. (2020) and Vlajic et al. (2018)

Table 1 (continued)

Factors	Description	References
Data safety and security issues	Interlinking devices and technologies may exacerbate security issues. Given that everyone has access to the internet, there is a need to safeguard, monitor, and inspect the data that is regularly uploaded. When devices do not share the same level of technology or skills, issues regarding authorisation tend to arise. Data integrity must be considered, because information should not be altered when transferred from one device to another. Interactions with humans and machines will occur during CE implementation. The company will face several challenges in ensuring workplace safety and data safety	Bechtsis et al. (2021), Belaud et al. (2019), Corallo et al. (2018), Papadopoulos et al. (2021) and Spanaki et al. (2021)
High investment cost	Significant initial investments are required to systematise the foundation of Industry 4.0 applications. As the adoption of Industry 4.0 applications does not guarantee an immediate return on investment, some businesses, particularly SMEs, may lack access to financial resources. The market's readiness for circular products has yet to be realised; hence, companies are discouraged from making such large investments. These costs are not limited to the initial step-up but also include other maintenance costs. There is a constant need for the upkeep of machinery and software, as well as high salaries for the employees who operate them	Almada-Lobo (2016), Oesterreich and Teuteberg (2016), Papadopoulos et al. (2021), Pereira and Romero (2017), Rajput and Singh (2021), Sony and Naik (2019) and Xu et al. (2018)

Table 1 (continued)

Factors	Description	References
Infrastructure and incompatibility issues	Several compatibility issues arise when implementing CE, including conflict of interest, awkward business models, inadequate services, lack of network support, and machinery incompatibility. When implementing CE through technological advancements, companies may need to redesign their processes and services. Certain issues arise when these new technological applications are incompatible with their existing technological infrastructures	Ivanov and Dolgui (2020), Kazancoglu et al. (2021), Oesterreich and Teuteberg (2016), Papadopoulos et al. (2021), Pereira and Romero (2017) and Vacchi et al. (2021)

emissions and seeks new ways to reduce them by tracking their performance (Reh, 2013). It encourages cooperation among suppliers to reduce emissions at various supply chain stages (Genovese et al., 2014). Reverse logistics is the process of converting waste products into usable products so that producers can take them back and reuse them. This is used not only to recycle general food waste but also to recover unutilised packaging material.

2.4 The need for circular economy implementation in the Indian fruit and vegetable supply chain

India is the world's second largest producer of fruits and vegetables, trailing only China (IFP Bureau, 2021). SMEs in India produce an assortment of fruits and vegetables, such as onions, potatoes, brinjals, lemons, apples, bananas, mangos, papayas, and oranges (IFP Bureau, 2021). In terms of fruit and vegetable exports, India accounts for only 1% of the global market. The United Kingdom, United Arab Emirates, Pakistan, Nepal, Bangladesh, and the Netherlands are among the important countries to which they are exported. However, fruits, and vegetables are also imported from a variety of countries, including the United States, Iraq, and Pakistan. The main reason India is forced to import is due to post-harvest loss, which accounts for up to 30% to 40% of total fruit and vegetable losses (IFP Bureau, 2021).

Despite having a diverse range of fruits and vegetables, India wastes almost Rs13.30 million in fresh produce each year (IFP Bureau, 2021). Rural infrastructure is relatively poor due to difficulties in setting up warehouses and storage, resulting in a 40% loss (IFP Bureau, 2021). Fragmentation issues arise because of the presence of a large number of middlemen, forcing farmers to reduce their share. Other factors, such as poor packaging, contribute significantly to fruit and vegetable waste. SMEs are struggling to adapt to the high cost of packing the product, resulting in poor and insufficient packing. A lack of cold storage facilities across the country, as well as financial issues such as price fluctuations, farmers' low-income levels, and a lack of transparency, are all causes of waste (Kazancoglu et al., 2021). Further, approximately 25% of food losses are attributed to improper handling. This is becoming one of the main causes of the rise in the level of hunger. India ranks 103rd out of 199 countries in the Global Hunger Index (GHI). The cumulative loss of fresh produce ranges from 4.58 to 15.88% (FAO, 2019). This can be prevented by introducing the CE concept, which takes responsibility for reducing food waste and implementing recycling measures.

Some of the main threats to the fruit and vegetable sector are related to product shelf life, supply lead time, and deterioration rate (Lezoche et al., 2020). Improper management of perishables eventually results in safety, condition, quantity, and depletion issues. Therefore, introducing advanced Industry 4.0 technologies could help prevent these problems (Lezoche et al., 2020). The implementation of a more digitalised supply chain in the fruit and vegetable sector will allow for a more flexible, robust, and resilient process (Lezoche et al., 2020). Industry 4.0 can help with data management, forecasting, and product tracking, allowing businesses to place more accurate orders, have greater visibility, and reduce the risk of overstock (Rogerson & Parry, 2020). Industry 4.0 also aids in the integration of older technologies. This will allow companies to evaluate historical data and information flows, helping them adapt to changing market conditions (Lezoche et al., 2020). Most small-scale companies in the Indian fruit and vegetable sector use traditional methods due to financial instability and a lack of knowledge of advanced technologies (IFP Bureau, 2021). Consequently, by adopting Industry 4.0 applications, the Indian fruit and vegetable sector may benefit by shortening the

production cycle and the time it takes for the product to reach the market, thereby increasing efficiency, control, and cost savings (Corallo et al., 2018; Miranda et al., 2019).

2.5 Resource-based view of the circular economy

The RBV of a firm describes an organisation as a bundle of resources, and the best utilisation of those resources can lead to competitive strategies (Barney, 1991). To adapt to changing circumstances, companies need to reconfigure their resource bundles. However, this may not always be possible, because their existing resources and capabilities limit new resource investment directions. CE implementation can help build and complement a company's resources and capabilities, thereby providing a sustainable advantage. This is because a company's resources can be reconfigured by combining them, adding new ones, and substituting old ones. To this end, new resources and capabilities are needed to collect or source otherwise-wasted materials and resources and convert them into new added-value resources/materials or design processes that can extend product life.

However, there are several challenges in CE implementation that could be overcome by investing in Industry 4.0 applications (Kazancoglu et al., 2021; Khan et al., 2021; Vacchi et al., 2021). CE adoption levels remain low, and the role of Industry 4.0 applications in CE implementation has not yet been explored at the SME level in emerging countries. SMEs in emerging economies face resource constraints, and competitive advantages may emerge as a result of CE requirements, such as resource reconfiguration. A firm's resources can be classified as either tangible or intangible. Examples of tangible resources are assets and machines, whereas intellectual capital, organisational knowledge, and staff skills are examples of intangible resources (Barreto, 2010; Teece & Pisano, 1994). Organisational capabilities can be developed based on these resources, including collaborative capability, financial capability, automation capability, predictive capability, self-learning capability, and agile capability (Mikalef & Pateli, 2017; Mikalef et al., 2019).

The collaborative capability of a firm can be developed through Industry 4.0 applications. The high visibility of crucial information allocations generates high trust, which can improve decision making and coordination processes (Williams et al., 2013). Information technology, such as cloud and blockchain, enables large amounts of critical information, such as transaction information and customer information, to be instantly shared, communicated, and secured, resulting in an intimate cooperation relationship (Giannakis et al., 2019). Financial capability is a key capability that is required for Industry 4.0 technologies, as investments in new equipment and updates to existing ones are essential for success. Predictive capability is an essential advantage gained from implementing Industry 4.0, as it can pinpoint future demand and supply changes (Gunasekaran et al., 2017; Hazen et al., 2016; Ilie-Zudor et al., 2015). When Industry 4.0 takes full advantage of its inimitable information and knowledge resources, as well as advanced data analysis technology, to predict unexpected demands and events, it will produce a superior resilient advantage in operation (Sheffi & Rice, 2005). IT automation, AI, and other subjects from Industry 4.0 enable self-learning with the lowest possible human costs (Oesterreich & Teuteberg, 2016). Innovative activities centred on the concept of Industry 4.0 will require new ways of updating product systems on a continuous basis. With advanced self-learning capability, human labour is maximised, and products are manufactured 24 h a day (Oesterreich & Teuteberg, 2016).

Companies will be more flexible and adaptable to volatile environments as a result of the agile capability brought about by Industry 4.0. Authentic market information is gathered

throughout the supply chain, and supplier performance improves through greater end-to-end engineering integration (Wong et al., 2015). Real-time assessment capability, which increases information transparency between different partners, is one way that enterprises can gain a competitive advantage through Industry 4.0. As a result, trust is built for long-term cooperation (Delbufalo, 2012). One of the greatest benefits of Industry 4.0 is its automation capability, that is, real-time assessment/sharing capability, which is identified as a magnificent enabler in this study. Massive amounts of data are required and exchanged with a large number of SC players. Therefore, transparency and visibility are guaranteed throughout the operational and management processes (Spanaki et al., 2018). Based on the barriers and enablers of Industry 4.0 in CE implementation for Indian fruit and vegetable SMEs, this study identifies tangible and intangible resources, as well as capabilities. Relative enablers are considered competitive advantages, while barriers are considered competitive disadvantages. Hence, the aim of this study is to explore the enablers and barriers of Industry 4.0 adoption for CE implementation in fruit and vegetable SMEs in India from an RBV perspective, and then propose a framework for CE implementation for SMEs in emerging economies based on the insights.

2.6 Research gap

Industry 4.0 has played a crucial role in improving existing technology and has the potential to support CE principles (Khan et al., 2021). The enablers of Industry 4.0 with regard to CE are improved energy efficiency and waste management systems, enhanced reliability and uptime, enhanced resilience, improved quality, improved infrastructure, and self-optimisation (Chauhan et al., 2021; Fatimah et al., 2020; Kazancoglu et al., 2021; Khan et al., 2021; Rajput & Singh, 2021; Vacchi et al., 2021). The barriers to Industry 4.0 relating to CE are interconnectedness and collaboration issues, data safety and security issues, high investment costs, and infrastructure and incompatibility issues (Almada-Lobo, 2016; Rajput & Singh, 2021). Various studies have investigated the principles, enablers, and barriers to CE and Industry 4.0 applications. However, the enablers and barriers of Industry 4.0 as a resource from the RBV point of view that will bring competitive advantage through CE in emerging market SMEs remain unexplored. The aim of this study is to address this research gap through interviews with food SME experts in the Indian fruit and vegetable sector, as well as to answer the following research question:

- What are the enablers and barriers of Industry 4.0 that could facilitate CE principle implementation in SMEs in emerging economies, particularly in the Indian fruit and vegetable supply chain, from the RBV perspective?

3 Research methodology

Given the exploratory nature of this study, a field study approach was used to identify Industry 4.0 enablers and barriers to CE implementation in the emerging market of fruit and vegetable SMEs. This allows for an in-depth exploratory investigation of the phenomenon under study, which leads to theory development (Ketokivi & Choi, 2014; Yin, 2009). The aim of this study was to add to the existing literature and further elaborate on the theory of CE in SMEs in emerging economies by focusing on Industry 4.0 as an enabler of CE implementation. The study is multifaceted, drawing on evidence from existing academic research while combining the explicit and tacit knowledge of experienced field professionals (Bryman & Bell, 2011)

to represent the perspectives of the Indian food industry context. The approach falls under elicitation studies (Edgar & Manz, 2017), employing an exploratory qualitative field research design.

The aim of the study's data collection was to capture knowledge from experts in the field (Suri, 2011); thus, purposeful sampling was used (Coyne, 1997; Patton, 2002; Suri, 2011). Industry professionals from the Indian food industry were identified based on their experience in the field, as well as their expertise in the vegetable and fruit industry (Table 2). Qualitative interviews engage investigators and respondents in a variety of dialogues and discussions in

Table 2 Information about the participants in this study

Interviewee code	Position	Experience (Years)	Number of employees	Products
I1	Managing director	17	30	Coconuts
I2	Proprietor	7	35	Lemons
I3	Director	16	20	Peas, Corn, and Cabbage
I4	Senior manager	9	50	Carrots, Cabbage, and Spinach
I5	Managing director	5	20	Bananas and Coconuts
I6	Sales and stock manager	8	60	Mangoes, Jackfruit, Cherries, Pumpkins, and Tomatoes
I7	Head of quality control	14	70	Papayas, Drumsticks, Bottle gourd, and Brinjals
I8	Head of finance and accounts	7	40	Potatoes, Beans, Onions, Garlic, Ginger, Guava, and Sapota
I9	Proprietor	40	40	Amla, Mangoes, Lemons, and Coconuts
I10	Manager	6	50	Mangoes, Bananas, and Coconuts
I11	Director	10	30	Mangoes and Coconuts
I12	Senior manager	7	60	Guava, Mangoes, and Cherries
I13	Proprietor	16	50	Papayas and Mangoes
I14	Manager	20	40	Potatoes, Onions, and Garlic
I15	Proprietor	15	20	Peas, Lemons, and Cabbage

which the topic is documented and examined (Bryman & Bell, 2011; Patton, 2002). This is useful for learning about another person's understanding, opinions, objectives, stance, and difficulties. For the purposes of this study, semi-structured interviews were carried out with 15 senior professionals from food SMEs in India. Semi-structured interviews involve prepared questions guided by identified themes that are consistently and systematically interposed with probes designed to elicit more detailed responses. The focus is on the interview guide, which incorporates a series of broad themes to be covered during the interview to help direct the conversation towards the topics and issues that the interviewers want to learn more about (Hennink et al., 2017). Hence, this was the most suitable option for investigating the enablers and barriers of Industry 4.0 for CE in countries such as India. It enables researchers to obtain detailed information, good response levels, and an in-depth understanding of the issue.

Before commencing the interview process, a series of questions were prepared to gather information about the topic. The questions were flexible, allowing the scope of enquiry to be broadened and adjusted according to changing responses to the interview material (Patton, 2002). These questions were designed to improve existing knowledge and provide insights into the interviewees' perceptions (Patton, 2002). The questions were planned in accordance with the aim of the study, which began with the implementation of CE principles and Industry 4.0 technologies, which served as the foundation for the entire study. Questions concerning the relationship between Industry 4.0 and CE principles were also developed to determine whether Industry 4.0 applications aided or hampered the implementation of CE principles in the context of the study (Rajput & Singh, 2021). Lastly, demographic questions were set up. Overall, the interview guide helped examine the relationship between Industry 4.0 and CE principles implementation, as well as their enablers and barriers, in the Indian fruit and vegetable sector.

As there is no specific list with the names of fruit and vegetable producers in India, the non-probability snowball sampling technique was selected to identify respondents for this study. The researchers' personal contacts were used as an initial pool of respondents, followed by reaching out to the contacts of the initially interviewed food supply chain SME experts as a second pool of respondents. Respondents included businesses involved in the supply of fruits, vegetables, frozen food, and groceries, which allowed for capturing views from various areas of the sector. Fifteen interviews were conducted with food supply chain SME experts. The number of interviews was decided based on saturation (Guest et al., 2006; Hennink et al., 2017) and the importance of having 20 or fewer participants to improve information exchange (Fontana & Frey, 1994).

The goal of the study was to identify the enablers and barriers of Industry 4.0 for CE implementation. Therefore, conducting interviews specifically on this topic allowed the researchers to achieve the desired results. The interviews were conducted online via Skype. Table 2 provides detailed information about the participants, as well as their experiences and the types of products they dealt with. Interviews were conducted with people in various positions with experience ranging from 5 to 40 years to generate diverse perspectives on the topic. Further, firms that sell single products, as well as those that sell fruit and vegetable assortments, were considered.

The interviews lasted 40 min to an hour, and the respondents agreed to be audio-recorded. Prior to the interviews, each interviewee was given an informed consent form and a confidentiality agreement. During the interview, respondents were encouraged to elaborate on their answers and anything else that they thought was relevant to the topic in order to explore any other issues in depth (Fontana & Frey, 1994). The interview recordings were analysed using thematic analysis with coding (Boyatzis, 1998; Braun & Clarke, 2006). The themes for the data analysis were the CE practices, the Industry 4.0 applications, and the various

barriers and enablers of Industry 4.0 identified through the literature review. As soon as the data were collected, two researchers coded each interview, first to identify whether additional interviews were required, and second to send the transcripts to the interviewees for review.

To ensure reliability and validity, the researchers provided background information on all the participants who agreed to be interviewed. Prior to the commencement of the interviews, the researchers provided 24 h' notice in accordance with the requirements for participation shared with the participants for consent prior to participation in this study. This increased trust because they had the option to withdraw at any time if they felt uncomfortable. During the interviews, the researcher's questions were strictly about the study; no other information was gathered. As a result, the validity and reliability of the research were ensured.

The data analysis was complemented with a sentiment and emotion analysis of the interview transcripts to identify the sentiments and emotions of the interviewees regarding CE practices, Industry 4.0 applications, and the various barriers and enablers of Industry 4.0. The analyses were carried out using IBM Watson Natural Language Understanding (NLU) cloud native software, which uses deep learning to extract sentiment, emotion, and other text-based metadata. The IBM Watson NLU sentiment analysis identifies attitudes, opinions, or feelings in text. The NLU analyses sentiments based not only on the polarity of individual words but also on the text's sequence. The results are displayed through sentiment labels of positive (score 0 to 1), neutral (score 0), and negative (score − 1 to 0). By contrast, emotion analysis allows for going beyond polarity to detect emotions, such as joy, sadness, fear, disgust, and anger, which ensures more granularity. Subsequently, hierarchical cluster analysis, k-means cluster analysis, and linear projection analysis were performed to identify the group of SMEs that shared the same features in terms of CE principles and Industry 4.0 applications. Figure 1 depicts the flowchart of the approach followed in this study.

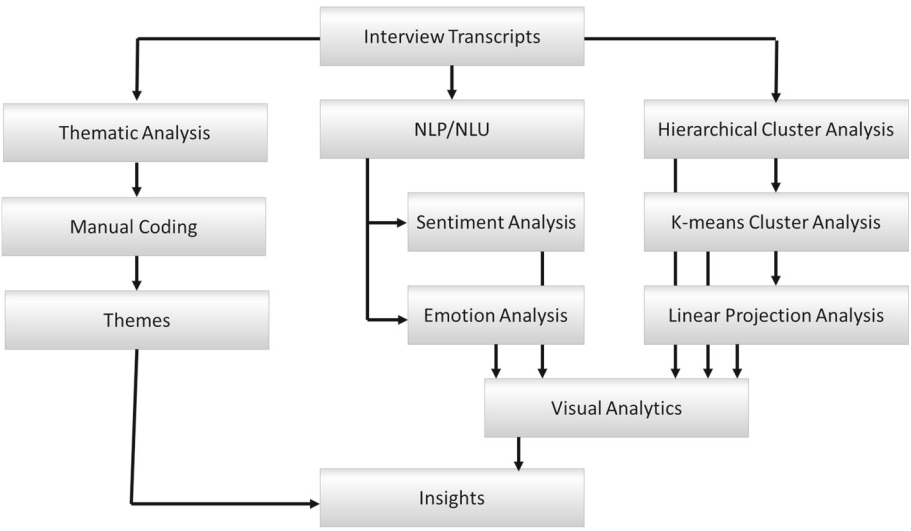

Fig. 1 Flowchart of the approaches to data analysis

4 Research findings and analysis

This study sought to understand the enablers and barriers of Industry 4.0 for CE principles implementation by SMEs in an emerging market in the food sector, namely fruit and vegetable SMEs in India. Hence, the interviewees were asked questions about the following aspects: CE practice implementation, Industry 4.0 practice implementation, and Industry 4 barriers and enablers in CE implementation.

4.1 Circular economy practices in the Indian fruit and vegetable sector

According to the literature, CE principles are divided into three main categories: reduce, reuse, and recycle. When asked about the application of these principles, all of the interviewees stated that they engaged in the CE practices of recycling, reducing, and reusing products. In terms of reducing waste and resource practices, the interviewees stated that they used water efficiency methods, such as rainwater wastewater, temperature control warehouses, collaborations with wholesalers, and recyclable packaging. A few of the interviewees stated:

> Along with these, we have contracted check dams to harvest rainwater, which increases groundwater level and acts as a useful water resource for our produce in times of need. (I3)

> Sometimes we cannot sell all our products in the local markets; therefore, we established collaborations with wholesalers who can immediately collect our produce and sell it somewhere else. Some buyers require that we package our fruit, and in collaboration with them we developed recyclable packaging (I9)

Regarding reusing products, the interviewees reported that they reused fruits and vegetables in a variety of ways, including creating value-added products, such as marmalade juice, using the exterior of the fruit as food packaging, animal feed, organic fertiliser, and plant-growing enhancement ingredients. Some of the interviewees mentioned:

> Coconuts are sold for retail or any other purpose; the outer unused shells are taken back by the company and are being reused for growing plants and used as containers. We also have leaf extracts that can be used instead of chemical pesticides and insecticides. This helps to avoid insects. (I6)

> Fruits like mangoes that are damaged while being transported are used for juices, in which we remove the damaged part of fruit and use the rest effectively. At times, we also send these fruits to companies that also make jams. Vegetables like tomatoes that are damaged are reused in such a way that we carefully extract the flawed portion and use the rest for making salads or for juices. (I11)

The majority of the participants engaged in recycling practices, converting their food waste into natural compost or using it to generate biogas. This helped them in multiple ways, including environmental security and pollution reduction. A few instances of recycling that the participants mentioned were as follows:

> In our farming company, we have a huge recycling plant that is used for converting coconuts and other unused food products into manure, which we use for our own crops and sell to other farmers who are in need of organic fertilisers. We also have leaf extracts

Table 3 CE principles implemented by the interviewees

Interviewee code	CE principles		
	Reduce	Recycle	Reuse
I1	X	✓	✓
I2	X	✓	X
I3	✓	✓	X
I4	X	✓	✓
I5	✓	✓	X
I6	X	✓	✓
I7	X	✓	X
I8	✓	✓	X
I9	✓	✓	✓
I10	X	✓	✓
I11	✓	✓	✓
I12	✓	✓	X
I13	X	✓	✓
I14	X	✓	✓
I15	✓	✓	X

that can be used instead of chemical pesticides and insecticides. This helps to avoid insects. (I5)

We generate lots of renewable energy in the form of biogas which avoids wastage and if there are products which are further leftover, those are used as manure which goes back to the field thereby completing the cycle. (I12)

The products we mainly use are perishables like fruits and vegetables that don't last for 3 to 4 days, which causes more wastage than other fields of business. So, we take steps to convert the wastage into manure, which we use for the fruits and vegetables that we grow in our own warehouse. (I14)

Table 3 provides a comprehensive overview of the various CE principles applied by the participants. According to the table, 7 of the 15 participants used reduction, 8 reused, all incorporated recycling, and only 2 used all 3 CE principles. This demonstrates that participants understand CE principles, which can aid in the implementation of CE principles in the Indian fruit and vegetable sector.

Sentiment analysis further identified the sentiments of the interviewees regarding the concept of CE and its principles. The interviews revealed a generally positive sentiment, although the tendency was towards neutrality. For example, interviewees indicated that CE offered several benefits, such as minimal wastage, reuse of resources, extension of the life-cycle of products, business sustainability, renewable energy, and pollution reduction. In this respect, the interviewees adopted a positive vocabulary in characterising their perceptions of the CE concept and its principles. This highlights that the interviewees had a positive attitude towards CE implementation in the fruit and vegetable sector, even though they did not all adopt all CE principles in practice. The tendency towards a neutral sentiment is relevant, however, and this can be explained by the fact that these interviews were characterised by a

greater emphasis on definitions and descriptions, which lowered the level of sentimentality displayed.

4.2 Industry 4.0 applications in the Indian fruit and vegetable sector

As previously stated in the literature review, Industry 4.0 applications include IoT, cloud computing, big data, augmented reality, and cyber-physical systems and security. Nine of the 15 participants employed Industry 4.0 applications in their firms, particularly cloud computing and IoT, because they felt these applications improved the level of control, they had over their firms. The majority of the interviewees stated that a common cloud computing issue they faced was poor purchase plans. However, some of the candidates also mentioned the following:

> We do use cloud technologies to control purchase because we have many vendors across different cities, and in the earlier days, we had issues regarding demand and supply. There was demand, and we were ready to supply, but there was no link between them. (I1)

Thus, with the introduction of cloud computing, their efficiency in handling data increased, allowing them to save money by keeping better track of their orders and increasing their mobility. Cloud technologies provide high levels of authentication, supervision, and encryption; they assist in keeping their data secured while scaling up their operations. As a result, it helped ensure scalability and security. The interviews highlighted these benefits, as shown in the following excerpts:

> We implemented a cloud-based technology where an online platform was set up to feed the demand, which helps our company get orders in real time. These orders are processed in such a way that we avoid wastage. (I3)

> While sending and receiving orders, we use cloud computing, which helps us to keep track of the orders and store them safely. We are using cloud computing so that it can be accessed from different places and at any time. (I8)

Other than cloud computing, applications such as IoT can be used for fine-tuning operations, better control, and an improved ordering system. One of the interviewees mentioned:

> As of now, we are using the internet of Things (IoT) for LAN [local area network] and WAN [wide area network] to connect all our business operations from the field to the store. We manage to send notifications on our customers' mobile phones through IoT applications when their orders are ready for collection. We have buyers from other cities, and we can better understand the demand. (I11)

Further, some of the participants took the initiative to introduce more Industry 4.0 applications in the future. However, 6 of the 15 interviewees did not install any applications or new technologies, as they felt that India's fruit and vegetable sector was traditional. They did, however, recognise the enormous potential for these technologies to be introduced in the future. Participants indicated that:

> Indian agriculture is still very traditional, at least the banana and coconut cultivation are still being traditional, so we don't have much application of Industry 4.0 as of now. But in the near future, we are looking forward to using applications like big data, which

Table 4 Usage of Industry 4 applications per interviewee

Interviewee code	Type of Industry 4.0 application	
	Cloud computing	IoT
I1	✓	X
I2	X	X
I3	✓	✓
I4	X	✓
I5	X	X
I6	X	X
I7	X	X
I8	✓	X
I9	✓	✓
I10	X	X
I11	✓	✓
I12	X	✓
I13	X	X
I14	✓	X
I15	✓	X

could help in computing data, analysing past trends, forecasting, and understanding relationships between other external factors. (I5)

We are also planning to install cloud computing when we start expanding our retail branches to more locations in the near future. We are just moving forward with Industry 4.0 technology with respect to processing and reaching out to the customer. (I6)

Participants who had not yet implemented these technologies were not opposed to novel technologies or machinery inventions. They employed several types of machinery for chopping their vegetables and irrigating crops. A related example from the participants is as follows:

We use solar pumping motors for supplying water on the farm during sowing; then we use precision drip irrigation to irrigate the crops and the trees. (I10)

Based on the above analysis, it can be concluded that some companies in the Indian fruit and vegetable sector have adopted Industry 4.0 applications. In total, 9 of the 15 participants used at least one Industry 4.0 application. Cloud computing and IoT were predominantly used compared to other applications. Table 4 summarises the Industry 4.0 applications used by each interviewee. As shown in the table, 7 of the 15 are using cloud computing applications, 5 are using IoT applications, and 3 are using both.

A sentiment analysis regarding the use of Industry 4.0 applications revealed a positive sentiment among participants across all applications. This result highlights that the interviewees held a positive attitude towards the use of Industry 4.0 applications in the fruit and vegetable sector, with an average score of 0.54 positive sentiment. Figure 2 shows the average emotion scores with regard to the Industry 4.0 applications discussed by the interviewees. The results show that the positive sentiments were driven by the perceived benefits brought about specifically by "cloud computing" (average score of 46.09% joy) and "cloud-based

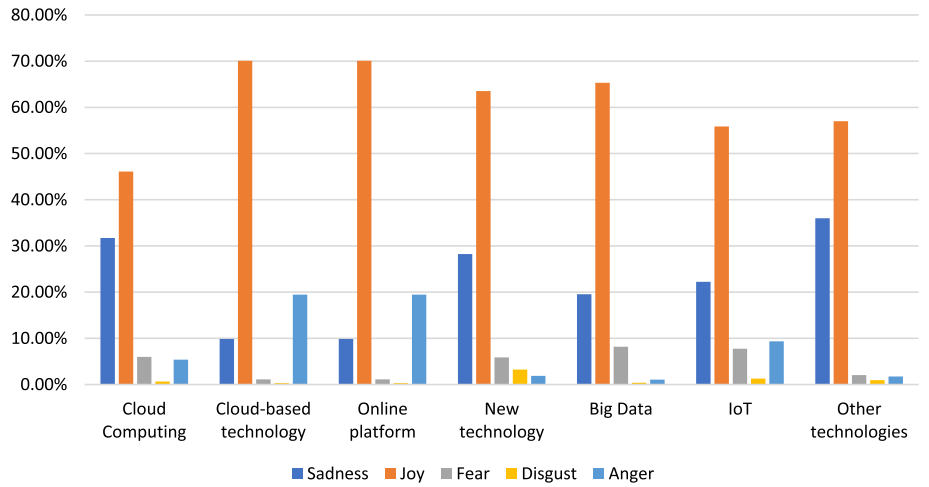

Fig. 2 Participants' average emotion scores on Industry 4.0 applications

technology" (average score of 70.06% joy), "online platforms" (average score of 70.06% joy), "new technology" (average score of 63.52% joy), "dig data" (average score of 65.32% joy), and "IoT" (average score of 55.87% joy), and solar pumping motors, with an average score of 57% joy). Even though not all respondents had implemented all these applications, the results showcase their awareness of the benefits that come with their adoption, which is indicative of them being very likely to adopt these in the future.

The interview transcripts were further subjected to cluster analysis to identify patterns in the full dataset of CE principles implemented by the various SMEs in India's fruit and vegetable sector, as well as the use of Industry 4.0 applications. In stage 1, we computed the number of clusters using hierarchical clustering. We used the cosine distance metric to obtain hierarchical clustering based on average linkage to compute the mean distance between the elements in any two clusters. The outputs are illustrated in Fig. 3, a visualisation of the formation of clusters, and Fig. 4 (hierarchical clustering), a dendrogram that reveals the existence of four clusters.

We then used k-means cluster analysis in stage 2 to optimise the group resolution for each cluster. The scatter plot of the k-means cluster in Fig. 5 considers the silhouette width, which was implemented for computing the optimal number of clusters in the k-means cluster analysis. It takes into account how perfectly the 'elements' are clustered, and it also measures the average distance between the clusters. It is worth noting that the number of clusters remains constant, at four.

The visual analysis in Fig. 5 identifies, therefore, four clusters to which the following 'elements' (three CE principles and two Industry 4.0 applications) belong:

- *Cluster 1* of objects I4, I6, I10, and I13. This cluster shows SMEs that implemented the 'recycle' and 'reuse' CE principles but did not implement the 'reduce' principle and did not use IoT applications.
- *Cluster 2* of objects I3, I9, I11, I12, and I15. This cluster shows SMEs that implemented only the 'reduce' and 'recycle' CE principles.
- *Cluster 3* of objects I1, I8, and I14. This cluster shows SMEs that implemented the 'recycle' CE principle and used 'cloud computing' but did not use 'IoT' applications.

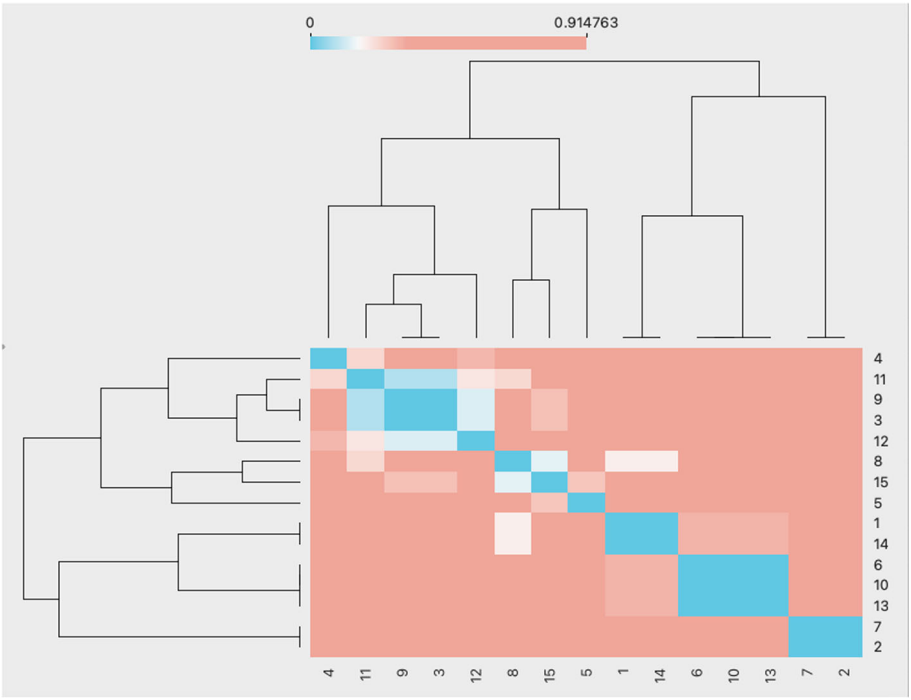

Fig. 3 Distance map—cluster with ordered leaves

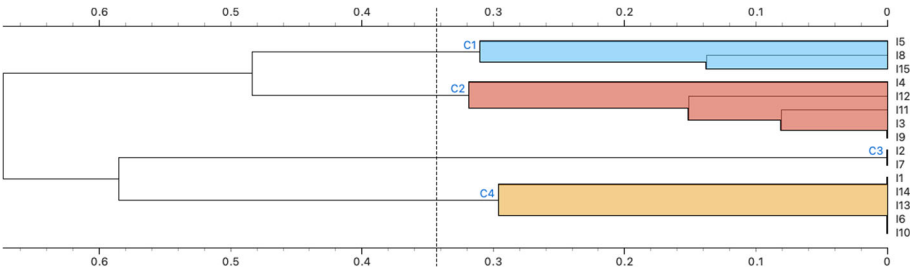

Fig. 4 Hierarchical clustering

- *Cluster 4* of objects I2, I5, and I7. This cluster shows SMEs that implemented the 'recycle' CE principle but did not implement the 'reuse' principles and did not use either 'cloud computing' or 'IoT' applications.

The identified clusters reveal interesting insights. The clusters group SMEs that share common characteristics in terms of implementing CE principles and using Industry 4.0 applications. Various combinations of CE principles and Industry 4.0 applications can be noted (also depicted in Figs. 6, 7); however, there is no cluster of SMEs that implements all three CE principles or both Industry 4.0 applications. This highlights the still-emerging nature of CE principles and Industry 4.0 applications in practice, supporting previous insights

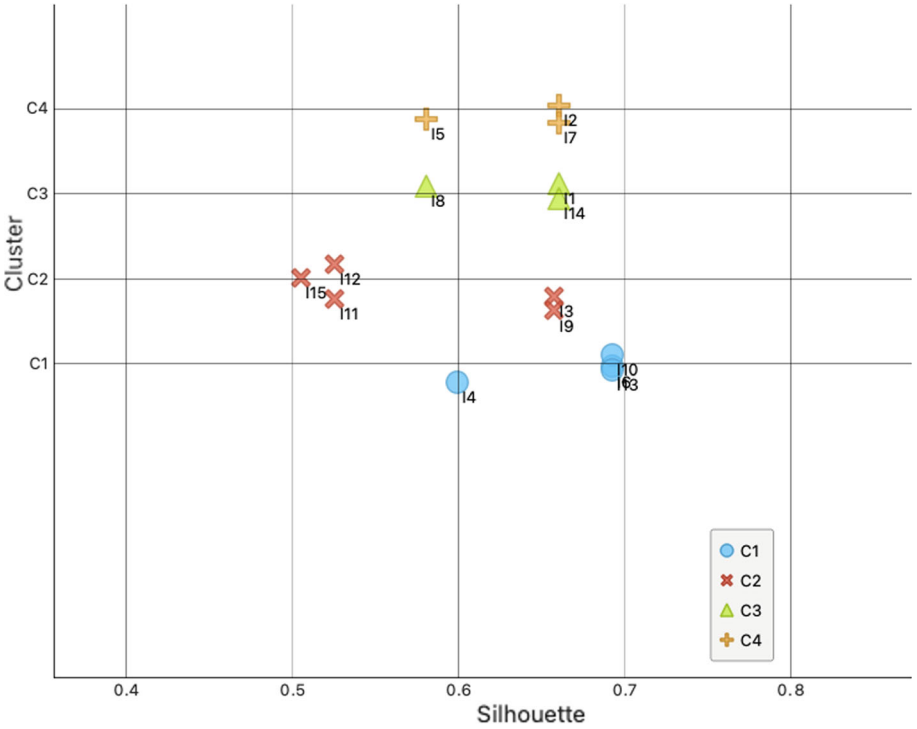

Fig. 5 Scatter plot of the k-means cluster

obtained from the thematic analysis. This outcome is also indicative of the work that needs to be done to remove barriers to their implementation.

4.3 Enablers and barriers of Industry 4.0 applications for circular economy principles implementation in the Indian fruit and vegetable sector

The impact of Industry 4.0 applications on the implementation of CE principles has its own set of enablers and barriers. The literature review analysis indicated the following enablers of Industry 4.0 for CE implementation: improved energy efficiency and waste management, enhanced process reliability and uptime, increased resilience, improved quality, improved infrastructure, and self-optimisation. The interviewees were asked their opinions about each of the enablers.

Industry 4.0 provides a wide range of applications that ensure that operating systems are continuously improved and updated. High levels of collaboration and constant product tracking can help companies save energy and reduce waste. This will ultimately help reduce overall costs and be more profitable, as products are optimally utilised. Some of the interviewees mentioned:

> The one enabler that comes to the top of my mind is energy and waste recovery. As I said earlier, wastage could be reused to produce organic manure, as organic farming is becoming very popular nowadays. I feel it is even starting to attract more youngsters

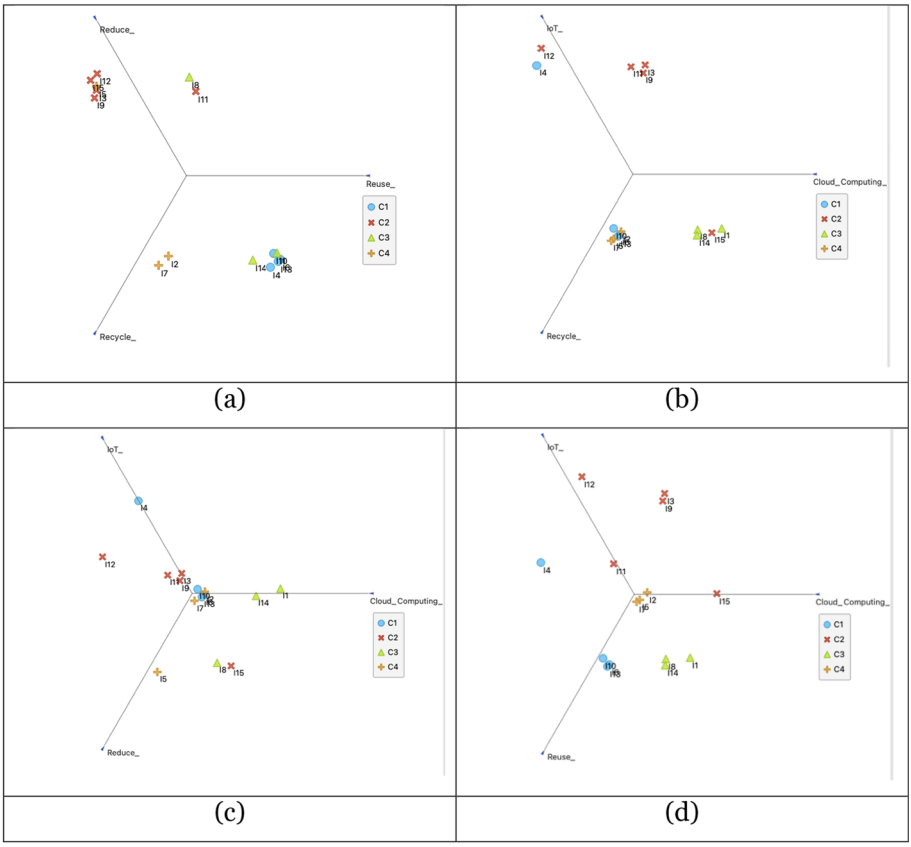

Fig. 6 Linear projection of interviewees based on different combinations of implemented CE principles and the usage of Industry 4.0 applications

to the agricultural sector. So, energy and waste recovery would be one enabler, as we have the chance though the use of technology to reuse and recycle the product. (I4)

Through the application of Industry 4.0, process reliability and uptime can be improved. Companies can now benefit from using machines and moving to automation, which is more consistent and faster than using labour. Some of the interviewees mentioned:

The technological applications that we use for demand planning help us control our wastage levels and plan our orders more efficiently. Since we started using online systems to inform our customers about their orders, we were able to schedule more deliveries at a shorter time as the order processing time was improved. (I11)

Industry 4.0 applications are dynamic and can instantly adapt to changes, which helps companies adapt. Subsequently, these applications can also predict machine failures before they occur, which helps companies make decisions based on them. These qualities improve the overall resilience of companies. One of the interviewees mentioned:

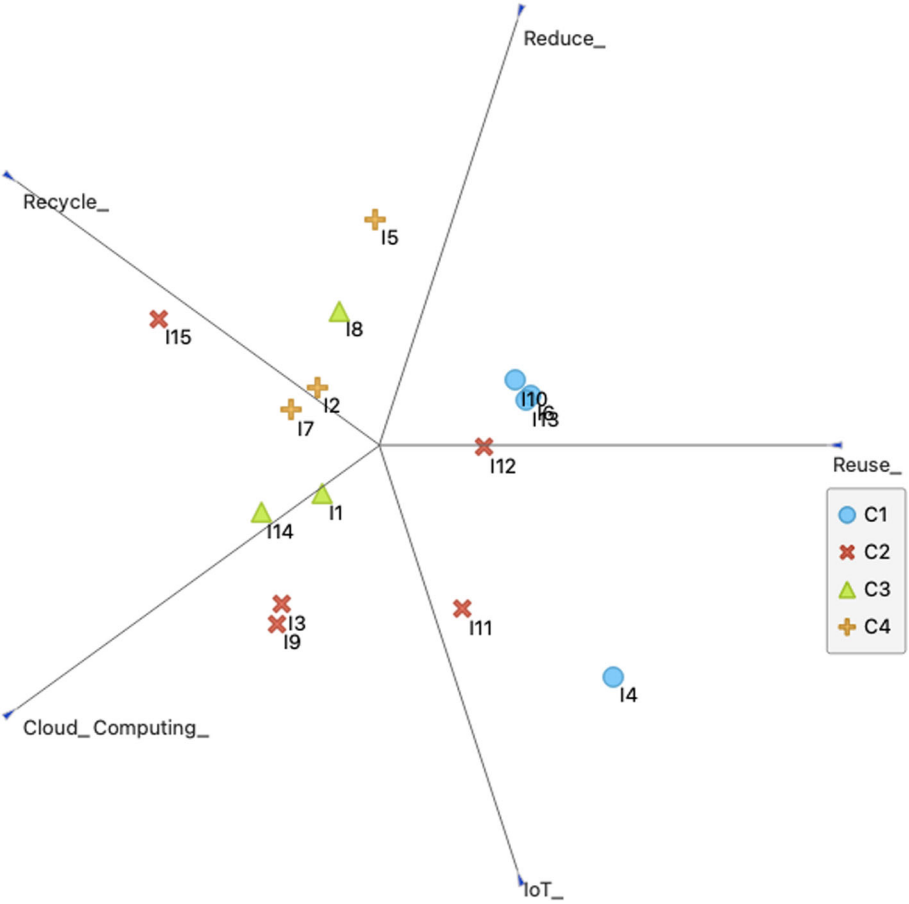

Fig. 7 Linear projection of interviewees based on implemented CE principles and usage of Industry 4.0 applications

> With the help of these efficient data processors, more accurate decisions can be made, thereby increasing flexibility as companies can cope up with changes easily. Especially in the vegetable sector in India, the demand and supply of vegetables are highly uncertain. (I3)

Industry 4.0 enhances a product's perceived quality, which allows companies to increase customer satisfaction. Companies now benefit from improving the quality of products by being cost-efficient, environmentally friendly, and productive. Some of the participants said:

> With the use of technology, we can track and process our customer orders more efficiently and effectively with reduced errors. This is very important for fruit and vegetables because they have limited shelf life and in case of errors they may be wasted. (I12)

Due to improved infrastructure, companies can cater to the specific needs of their customers and make the best use of the space available to them. The interviewees also reported

that by improving the current infrastructure, they would be able to accommodate new systems and concepts. One of the interviewees indicated that:

> According to our natural farm, I think the biggest enabler would be infrastructure. For example, it would help to improve the production, help us to manage the water efficiently, it would help us to provide minimal labour at maximum yield and can be used for saving energy. (I1)

This will, in turn, increase the performance of the production process by making it more dynamic and responsive. Having level processors allows companies to store and retrieve data independently without human interference, which frees up time to focus more on their core values and future opportunities, as these self-organised machines take care of recurring activities. One of the interviewees stated:

> Another important benefit is self-optimisation, as these technologies can cope with change and learn at the same time. So, don't have the burden of changing the systems and mainframes from time to time. Along with that, since these technologies can self-organise itself, the responsibility of reprogramming the data or devices will come down. (I9)

Regarding the interviewees' sentiments on the enablers of CE principle implementation with the greatest impact, the sentiment analysis revealed a positive sentiment, with an average score of 0.39 positive sentiment across all interviews (with joy as the predominant emotion, with an average score of 38.11%). A further breakdown of scores at the construct level (see Fig. 8), considering the predominant emotions associated with each of the main enablers, revealed that the interviewees were most content with the benefits of cultural enablers (average of 54.02% joy) and regulatory enablers (average of 40.81% joy). The emotions were mixed with regard to financial enablers (average of 27.16% joy and 22.48% sadness) and internal enablers (average of 26.18% joy and 12.91% sadness). Interestingly, the analysis also revealed the presence of fear, with an average score of 13.78% associated with regulatory enablers and 12.32% associated with cultural enablers, which can be explained by the fact that they

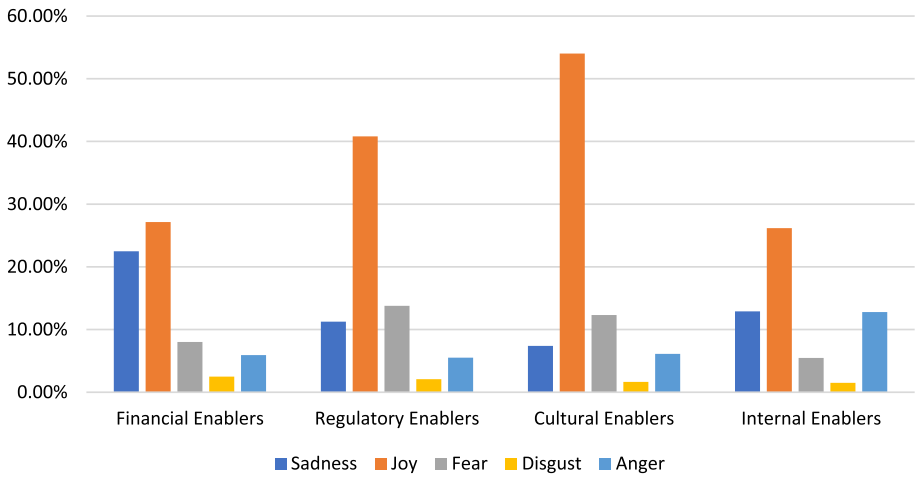

Fig. 8 Participants' average emotion scores on enablers of CE implementation

are the most difficult to deal with because they require structural changes, although they have the greatest potential to make a significant positive difference in practice.

Although Industry 4.0 applications appear to enable CE implementation, certain barriers must be addressed. Based on the literature review analysis, these are related to interconnectedness and collaboration issues, data safety and security issues, high investment costs, infrastructure, and incompatibility issues.

According to the interviewees, interconnectedness and collaboration issues are major barriers because of the lack of standardised software across the sector. This presents a disadvantage for a company that has installed cutting-edge technology because it will be unable to connect with other similar companies, leading to difficulties in placing orders and selling products on the market. The participants felt that:

> We could not share the data or information with other companies as they did not have the standardised medium for the data to be sent. Since there was no standardisation, we could not measure the abnormalities, which cost us a lot. Similarly, this reduced the collaboration, as we were not able to connect with other companies. (I8)

According to the interviewees, there are several issues with data safety and security because people can now afford to access this at any time, and a lack of knowledge will make people prone to injuries if they are not trained in how to use these technologies. According to some of the participants, external factors, such as animals, rainfall, and scarcity in India, have an impact on the safety of these applications. They said that:

> When it comes to safety and security, people will need to be trained, and at the moment, they are not trained to handle these technologies that use all this data. People will not be afraid to use new machinery if they know how to handle it. Safety and security are non-negotiable. If you have no personnel in charge of the safety and security of the equipment concerns, I think it is never going to work out. (I5)

Companies will have to incur massive investment costs to implement these technologies. They will also have to bear the burden of regularly checking applications to ensure maximum performance, which will incur ongoing maintenance costs. Given that the farming community in India is at the lower end of profitability, most farmers will face affordability issues.

> The present barrier is again related to cost, which is the financial barrier. Compared to other countries, the cost of doing business in India is quite high. Even though liberalisation has helped us get more money now, the cost remains high. To invest in new technologies, we need finance. At this stage, the technology in our country is not quite affordable for MSMEs [micro, small, and medium enterprises]. (I14)

Again, the majority of companies lack the basic infrastructure required to accommodate these advanced technologies. Thus, they will have to make significant changes to their current CE implementation efforts, which are not favoured in India due to the country's minimalistic culture. Another challenge will be for companies to convert all of their applications uniformly in order to facilitate data transfer. The participants felt that this problem would again lead to issues with the network and communication with other companies. One interviewee mentioned:

> Most of the systems in our company are still lacking the configurations of the latest technologies, and if we install the brand-new technology in one outlet, it won't be able to connect with the other outlets as they are still outdated. (I8)

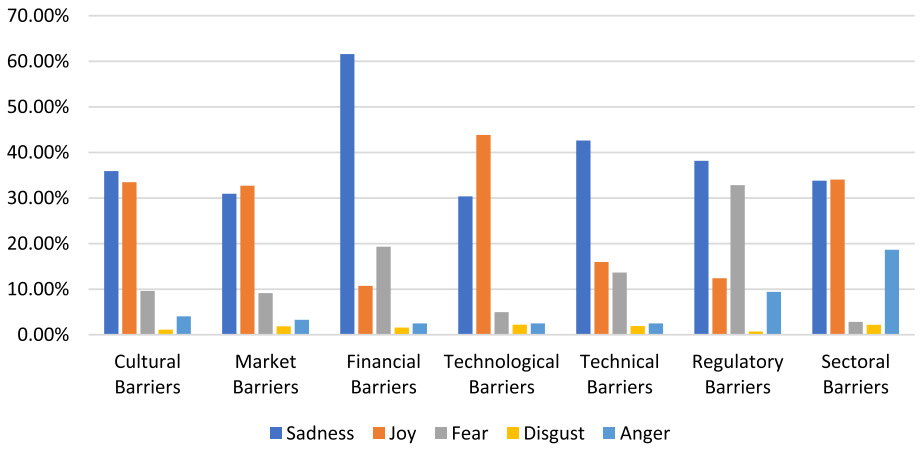

Fig. 9 Participants' average emotion scores on barriers to CE implementation

The most common enablers mentioned by the interviewees were enhanced resilience, improved infrastructure, and self-optimisation. These three enablers were said to play a crucial role in implementing CE for Industry 4.0. Similarly, almost all participants mentioned three of the four major investment cost barriers. This indicates that the greatest obstacle to Industry 4.0 in aiding CE is cost or total expenditure. This barrier, however, can be overcome if similar companies pool their resources and co-create or depend on the government to initiate and offer subsidies for the implementation of CE.

According to the sentiment analysis of the barriers to CE principle implementation with the greatest impact, the interviews expectedly revealed a general negative sentiment, with an average score of − 0.53 negative sentiment across all interviews; the dominant emotion was sadness, with an average overall score of 38.02%. A further breakdown of scores at the construct level (see Fig. 9), considering the predominant emotions associated with each of the main barriers, revealed that interviewees expressed the most sadness with financial barriers (61.59% average score) and technical barriers (42.61% average score). The least sadness was displayed regarding technological barriers (30.36% average score). The positive feelings towards technological barriers can be explained by the fact that all interviewees had already adopted some form of technology in their operations; therefore, their perception of this element being a barrier was low. The emotions were mixed with regard to cultural barriers (average of 35.90% joy and 33.46% sadness), market barriers (average of 30.93% joy and 32.70% sadness), and sectoral barriers (average of 33.80% joy and 34.03% sadness). The greatest level of fear was detected in relation to regulatory barriers (average score of 32.83%), followed by financial barriers (average score of 19.33%) and sectoral barriers (average score of 18.64%).

5 Discussion

This study aimed to explore the enablers and barriers of Industry 4.0 adoption for CE implementation in fruit and vegetable SMEs in India from the RBV perspective and, based on that, to propose a framework for CE implementation for SMEs in emerging economies. To this end, the adoption of CE principles and Industry 4.0 applications in a specific context

was explored. CE consists of three principles: recycling, reusing, and reducing (Reh, 2013). Recycling is not throwing away products after they have been used but rather repurposing them to be functional again. Similarly, reuse is a principle that ensures that products are not disposed of as waste and are instead consumed for the same purpose (Camacho-Otero et al., 2018). By contrast, reduction is the process of increasing production efficiency by optimising resources and avoiding goods that are harmful to society (Kazancoglu et al., 2021). On analysing these principles in relation to the implementation of CE in India, the interview data showed that all participants had incorporated at least one of these principles into their supply chains, proving that traces of these practices already exist in India. Out of these, recycling was the most common principle adopted by the participants.

Industry 4.0 refers to a new industrial revolution that has digitally transformed the supply chain of industries. Industry 4.0 applications include IoT, cloud technology, big data, augmented reality, and cyber-physical systems and security (Almada-Lobo, 2016; Oesterreich & Teuteberg, 2016; Vaidya et al., 2018). According to the findings, Indian SMEs are already embracing a few Industry 4.0 applications, with efforts being made by food SMEs to implement CE and adopt some Industry 4.0 applications. The two most commonly used Industry 4.0 applications are cloud computing and IoT, with forecasting, optimisation, and efficiency enhancement applications needed for CE. This will lead to the improvement of current systems by making them smarter, more unified, and more regulated. This, in turn, will help companies adopt more sustainable practices, leading to the implementation of CE. Figure 10 depicts the process of how Industry 4.0 contributes to CE.

This study aimed to identify the tangible and intangible resources and capabilities needed for CE implementation using Industry 4.0 applications. These were identified as enablers (that will serve as competitive advantages) and barriers (that will serve as competitive disadvantages) of Industry 4.0 for CE implementation. According to RBV theory, the needed capabilities can be delineated by identifying tangible and intangible resources. The findings of this study confirm the competitive advantages identified in the literature review analysis, which are as follows: improved energy and waste management, enhanced process and reliability uptime, enhanced resilience, improved quality, improved infrastructure, and self-optimisation (Fatimah et al., 2020; Kazancoglu et al., 2021; Khan et al., 2021; Vacchi et al., 2021) This study adds to the existing literature by confirming the existence of these enablers or other competitive advantages in Indian fruit and vegetable SMEs. Table 5 summarises the enablers/competitive advantages and barriers/competitive disadvantages of Industry 4 implementation for CE, as well as the respective resources and capabilities required or lacking from the perspective of SMEs, using RBV theory. Industry 4.0 applications have been mentioned as a means to develop specific capabilities, such as collaborative capability, financial capability, automation capability, predictive capability, self-learning capability, and agile capability (Mikalef & Pateli, 2017). Thus, this study confirms that Industry 4.0 technologies, particularly IoT and cloud computing, can assist SMEs in developing these capabilities, and further extends the literature by indicating that this will enable CE implementation.

Industry 4.0 promotes efficient practices that can reduce consumption while maintaining low levels of energy input to provide clear and scalable manufacturing expertise (Papadopoulos et al., 2021; Stock & Seliger, 2016). Such technologies can be programmed to identify products with the potential to be reused, thereby indirectly extending the good's life. This study confirmed that Industry 4.0 applications could indeed reduce energy consumption and facilitate waste reduction and management, enabling CE implementation at the SME level in India. This can be achieved through the use of both tangible and intangible resources (see Table 5). These tangible resources include tracking and tracing technologies, as well as financial resources. Knowledge and expertise, by contrast, are intangible resources, as is

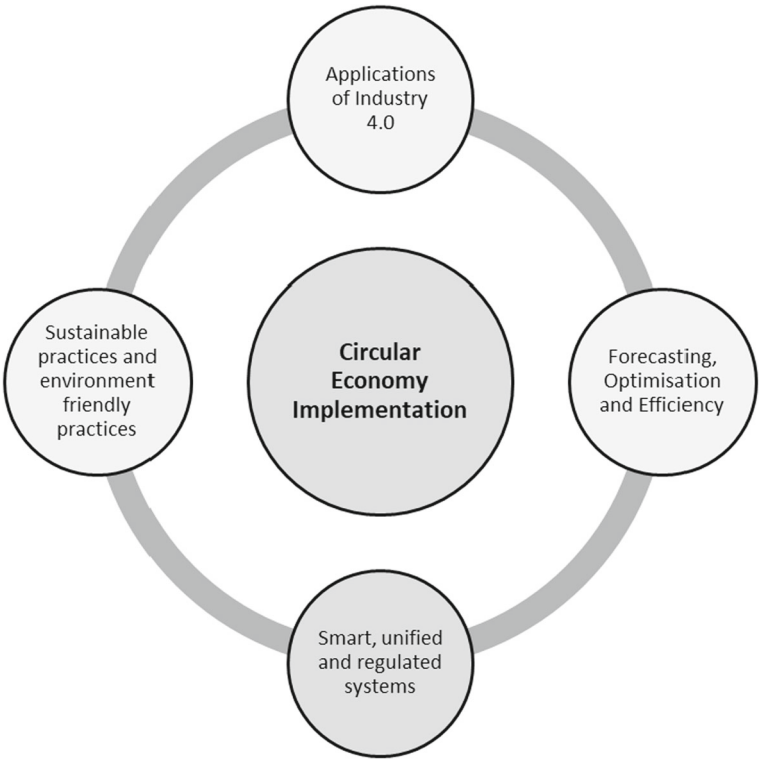

Fig. 10 The process of determining how Industry 4.0 impacts the circular economy based on the specific context. *Source*: Developed by the authors

supplier relationship management. Indian SMEs could develop collaborative and financial capabilities based on these two sets of resources.

According to the findings of this study, the cloud computing and IoT applications of Industry 4.0 could also enhance the process reliability and uptime of Indian fruit and vegetable SMEs for CE implementation. For this, tangible resources, such as updated machinery, online ordering systems, and demand and supply systems, are required. The intangible resources required are knowledge, expertise, and cumulative experience. All of these will contribute to the development of automation capabilities (see Table 5). CE could benefit from Industry 4.0 applications because it can enhance business resilience by establishing interconnections that transform the current business model to increase innovation and ensure business continuity (Azadegan et al., 2020). This study found that this is the case for Indian SMEs. It will be possible, however, only when machines are interconnected, proper demand and supply systems are in place, food supply chain visibility is present, and a changing culture is embedded. This would allow Indian SMEs to develop predictive capabilities.

Industry 4.0 applications for CE implementation efforts could help improve quality. This is because all data and resources are tracked and traced, and relevant information about their conditions is shared across the network (Spanaki et al., 2021). This study found that IoT and cloud computing applications can improve product quality in CE implementation when SMEs

Table 5 Enablers and barriers of Industry 4 implementation for CE and their respective resources and capabilities. *Source*: Developed by Authors

	Tangible resources	Intangible resources	Capabilities
Enablers/competitive advantages			
Improved energy and waste management systems	Tracking and tracing technologies Financial resources	Knowledge and expertise Supplier relationship management	Collaborative capability Financial capability
Enhanced process reliability and uptime	Updated machinery Online ordering systems Demand and supply planning systems	Knowledge and expertise Cumulative experience	Automation capability
Enhanced resilience	Demand and supply planning systems Connected machinery	Food supply chain visibility Change culture	Predictive capability
Improved quality	Tracking and tracing technologies Updated and connected machinery	Customer relationship management skills Skilled workforce	Self-learning capability
Improved infrastructure	Updated technical equipment Efficient resource management	Customer relationship management skills Technological know-how	Technological capability
Self-optimisation	Updated and connected technological equipment	Data management techniques	Agile capability
Barriers/competitive disadvantages			
Interconnectedness and collaboration issues	Lack of standardised software	Insufficient network collaborations	Lack of collaboration capability
Data safety and security issues	Inappropriate technologies Insufficient data safety and security measures	Lack of training Lack of knowledge on handling new technologies	Lack of self-learning capability
High investment cost	Budget constraints Lack of funding Absence of affordable technologies	Insufficient network relationships	Lack of collaboration capability Lack of financial capability
Infrastructure and incompatibility issues	Insufficient infrastructure for new technologies Shortage of new technologies in the country	Insufficient technological know-how	Lack of technological capability

have tracking and tracing technologies, updated machinery, customer relationship management skills, and a skilled workforce to operate the machinery effectively and efficiently. These technologies will enable the development of self-learning capabilities. Infrastructure improvements are also possible with Industry 4.0 in CE because it streamlines processes and ensures equipment integration (Adeyeri et al., 2015). This study found that at the SME level, this is possible when specific tangible resources, such as updated technical equipment and efficient resource management, as well as intangible ones, such as customer relationship

management skills and technological know-how, are in place, resulting in a technological capability for CE implementation. Industry 4.0 technologies for CE implementation can provide a self-optimisation advantage because they can handle sudden changes, adapt to them, and optimise current processes (Ivanov & Dolgui, 2020). Industry 4.0 can indeed bring the advantage of self-optimisation when implementing CE in Indian SMEs (Rajput & Singh, 2021). The resources needed for that are updated and connected technological equipment and data management techniques for building an agile capability.

Although the interviews revealed that Industry 4.0 comes with many enablers, also known as competitive advantages, certain barriers were found to be present in the specific context at the level of CE implementation. The barriers suggested by the literature are related to insufficient network collaborations, a lack of appropriate technological infrastructure, a lack of access to technologies, a lack of technical training for staff, and a lack of funding for new investments (Kazancoglu et al., 2021). This study confirms that these barriers, also known as competitive disadvantages, are present in Indian fruit and vegetable SMEs.

Industry 4.0 technologies are interconnected, and information is shared across the network, enabling the CE principles of reducing, reusing, and recycling (Reh, 2013). Thus, given that authentication requirements and trust complications among shared networks can disrupt the technologies, interconnectedness and collaboration issues may arise (Spanaki et al., 2018). This study found that interconnectedness and collaboration issues are present in the specific context of CE implementation via Industry 4.0. This is due to a lack of resources, specifically a lack of standardised software and insufficient network collaboration, which results in a lack of collaboration capability. Interlinked devices and shared networks could be prone to cyberattacks. During CE implementation using Industry 4.0 applications, data safety and security issues may arise (Spanaki et al., 2021). Indeed, this study found that the aforementioned issues are present at the SME level in India as a result of inappropriate technologies, insufficient data safety and security measures, lack of employee training, and a lack of knowledge about how to handle these new technologies. All of these factors inhibit the development of self-learning capabilities.

The high investment cost of Industry 4.0 adoption for CE, which has been mentioned as a barrier by different researchers (Rajput & Singh, 2021), was confirmed in this study to be a major competitive disadvantage for these technologies for CE implementation. This is due to SMEs' budget constraints, a lack of other sources of funding for these technologies, a lack of affordable technologies in the country, and insufficient network relationships that will allow these costs to be reduced through resource-sharing activities. As a result, SMEs face a lack of collaboration and financial capabilities. Researchers and companies have indicated that Industry 4.0 infrastructure and compatibility issues are common, which may inhibit CE implementation (Upadhyay et al., 2021). According to the findings of this study, this is due to SMEs lacking adequate infrastructure for these new technologies, a scarcity of new technologies in India, and a lack of technological know-how in the country.

Based on the above analysis, Fig. 11 depicts a conceptual framework that could be used by SMEs in emerging countries seeking to implement CE with Industry 4.0. According to the framework, SMEs must have certain tangible and intangible capabilities that will be acquired through the adoption of Industry 4.0 technologies to achieve this goal. These resources, gained through Industry 4.0 technologies, will enable the development of certain capabilities, giving CE a competitive advantage.

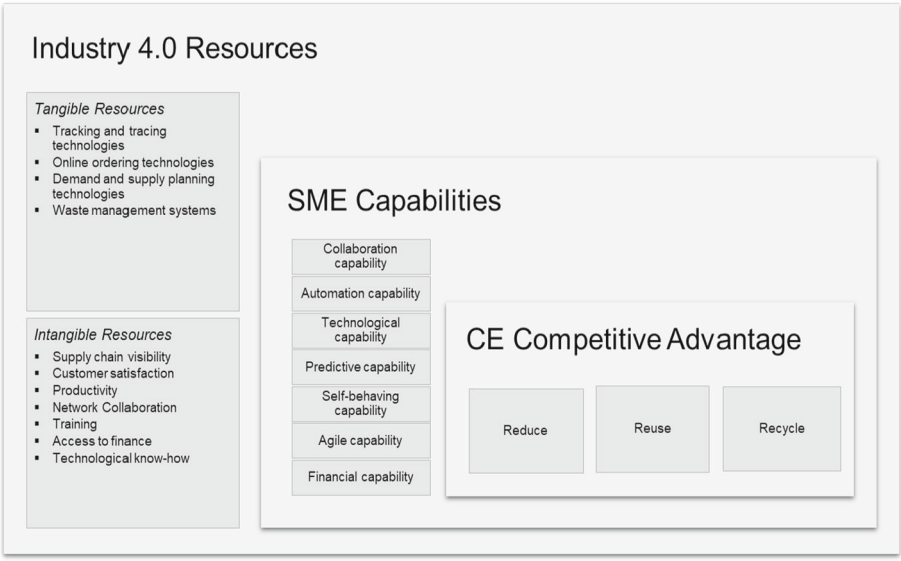

Fig. 11 Industry 4.0 resources and SME capabilities for CE competitive advantage in emerging economies. Source: Developed by the authors

6 Conclusions

India is the world's second largest producer of fruits and vegetables, trailing only China (IFP Bureau, 2021). Even though the country is prospering in terms of production and exports, one of the major drawbacks it has been facing in recent times is the wastage of perishable goods. Poor infrastructure, inadequate packaging, improper handling, and a lack of cold storage facilities are some of the major causes of waste (Despoudi, 2019). Thus, incorporating CE principles into the supply chain can help the country reduce waste while improving its sustainability practices.

This study explored the enablers of and barriers to Industry 4.0 adoption for CE implementation in fruit and vegetable SMEs in India from the RBV perspective. The enablers and barriers were considered competitive advantages and disadvantages, respectively. Interviews were conducted with 15 food SME experts from the Indian fruit and vegetable supply chain. This study explored the various CE principles, as well as the enablers and barriers to implementation. It further analysed the different applications of Industry 4.0 and the various enablers and barriers of Industry 4.0 that will impact the implementation of CE principles. The findings show that CE principles could be successfully implemented in India because the country has already been exploring several principles in its supply chain. Industry 4.0 is expected to play a crucial role in assisting the overall CE implementation process.

Based on the findings, a conceptual framework for CE implementation using Industry 4.0 applications for SMEs in India was developed. According to the framework, for SMEs to achieve a CE competitive advantage, they need to have specific tangible and intangible resources, as well as SME capabilities, in place. SMEs that aim to become more sustainable should consider implementing Industry 4.0 applications because they could give them a competitive advantage. Closing the loop of the linear economy and adopting Industry 4.0 will support the implementation of CE.

6.1 Managerial implications

The findings of this study offer insights into the various enablers and barriers to implementing a circular economy using Industry 4.0, which can be used by supply chain managers or SMEs to improve their competitive position in the market, highlighting the importance of adopting a problem-centric thinking approach to decision making (Charles et al., 2022). SMEs must adopt new business models to improve their environmental performance while remaining financially sustainable. Industry 4.0 applications, despite apparent drawbacks, such as high investment costs and infrastructural issues for SMEs, have the potential to bring significant benefits and enable CE implementation. Managers of SMEs should seek to secure a reliable source of finance from investors, the government, or banks, among others. There is a need for increased focus on training and educating people on how to use these new technologies and their benefits. To ensure interconnectivity, SME managers should choose applications based on the company's needs and equipment. Adopting Industry 4.0 benefits the supply chain in general because it provides much-needed flexibility and improves the overall infrastructure. Therefore, implementing CE with the help of Industry 4.0 will reduce waste and extend the lifetime of resources by reducing, reusing, and recycling, thus bringing the company to a more viable state.

6.2 Limitations and future research

This study provides a broad overview of CE implementation in the Indian fruit and vegetable sector, as well as its relationship with Industry 4.0. However, the study has potential limitations that could serve as a foundation for future research. The first limitation relates to the industry chosen, as this study focused on Indian fruit and vegetable SMEs rather than on the entire fruit and vegetable supply chain. Future studies could examine Industry 4.0 and CE at the overall food supply chain level. As this study focused on SMEs in a specific sector and country, the findings are limited to this context. More studies are also needed to determine whether the identified resources and capabilities exist in SMEs in other sectors and countries. The data for this study were gathered through interviews with 15 food SME experts. In the future, a survey could be deployed to collect more data and broaden the generalisability of the findings.

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Declarations

Conflict of interest The authors have no conflict of interest in this manuscript.

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The effects of environmental, social and governance disclosure on the cost of capital in small and medium enterprises: The role of family business status

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Abstract

Environmental, social, and governance (ESG) disclosure has become a critical component of corporate reporting. However, the effectiveness of this type of disclosure remains poorly explored among small and medium enterprises (SMEs), despite the fact that these businesses represent the majority of firms around the world. By leveraging on a dataset of Italian listed SMEs, we fill this gap to shed new light on the effects of nonfinancial disclosure on the cost of capital. The study reveals that, in stark contrast with the evidence on large companies, environmental disclosure for SMEs is bound to provoke an increase in the cost of capital. Yet this pattern is capsized when the company is a family SME, as it benefits from environmental disclosure, as large companies do.

KEYWORDS

cost of capital, environmental disclosure, ESG disclosure, family business, small business, SMEs

JEL CLASSIFICATION

G14; G34; M14; M41; Q56

1 | INTRODUCTION

In recent years, environmental, social, and governance (ESG) disclosure has become a critical component of corporate reporting, assuming relevance among both academics and practitioners (Baldini, Dal Maso, Liberatore, Mazzi, & Terzani, 2018; Ng & Rezaee, 2015). Since Verrecchia (1983), scholars have focused their attention on the assessment of both the benefits and costs of ESG disclosure, mainly ascribing them to either the agency theory (Jensen & Meckling, 1979) or the stakeholder theory (Donaldson & Preston, 1995). The main belief, largely confirmed by empirical evidence, is that the benefits tend to outweigh the costs: firms that voluntarily disclose ESG information by publicizing it through corporate websites, annual and/or CSR reports, are bound to boost performance (Surroca, Tribó, & Waddock, 2010), increase their value (Nekhili, Nagati, Chtioui, & Rebolledo, 2017), and reduce the cost of capital[1] (El Ghoul, Guedhami, Kwok, & Mishra, 2011; Ng & Rezaee, 2015).

Yet, despite this growing interest, most of these studies have been conducted on large firms, leaving the case of small and medium enterprises (SMEs) poorly explored (Baumann-Pauly, Wickert, Spence, & Scherer, 2013). The practical relevance of bridging this gap is straightforward. SMEs represent 90% and 99% of worldwide (Bakos, Siu, Orengo, & Kasiri, 2020) and EU (Bartolacci, Caputo, & Soverchia, 2019) businesses, respectively, and their peculiarities in terms of structural, social, and functional factors (Russo & Perrini, 2010) make them very different from large firms. Indeed, SMEs are far from being "little big firms" (Tilley, 2000), and their specific characteristics (Dey et al., 2020), such as simpler management

[1]Throughout the paper, we use the generic term cost of capital or WACC to refer to the average price paid to company financiers, both shareholders and debtholders.

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schemes, limited financial and human resources, and stronger social relations, may alter the effectiveness of ESG disclosure. We nest inside this debate by arguing that, contrary to large firms, ESG disclosure is bound to increase the SMEs' weighted average cost of capital (WACC). Indeed, SME's peculiarities may affect the amount of costs and benefits of voluntary ESG disclosure that the agency theory and the stakeholder theory suggest. Thus, whereas benefits tend to outweigh costs in large companies, SMEs experience the opposite because they enjoy less benefits and suffer higher costs.

In addition, we argue that this relationship is negatively moderated by the family firm status. Indeed, family SMEs are very popular both in the United States (Kirchhoff & Kirchhoff, 1987) and Europe (European Commission, 2008), and because of their distinguishing characteristics (Chrisman, Chua, Pearson, & Barnett, 2012), for example, transgenerational intention, family identity, and social and human capital, they represent a stand-alone group in which ESG disclosure can affect the cost of capital in its own way. In other words, in the light of the resource-based view of the firm (Barney, 1991), we argue that the intangible assets that family firms can exploit to obtain a competitive advantage may affect the way costs and benefits of disclosure take place.

We test our arguments by leveraging on a unique dataset of Italian SMEs listed on the Alternative Investment Market (AIM), a segment of Borsa Italiana with low regulation requirements. Such a framework offers at least a twofold benefit. First, the AIM represents the largest European stock exchange specifically dedicated to SMEs.[2] Second, as their shares are traded on a stock market, we can benefit from a more reliable, market-based, proxy of the cost of capital, an aspect that usually hampers research on SMEs (e.g., Lardon & Deloof, 2014; Scherr & Hulburt, 2001).

Unlike with large companies, our empirical results show that ESG disclosure significantly increases the cost of capital for SMEs, though this effect is not affected by the family firm status. SMEs' huge recourse to bank financing usually delegates monitoring to financial intermediaries (Diamond, 1984), thereby making unnecessary, or better, ineffective, the cap on managerial discretion put by nonfinancial disclosure (Bushman & Smith, 2001; Hope & Thomas, 2008). Also, the limited diversification of SMEs reduces the discretion of the preparer and increases the chance that sensitive information containing clues to competitive advantage becomes disclosed, exposing SMEs to imitation from competitors.

The possibility to separately measure the disclosure related to each of the three components of the ESG index—environmental, social, and governance—allows us to further explore (i) if the three dimensions act homogeneously; (ii) what forces mainly dictate the results; and (iii) if the family firm status moderates them separately. We show that environmental disclosure dictates the increase in the cost of capital, whereas social and governance information does not exert any influence. Furthermore, we uncover that this relation is negatively moderated by the family firm status to the extent that, for family SMEs, the relationship between environmental disclosure and WACC turns negative.

With respect to the debate on ESG disclosure, we innovate on two accounts. First, we show that the impact of ESG disclosure on the cost of capital capsizes in the peculiar context of SMEs, further proving that they are not "little big companies." Second, we add to ESG literature by disentangling the effects of the three components of ESG disclosure to demonstrate that SMEs' financial investors do not rely on them evenly, as only environmental disclosure plays a pivotal role in their financing decisions.

We also contribute to the family business literature in two ways. First, to our best knowledge, this is the first study that investigates the effects of ESG disclosure in the context of family firms. Second, we add to the studies on the cost of capital of family firms by identifying a new driver: environmental disclosure (Anderson, Mansi, & Reeb, 2003; Zellweger, 2007).

Overall, the following take-away synthetizes our results: environmental disclosure is detrimental to an SME, unless it is a family business. Whereas compensation schemes may be enacted to incentivize environmental disclosure on the part of SMEs, a similar effort becomes unnecessary for family SMEs, as they benefit directly from better transparency, paying their financiers less.

2 | HYPOTHESES DEVELOPMENT

2.1 | ESG disclosure and cost of capital

Quazi and O'Brien (2000) describe the firms' approach to social responsibility as given by the intersection between two dimensions: vision of social responsibility (narrow to wider) and range of outcomes (costs vs. benefits). We build on their model and mainly on its cost–benefit dimension to assess the effectiveness of ESG. In this line, scholars have largely investigated the relationship between ESG disclosure and the cost of capital (Dhaliwal, Li, Tsang, & Yang, 2011; El Ghoul et al., 2011; Ng & Rezaee, 2015; Sharfman & Fernando, 2008). Abstracting from their peculiarities, these studies mainly refer to, or rely on, two main theories to hypothesize and discuss if and how nonfinancial disclosure is bound to alter a firm's cost of capital: agency and stakeholder theory. Under the lens of the former, higher levels of ESG disclosure reduce information asymmetries among investors and between investors and management, curbing monitoring costs (Dhaliwal et al., 2011; Reverte, 2012) and limiting managerial discretion. Accordingly, investors require lower rates of return for holding firms' stocks. Under the lens of the latter, companies should meet expectations of different groups of stakeholders, not only shareholders, to gain their support and to ensure the long-term value of the firm. By reflecting firms' practices in improving the work environment, maintaining customer loyalty, and strengthening relationships with stakeholders at large, ESG disclosure enables firms to attract more prepared employees, build trust over time, enhance visibility, and strengthen its reputation (Gray, Kouhy, & Lavers, 1995). Following this rationale, an improvement in intangible resources, such as trust,

[2]Source: https://aimnews.it/wp-content/uploads/2020/01/AIM-ITALIA-IRTOP-2019.pdf.

strong ties, and reputation, is bound to enhance a firm's competitiveness and performance, thereby easing external financing (Beyer, Cohen, Lys, & Walther, 2010; Ng & Rezaee, 2015).

On the other hand, ESG disclosure leads to either direct costs, such as those related to preparing and disseminating information (Ng & Rezaee, 2015; Prencipe, 2004), or indirect ones, namely, the loss of competitive advantage due to the leaking of important information to competitors (Healy & Palepu, 2001; Prencipe, 2004).

Empirical research reveals that the disclosure of such practices produces more benefits than costs, as publishing firms pay less for their capital (Cheng, Ioannou, & Serafeim, 2014; Dhaliwal et al., 2011; El Ghoul et al., 2011; La Rosa, Liberatore, Mazzi, & Terzani, 2018; Ng & Rezaee, 2015). However, these empirical assessments are mainly focused on large firms, leaving somewhat unexplored if this effect holds true for SMEs, too.

2.2 | ESG disclosure and cost of capital in SMEs

The peculiarities of SMEs may affect the way benefits and costs of ESG disclosure take place, thus undermining any inferential processes based on empirical evidence focused on large firms.

First, benefits can be limited. The simpler management structure of SMEs tends to reduce free riding by managers (Shleifer & Vishny, 1986) and facilitates direct communication between owners and managers (Torugsa, O'Donohue, & Hecker, 2012; Worthington, Ram, & Jones, 2006). Accordingly, the monitoring role of disclosure is bound to decrease, fading away when principal and agent coincide (Ang, Cole, & Lin, 2000). It can be further alleviated for SMEs because, due to their significant dependence on bank financing (Howorth & Moro, 2012), they are subject to the oversight of bankers (Ang et al., 2000; Diamond, 1984).

Second, costs may increase. ESG disclosure requires certain technical knowledge, advertising skills, organizational planning, and higher managerial efforts, which SMEs may lack. It is thus no coincidence that SMEs resource constraints, more binding than those of large firms, are considered as the main barrier to their socially responsible behavior (Parsa & Kouhy, 2008). Even indirect costs may grow: the lower diversification of SMEs, along with their usual focus on market niches (Torugsa et al., 2012), can potentially jeopardize their competitive advantage. Indeed, with the reduction in information asymmetries, a release of proprietary information is more likely to occur, as well as an increased risk of imitation from competitors.

Thus, the peculiarities of SMEs may alter the cost–benefit structure of voluntary nonfinancial disclosure, calling into question its overall effectiveness. Indeed, a reduction or total loss of monitoring role of disclosure, along with potentially having heavier costs due to the adoption of ESG disclosure tools, may result in an increase in the price required from SMEs' financiers. Thus, we hold that:

H1 ESG disclosure is positively associated with the cost of capital in SMEs.

2.3 | The moderating role of family firm status

The large presence of family SMEs (Chang, Chrisman, Chua, & Kellermanns, 2008) deserves a more fine-grained analysis regarding the relationship between ESG disclosure and cost of capital in these firms. As argued by Habbershon and Williams (1999), the interplay between firm's objective and family's values and goals makes family firms unique. Inspired by the resource-based view of the firm (Barney, 1991), Habbershon and Williams (1999) and Sirmon and Hitt (2003) argue that such uniqueness contributes to creating distinct resources that affect governance structure, and human and social capital, making them profoundly different from nonfamily firms.

In terms of benefits, ESG disclosure could be more beneficial in family SMEs for at least two reasons. First, the conflicts between controlling and minority shareholders may be acute, especially when the latter are not family members (Villalonga & Amit, 2006). Indeed, despite that the large frequency of block holders in SMEs makes them usually exposed to this governance issue (Cordeiro, Profumo, & Tutore, 2020), the presence of families is bound to make it worse. Indeed, in the spirit of the socio-emotional wealth (SEW) perspective (Berrone, Cruz, & Gómez-Mejía, 2012; Gómez-Mejía, Haynes, Núñez-Nickel, Jacobson, & Moyano-Fuentes, 2007), family firms differ from nonfamily ones in that they exhibit preference to gain and preserve nonfinancial aspects such as the desire to exert the family control and influence, the sense of identity, and perpetuation of family dynasty. This preference for SEW goals leads family firms to suboptimal investment decisions that maximize the family's utility rather than the firm's economic value (Berrone et al., 2012). Second, the fact that family firms are passed on generation to generation makes them more conservative and less in debt (López-Gracia & Sánchez-Andújar, 2007). The ensuing limited oversight by financial intermediaries reinstates the monitoring role of ESG disclosure. In terms of costs, ESG disclosure could affect family SMEs differently for reasons that are related to their human and social capital (Sirmon & Hitt, 2003). Regarding the former, family members have usually been involved in the family business since childhood and participate in both the family's and firm's relationships (Cabrera-Suárez, De Saá-Pérez, & García-Almeida, 2001). Thus, they develop strong commitment, a sense of belonging, and deeper tacit knowledge, elements that become key sources of competitive advantage that are difficult for competitors to imitate (Cabrera-Suárez et al., 2001; Sirmon & Hitt, 2003), even in the case of high disclosure. Concerning the latter, the superior ability of family SMEs to build trust over time and enhance long-lasting relationships with suppliers, customers, and the community at large provides them with additional resources from their networks (Arregle, Hitt, Sirmon, & Very, 2007). Even this type of resource is scarcely imitable by competitors, regardless the level of ESG disclosure.

Accordingly, we hypothesize that:

H2 The family firm status negatively moderates the relationship between ESG disclosure and the cost of capital in SMEs.

3 | STUDY DESIGN AND METHODOLOGY

3.1 | Disclosure index

Following the track set by previous studies on voluntary disclosure, we construct an ad hoc index that directly measures the level of ESG disclosure of each sampled SME by means of a content analysis (Botosan, 1997; Plumlee, Brown, Hayes, & Marshall, 2015). We adopt sentences as unit of analysis (Li, 2010) and a checklist based on the Global Reporting Initiative (GRI) guidelines to assess the level of discretionary ESG information disclosed by SMEs through annual/CSR/sustainability reports and/or corporate websites.

Specifically, the checklist includes the 94 GRI items regarding ESG: environmental—GRI 300, 32 items; social—GRI 400, 40 items; and governance—GRI 102, 22 items. For each company under scrutiny, two junior researchers completed the disclosure scoresheet, assigning to each item value 0 (no information), 1 (qualitative information), or 2 (quantitative information), whereas two senior researchers checked the accuracy of collected data.

Once the scoresheet is compiled, we compute the unweighted disclosure score indices by summing the points of the N items that make up each single category. In formula

$$X_i = \sum_{j=1}^{N_X} \max\left(s^j_{annual\ report}; s^j_{CSR\ report}; s^j_{corporate\ website}\right)_i, \quad (1)$$

where $X = E$, S, or G. In words, we construct three indices corresponding to the ESG components by summing the maximum score of each of the N items included in the specific category X. The corresponding individual scores (E_i, S_i, and G_i) constitute the ingredients necessary to compute the aggregate ESG score of the ith company, as described by Equation 2:

$$ESG\ score_i = E_i + S_i + G_i. \quad (2)$$

Because the checklist includes 94 items, the resulted aggregate score ranges from 0 (no ESG disclosure) to 188 (quantitative information is disclosed for all selected items). As robustness check, we also rescaled the indices in a 0–2 range, dividing them by the number of items. Results qualitatively confirm those shown here and are available upon request from the authors.

3.2 | Sample selection

We construct our sample starting from the 132 SMEs listed on AIM Italia with an active market status in December 2019. Out of these companies, we excluded those pertaining to the financial industry (21), three foreign/non-Italian companies, and 21 others, either because of missing data (17) or because they were outliers (4). The final sample includes 87 companies, with the industrial (energy) sector being the most (least) represented, as it counts for 36.8% (10.3%) of the sampled companies.

All data except for the ESG score (see Section 3.1) come from Bloomberg and PMI Capital, the vertical digital platform on AIM that supports SMEs during the listing process. Before turning to the next section, where the variable selection is thoroughly discussed, Table 1 provides both their descriptive statistics (mean and standard deviation) and the correlations among them.

Companies under scrutiny appear extremely heterogeneous. In terms of size, they range from 1.33 to 413.16 Euro million (averaging 56.35), with the youngest (oldest) firm being 1 (93) year(s) old, average 18.47.

The ESG index reveals a weak nonfinancial disclosure among sampled SMEs, as it ranges from 0 (no ESG disclosure) to 49, averaging 12.63. As expected, correlations among selected variables are quite low, suggesting the absence of collinearity among them.

3.3 | Model and variables

To test the impact of ESG disclosure on the cost of capital (H1) and the moderating effect of the family firm status (H2), we estimate several models, all embedded in the most complete version presented in Equation 3, clustering standard errors by industry to account for common unobserved correlated components of outcomes within groups (Hansen, 2007).

$$WACC_i = \beta_0 + \beta_1 ESG\ score_i + \beta_2 Family\ firm\ status_i + \beta_3 Family\ firm\ status_i \cdot ESG\ score_i + \beta_4 X'_i + {}_i. \quad (3)$$

In line with Sharfman and Fernando (2008) and Vena, Sciascia, and Cortesi (2019), we use the measure of WACC provided by Bloomberg as dependent variable. Along with the control variables discussed below, the equation features three more variables that directly investigate our hypotheses. First, there is the ESG index ($ESG\ score_i$), proxying the level of ESG disclosure to assess whether the nonfinancial information alters the cost of capital (H1). Second, there is the dichotomous variable $Family\ firm\ status_i$ taking value of 0 in case of nonfamily SMEs and 1 for family SMEs. Third, there is the interaction term $Family\ firm\ status_i \cdot ESG\ score_i$, calculated as the product of the two originating variables, estimating the moderating role of family firm status on the relationship between ESG disclosure and the cost of capital (H2). We classify as family SMEs those companies that meet the following two criteria: (i) the family holds at least 10% of voting rights, either directly or indirectly, and (ii) at least one family member sits the board or is a top officer of the company (La Porta, Lopez-De-Silanes, & Shleifer, 1999).

Turning to the control variables ($X'_{i,t}$), we include size, measured by *Total assets* (ln); firm *Leverage*, the ratio of total assets to total capital, to control for the effects of capital structure decisions on the WACC; *Age* and *IPO*, computed as 1 plus the number of years since the firm's incorporation and listing date, respectively (Ortiz-Molina & Phillips, 2014); the dichotomous variable *Dloss*, taking value 1 in case of negative earnings and 0 otherwise (Ng & Rezaee, 2015); and the

TABLE 1 Descriptive statistics and correlations

Variables		Mean	St dev	Correlations (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
WACC	(1)	7.90	3.19	1.00													
Total assets	(2)	56.35	73.96	−0.28***	1.00												
Leverage	(3)	3.35	2.31	−0.38***	0.01	1.00											
FRQ	(4)	0.08	0.08	0.11	−0.11	0.02	1.00										
Innovative SMEs	(5)	0.39	0.49	0.29***	−0.33***	−0.06	0.13	1.00									
Nr analysts	(6)	1.01	0.83	−0.06	0.23**	−0.08	−0.01	0.13	1.00								
Age	(7)	18.47	18.07	−0.25**	0.30***	0.01	−0.21**	−0.23**	−0.17	1.00							
IPO	(8)	2.72	2.46	−0.27**	0.26**	0.16	0.01	−0.27**	−0.19*	0.09	1.00						
Dloss	(9)	0.24	0.43	0.14	−0.19*	0.03	0.14	0.04	−0.11	−0.11	0.24**	1.00					
Family firm status	(10)	0.53	0.50	−0.05	0.00	0.10	−0.11	−0.19*	−0.24**	0.29***	−0.06	−0.11	1.00				
ESG score	(11)	12.63	7.04	−0.06	0.23**	−0.05	−0.21*	−0.21*	0.09	0.43***	−0.11	−0.14	0.20*	1.00			
E score	(12)	1.89	3.11	−0.08	0.18*	−0.01	−0.14	−0.17	0.05	0.40***	−0.02	−0.12	0.17	0.83***	1.00		
S score	(13)	5.68	4.49	−0.04	0.18*	−0.04	−0.20*	−0.16	0.11	0.34***	−0.20*	−0.16	0.17	0.90***	0.54***	1.00	
G score	(14)	5.07	1.22	0.01	0.17	−0.10	−0.07	−0.18*	0.00	0.26**	0.14	0.08	0.09	0.35***	0.21**	0.13	1.00

Note: The table shows mean and standard deviation of the variables used to assess the effectiveness of ESG disclosure in SMEs and the Pearson's correlations among them. We thus have *WACC*, (%) the weighted average cost of capital; *Total assets*, (in EUR mln) the sum of all firm's assets; *Leverage*, a debt indicator computed as the ratio between total assets and total equity; *FRQ*, the proxy for financial reporting quality proposed by Ball and Shivakumar (2006); *Innovative SMEs*, dummy variable taking value 1 if the firm is an innovative SME, 0 otherwise; *Nr analysts*, the number of analysts covering the company; *Age*, the number of years since the firm's incorporation date; *IPO*, the numbers of years since the firms' IPO date; *Dloss*, dummy variable taking value 1 in case of negative earnings, 0 otherwise; *Family firm status*, dummy variable taking value 1 for family SMEs, 0 otherwise; *ESG score*, the aggregate index of environmental, social, and governance disclosure; *E score*, the score on environmental disclosure; *G score*, the score on governance disclosure; and *S score*, the score on social disclosure.

*Statistical significance at the 10% confidence level.

**Statistical significance at the 5% confidence level.

***Statistical significance at the 1% confidence level.

number of analysts following the company (*Nr analysts*). Because investors rely on financial reports to make their decisions (Francis, Nanda, & Olsson, 2008), we use the financial reporting quality (*FRQ*) proposed by Ball and Shivakumar (2006). Lastly, we model the higher risking innovative SMEs, companies with the explicit purpose to develop, produce, and commercialize innovative goods/services of high technological value. The relative variable, *Innovative SME*, takes value 1 if the firm is innovative and 0 otherwise.

4 | FINDINGS

Results and discussion will focus on the effect of the ESG score and on the moderating role played by the family firm status, limiting here our comments on control variables whose signs and significances align with expectations. Table 2 reports the results of the different model specifications.

In line with our first hypothesis, the coefficient associated with the ESG score is positive and statistically significant. Across the specifications, its magnitude is stable in the 0.067–0.071 range, signaling the robustness and the validity of such effect. In economic terms, for the mean SME, the ESG disclosure is worth almost 1% more in terms of price paid to financiers. Despite the fact that our empirical assessment does not allow for directly investigating the source of these effects, at least one of the following, not mutually exclusive, can be a valid rationale. First, the direct cost for SMEs to implement nonfinancial disclosure may be higher, while revealing nonfinancial information may end up being a threat to their competitive advantage. Second, the simpler management structure may limit the monitoring role usually played by nonfinancial disclosure.

Family firm status does not seem to moderate the ESG disclosure–WACC relationship (Table 2, last column). Indeed, albeit negative, the coefficient associated with the interaction term ($Family\ firm\ status_i \cdot ESG\ score_i$) fails to reach statistical significance (p-value 0.8164). The second hypothesis (H2) seems far from being confirmed by our empirical evidence: in economic terms, no matter the ownership structure of the SME, the disclosure of ESG information significantly contributes to increasing the cost of capital.

The next section further investigates this aspect by leveraging on the tripartition of nonfinancial disclosure in the ESG categories.

4.1 | Disentangling the dimensions of ESG disclosure

As previously pointed out, while confirming our first hypothesis, the evidence so far commented on appears to be in stark contrast with our second hypothesis, as the family firm status does not seem to play any moderating role. Depicting a rationale for this pattern appears difficult, especially because when they are highly engaged in reporting social activities, family SMEs are found to benefit greatly in terms of financial performance (Craig & Dibrell, 2006) and market value (Nekhili et al., 2017).

Accordingly, this section deepens our second hypothesis by resorting to the tripartition of the ESG index. That is, should the three dimensions of nonfinancial disclosure behave differently (in absurdly opposite ways), we may obtain a misleading indication from the

TABLE 2 Explanatory factors of SMEs' cost of capital: ESG score and the moderating role of family firm status

Indep var	WACC (1)	WACC (2)	WACC (3)	WACC (4)
Total assets (ln)	−0.267 (0.6324)	−0.357 (0.4960)	−0.384 (0.4428)	−0.384 (0.4476)
Leverage	−0.447** (0.0144)	−0.441** (0.0127)	−0.463*** (0.0035)	−0.468*** (0.0025)
FRQ	−0.004 (0.2999)	−0.004 (0.2860)	−0.004 (0.2365)	−0.004 (0.2276)
Innovative SMEs	1.124* (0.0538)	1.254** (0.0395)	1.307* (0.0620)	1.309* (0.0556)
Nr analysts	−0.673 (0.2626)	−0.713 (0.2167)	−0.605 (0.2981)	−0.603 (0.3030)
Age	−0.024** (0.0299)	−0.033** (0.0169)	−0.034** (0.0131)	−0.034** (0.0164)
IPO	−0.266* (0.0567)	−0.236** (0.0465)	−0.231** (0.0320)	−0.234** (0.0250)
Dloss	0.942 (0.2590)	0.943 (0.2494)	1.046 (0.2172)	1.071 (0.1547)
ESG score		0.067* (0.0909)	0.066* (0.0664)	0.071** (0.0105)
Family firm status			0.717 (0.3406)	0.718 (0.3232)
Family firm status × ESG score				−0.091 (0.8164)
Constant	11.213*** (0.0013)	10.712*** (0.0023)	10.243*** (0.0030)	10.176*** (0.0033)
*N*_obs	87	87	87	87
R^2	0.3888	0.4032	0.4125	0.4131
R^2_adj	0.2897	0.2970	0.2983	0.2891

Note: The table reports the results of regressions performed to investigate effectiveness of ESG disclosure and the moderating role of family firm status. Refer to Table 1 for variable description. Tests for significance of coefficients are conducted using robust standard errors; p-values are in parentheses.

*Statistical significance at the 10% confidence level.

**Statistical significance at the 5% confidence level.

***Statistical significance at the 1% confidence level.

TABLE 3 Explanatory factors of SMEs' cost of capital: Disentangling the effects of the ESG components and the moderating role of family firm status

Indep var	WACC (1)	WACC (2)	WACC (3)	WACC (4)
Total assets (ln)	−0.267 (0.6324)	−0.313 (0.5569)	−0.338 (0.5074)	−0.309 (0.5629)
Leverage	−0.447** (0.0144)	−0.434** (0.0127)	−0.456*** (0.0033)	−0.440*** (0.0049)
FRQ	−0.004 (0.2999)	−0.004 (0.3201)	−0.004 (0.2638)	−0.004 (0.2246)
Innovative SMEs	1.124* (0.0538)	1.259** (0.0420)	1.312* (0.0663)	1.294* (0.0515)
Nr analysts	−0.673 (0.2626)	−0.758 (0.1857)	−0.650 (0.2608)	−0.726 (0.1561)
Age	−0.024** (0.0299)	−0.034** (0.0122)	−0.036*** (0.0095)	−0.032** (0.0253)
IPO	−0.266* (0.0567)	−0.261** (0.0312)	−0.257** (0.0240)	−0.279** (0.0182)
Dloss	0.942 (0.2590)	0.939 (0.2217)	1.045 (0.1839)	1.077* (0.0926)
E score		0.129*** (0.0007)	0.131*** (0.0010)	0.229** (0.0345)
S score		0.020 (0.7511)	0.018 (0.7127)	0.002 (0.9807)
G score		0.126 (0.4589)	0.121 (0.4018)	0.209 (0.1627)
Family firm status			0.723 (0.3521)	0.565 (0.3711)
Family firm status × E score				−0.646* (0.0941)
Family firm status × S score				0.422 (0.2166)
Family firm status × G score				−0.404 (0.1468)
Constant	11.213*** (0.0013)	10.440*** (0.0021)	9.982*** (0.0033)	9.466*** (0.0004)
*N*_obs	87	87	87	87
R^2	0.3888	0.4068	0.4162	0.4536
R^2_adj	0.2897	0.2814	0.2828	0.2986

Note: The table reports the results of regressions performed to investigate effectiveness of single ESG components and the moderating role of family firm status. Refer to Table 1 for variable description. Tests for significance of coefficients are conducted using robust standard errors; *p*-values are in parentheses.

*Statistical significance at the 10% confidence level.

**Statistical significance at the 5% confidence level.

***Statistical significance at the 1% confidence level.

aggregate index only. Thus, instead of the aggregate ESG score, models presented in Table 3 include the three individual components and the relative interaction terms to measure if such variables impact the cost of capital of family SMEs analogously.

Among the three components of ESG disclosure, only the environmental score (*E score*) has a positive and statistically significant influence on the cost of capital, whereas the social (*S score*) and governance (*G score*) dimensions, as well as the family firm status, still do not influence WACC (Table 3, columns 3 and 4). Turning to the role of family firm status, the last model in Table 3 reveals that it moderates the relationship between environmental disclosure and cost of capital. The dissemination of environmental information is beneficial to such an extent that family firm status capsizes, rather than simply moderating, the relationship between cost of capital and ESG disclosure in SMEs. Thus, whereas SMEs may find the ESG disclosure to be hardly attractive, family SMEs can reduce the price paid to financial stakeholders by revealing more environmental information. Conversely, no clear patterns emerge from the interactions between family firm status and social and governance disclosure, as the two related coefficients fail to reach statistical significance. The statistical irrelevance of these dimensions provides further support to this part of the analysis, as they adumbrate the positive effects of environmental disclosure and the presence of families, which is relevant enough to capsize, reinstating, the negative nonfinancial disclosure–WACC relation.

5 | DISCUSSION AND CONCLUSION

SMEs differ radically from large companies because of several structural, social, and functional factors (Russo & Perrini, 2010) that make them a *unicum*. Because their peculiarities prevent us from drawing any pattern from empirical evidence based only on large companies, this study represents one of the first attempts to focus on SMEs, exploring (i) the effectiveness of ESG disclosure on the cost of capital in such a context and (ii) the moderating role of the family firm status.

Contrary to the prevalent empirical evidence on large firms (Dhaliwal et al., 2011; La Rosa et al., 2018; Ng & Rezaee, 2015; Vitolla, Salvi, Raimo, Petruzzella, & Rubino, 2020), our analyses reveal interesting, and apparently counterintuitive, findings. With regard to the first hypothesis (ESG disclosure increases SMEs' cost of capital), our research confirms the perception that SMEs are unlikely to benefit from higher nonfinancial disclosure because more environmental information raises their cost of capital. The underlying rationale resides in the costs–benefits trade-off of disclosing such types of

information. Indeed, SMEs' huge recourse to bank financing somehow calls the monitoring role of disclosure off, and their lower diversification affects the indirect costs, given the huge risk entailed in releasing sensitive, proprietary information. These aspects lead SMEs that have a higher social agenda to face an increase in the cost of capital.

Turning to the second hypothesis, postulating that family firm status negatively moderates the ESG–WACC relationship, an empirical assessment based on the aggregate ESG score does not allow for revealing any moderating effect.

Because of this unexpected outcome, decomposing the score in its three constituents, we have furtherly deepened our analyses, obtaining a twofold benefit. On the one hand, the pressure of ESG disclosure toward a higher cost of capital is solely determined by the environmental component, which shows a positive and statistically significant coefficient. On the other hand, for family SMEs, the increase in WACC due to the environmental disclosure is capsized to the extent that they benefit from a reduction in the cost of capital in the same way that large companies do. In contrast with some previous studies, where environmental engagement by family firms may not exhibit a potential effect (Adomako, Amankwah-Amoah, Danso, Konadu, & Owusu-Agyei, 2019) or may even result in a lower performance (Dal Maso, Basco, Bassetti, & Lattanzi, 2020), our findings suggest that higher environmental disclosure in family SMEs will reduce the price paid to financiers. This pattern aligns with the view that family firms are more sensitive to environmental strategies (Campopiano & De Massis, 2015), which in turn reduces the probability of being perceived as irresponsible corporate citizens, and avoid potential, devastating, public scandals (Dyer & Whetten, 2006). The desire of family firms to project a good public image (Aureli, Del Baldo, Lombardi, & Nappo, 2020) and meet family's affective needs in protecting SEW leads them, more than other firms, to actively engage with their stakeholders (Cennamo, Berrone, & Cruz, 2012) by consolidating their social status through a better environmental behavior (Berrone, Cruz, Gómez-Mejía, & Larraza-Kintana, 2010; Seroka-Stolka & Fijorek, 2020). Several theoretical and practical implications stem from these results.

5.1 | Theoretical and practical implications

Our study contributes both to the voluntary ESG disclosure literature and to the family business literature. Regarding the former, it demonstrates that ESG disclosure increases the cost of capital in SMEs. Such an apparently counterintuitive outcome occurs because, as opposed to large firms, SMEs are not able to cover the cost of disseminating ESG information with the related benefits. Also, by disentangling the effects of the three components of ESG disclosure, the study shows that only the first dimension assumes relevance among market participants. This is consistent with the stream of the literature viewing SMEs as more reluctant to engage in environmental practices because they perceive it as a threat or a burden (Hoogendoorn, Guerra, & van der Zwan, 2015).

Concerning the latter, to our best knowledge, this is the first study that sheds light on the effects of ESG disclosure on the cost of capital, either on an aggregate or on an individual basis, in the context of family SMEs. Within this context, ESG disclosure is bound to produce the same effects registered in large firms because (i) the monitoring role of nonfinancial disclosure is reinstated due to the low recourse to bank financing, which in turn reduces, or worse, removes incentives for financial intermediaries to check on managers and put a limit on their discretion (Diamond, 1984); (ii) the peculiar human and social capital and the desire to increase and preserve SEW (Berrone et al., 2012; Berrone et al., 2010) make family firms less exposed to imitation risks, thereby reducing those indirect costs of disclosure that threaten SMEs. Such a pattern can be rationalized within the theoretical and empirical insights offered by the family business literature at the intersection of the resource-based view, the SEW perspective, and the stakeholder theory.

Hence, the focus on environmental issues (Hoogendoorn et al., 2015; Sharma & Sharma, 2011) chimes with both family firms' long-term perspective (Campopiano & De Massis, 2015; Dangelico, Nastasi, & Pisa, 2019), higher commitment toward social ties, and identity (Arena & Michelon, 2018), which takes shape because of family members' desire to protect SEW. We also add to the debate on the cost of capital of family firms by identifying a new driver: the environmental disclosure (Anderson et al., 2003; Zellweger, 2007).

No matter the ownership structure, the significance of the relationship between environmental disclosure and cost of capital proves that financial stakeholders rely on this type of information to make their investment decisions. Yet the corresponding increase in the cost of capital makes disclosing environmental information inconvenient for an SME, unless it is of the family type. Thus, whereas for this latter group of companies the lower price on financial capital provides a direct incentive to disclose ESG information, and especially of the environmental type, an opposite stimulus occurs for nonfamily SMEs. Accordingly, a compensation scheme through financial aid (Simpson, Taylor, & Barker, 2004) may be used to encourage the dissemination of environmental information by nonfamily SMEs too. Also, increasing technological assistance and business training to develop and encourage proactive environmental behavior (Torugsa et al., 2012), as well as enhancing environmental legislation (Hoogendoorn et al., 2015), may be valid tools to trigger nonfinancial disclosure. Even at the worst, regulators can call for its mandatory adoption.

5.2 | Limitations and future research directions

This study has several limitations, which suggest directions for further research. First, our sample is limited to Italian SMEs listed on AIM: further studies should investigate the effectiveness of ESG disclosure and the moderating role of family firm status in different countries. Leveraging on other semiregulated capital markets dedicated to SMEs (Boakye, TIngbani, Ahinful, Damoah, & Tauringana, 2020; Lardon & Deloof, 2014), a cross-country analysis should enrich these findings, as environmental engagement may differ across types of practices,

firms, and countries (Hoogendoorn et al., 2015). Second, as this study focuses only on the year 2018, a longitudinal study may allow for appreciating not only the current level of disclosure but also its pattern over time, thereby providing a better setting for examining the effectiveness of ESG disclosure in SMEs too. Last, despite confirming that the family firm status moderates the relationship between environmental disclosure and cost of capital, our analyses leave unclear which dimensions and specific characteristics of family firms determine such a moderating role and, accordingly, the drivers of the heterogeneous orientations toward social practices (Déniz-Déniz & Cabrera-Suárez, 2005). Future studies could deal with this issue exploring if and how the relationship between ESG disclosure and cost of capital is moderated by variables as the identification of family members with the firm, their binding social ties, their emotional attachment, and the degree of family involvement in the different governance levels.

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