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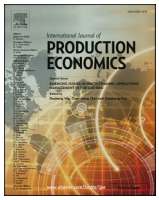

The role of circular economy principles and sustainable-oriented innovation to enhance social, economic and environmental performance: Evidence from Mexican SMEs

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ABSTRACT

The UN's sustainable development goals underscore engaging supply-chain stakeholders with environmentally friendly practices. Small- and medium-size enterprises (SMEs) are key participants in several supply chains, but their operations often produce a significant environmental impact. Their transition to sustainable practices is challenging because they operate with constrained resources, which are mostly invested in pressing activities. Therefore, evidence is needed that shows the benefits of investing limited resources in sustainable activities to support decision-making in SMEs. Research has neglected to connect circular economy and sustainable-oriented innovation whilst accounting for external factors affecting the implementation of sustainable processes and technology within SMEs in developing countries. This paper fills that gap by analyzing the impact of external factors on the implementation of circular economy and technology, and their influence on sustainable-oriented innovation and sustainable performance. Responses from 165 Mexican SMEs have been collected and analyzed using structural equation modeling to test direct and indirect effects between constructs. Findings reveal that while both governmental support and customer pressure facilitate the adoption of circular economy, only governmental support contributes directly to technology implementation. They also highlight the value of circular economy to support the adoption of sustainable-oriented innovation and to mediate the relationship between technology implementation and sustainable-oriented innovation. The overarching finding is that circular economy promoting sustainability-oriented innovation has a positive impact on financial, environmental, and social performance. This is a key implication to inform managers in SMEs on the potential benefits of investing in sustainable solutions.

1. Introduction

The 2030 agenda for sustainable development from the UN underscores the importance of achieving sustainable use of natural resources to avoid depletion (UN, 2015). Additionally, sustainability has been identified as a potential generator of competitive advantage (Mwangi et al., 2021). Although large multinational organizations have started introducing sustainability management (Lii and Kuo, 2016), SMEs tend to be less engaged (Johnson and Schaltegger, 2016). The Carbon Majors Report 2017, compiled from a database of publicly available emissions figures, estimates that 25 corporate and state-owned producing companies are responsible for 51% of the global industrial GHG emissions (Carbons_Majors_Database, 2017). Unfortunately, it is difficult to find accurate percentage figures for SMEs in SMEs. A recent survey from the British Chamber of Commerce suggests that only 11% of UK SMEs measured their carbon footprint

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(British_Chamber_of_Commerce, 2021). SMEs are relevant actors because they represent around 90% of all companies globally (Aghelie, 2017; Asgary et al., 2020), 99.8% of non-financial companies in Europe (EC, 2019) and 99% of all businesses in Mexico (INEGI, 2016). SMEs produce 60% of the total turnover from manufacturing and services (Garetti and Taisch, 2012), 58% of the value-added, and they employ 66.6% of the workforce in Europe (EC, 2019). Similarly, in Mexico they produce more than half of the GDP (Córdova-Rangel, 2011), employing nearly 89% of the economically active population (INEGI, 2016). Different estimates agree that there is an important environmental impact from SMEs globally (Miller et al., 2011; OECD, 2018a, b; Parker et al., 2009; Revell et al., 2010). Hence, it is important to examine ways to encourage these companies to engage in efficient and less impactful activities (Parker et al., 2009) to reduce the environmental effect of larger supply chains (Hong and Jeong, 2006). This is particularly true in emerging economies, because their SMEs may have limited financial and managerial resources and a lack of time and skills (López-Pérez et al., 2017; Sullivan-Taylor and Branicki, 2011). It is important to consider their characteristics and context in order to successfully support their transition towards sustainability (Klewitz and Hansen, 2014). Furthermore, sustainability can support their competitiveness in the current market (Kumar et al., 2020).

When the activities of a company are aimed at providing solutions to social and environmental challenges, these can promote effective sustainability innovation (Schaltegger and Wagner, 2011; Van Holt et al., 2020). The need to orient business activities toward sustainability using innovation has evolved from eco-innovations – considering mostly environmental concerns – to sustainable-oriented innovation (SOI) (Klewitz and Hansen, 2014). SOI involves product, process and organizational transformation to produce social and environmental value along with financial benefits (Adams et al., 2016; Dey et al., 2020b; Klewitz and Hansen, 2014). It encourages the modification of processes and operations, aiming to achieve sustainable growth (Brown et al., 2019). SOI promotes innovation in companies to: alter the way they use resources, encourage closed-loop production, enhance the eco-efficiency of operations, introduce new management structures, and instigate eco-design (Klewitz and Hansen, 2014).

Adams et al. (2016) and Brown et al. (2019) highlight the importance of innovation activities at the system-building level because of the need to think beyond the firm to engage other stakeholders. They place circular economy (CE) at that level because it moves away from traditional systems to extend value through narrowing resource flows, slowing resource loops, or closing resource loops (Bocken et al., 2016). CE is seen as a key factor contributing toward sustainability (Ntsondé and Aggeri, 2021). Whilst the former is focused on eliminating inputs, waste and emissions, the latter has more open-ended goals reliant on the stakeholders and their interests (Geissdoerfer et al., 2017). CE is a business model requiring new ways of thinking and doing business (Bocken et al., 2016). It is a restorative and regenerative paradigm (Charonis, 2012), aiming at increasing production and consumption efficiency through the implementation of reuse, reduce and recycle principles (Ghisellini et al., 2016).

Although there are benefits in implementing circular principles alone, Rattalino (2018) suggests that the true benefits of circularity emerge on the interaction with SOI. Rattalino (2018) argue that implementing a few circular principles, as done by some companies, does not necessarily change the paradigm of the company. Instead, it prevents them from leveraging circularity. However, CE can provide the foundations to implement SOI fully through an ongoing process to enhance the efficient and effective use of resources (Lüdeke-Freund et al., 2019). This is because the combination of sustainability-based practices and existing innovation practices promotes SOI (Metz et al., 2016). As introducing CE principles can help in providing innovative solutions, balancing sustainability and company growth (Rattalino, 2018), organizations that have successfully introduced SOI often start by implementing sustainability practices as drivers (Metz et al., 2016). That means the business model change required to implement SOI and obtain value (Kiron et al., 2013) can be based on CE and a closed-loop production systems (Klewitz and Hansen, 2014). Therefore, understanding the link between CE and SOI is valuable in supporting the transition of organizations to sustainable practices (Brown et al., 2019). This article argues that the implementation of CE principles can support and promote a SOI orientation in SMEs underpinned by the idea that closed-loop activities are valuable for process innovation and the development of innovative organizations (Adams et al., 2016; Khurana et al., 2021; Klewitz and Hansen, 2014).

There are different calls for more research in SMEs to promote their engagement with SOI (Aghelie, 2017; Klewitz and Hansen, 2014) and CE (Ghisellini et al., 2016; Ormazabal et al., 2018). A major need is to provide evidence about the effect of both on performance (Dey et al., 2020a; Maletič et al., 2016). From a practical perspective, companies cannot afford to be reactive to environmental approaches only because of market pressures and innovation potential (Noci and Verganti, 1999). Hence, this article aims to answer the following research questions:

- What is the impact of external factors in the implementation of CE principles in SMEs?
- What is the effect of implementing CE principles on SOI in SMEs?
- What is the influence of SOI on sustainable performance in SMEs?

The purpose is to provide evidence about the impact of external factors on CE implementation, empirically examine the relationship between CE and SOI, and analyze the impact of SOI on the three dimensions of sustainable performance in SMEs in Mexico. The focus on Mexico is based on the current lack of empirical studies looking at the impact of internal and external factors on the adoption of CE in emergent economies (Chiappetta Jabbour et al., 2020). Mexico is a developing economy with a large number of SMEs (INEGI, 2016) which have a significant environmental impact (Araya, 2003). For this reason there is an intention to implement CE principles in the country (Diéguez-Santana et al., 2021). Empirical analysis is undertaken using structural equation modeling (SEM) implemented in AMOS software. A dataset of 165 responses from Mexican SMEs to test hypotheses obtained from the model.

The results are discussed to: contribute theoretically to the understanding of the relationship between CE and SOI, examine the nature of the relationship between external factors and the integration of CE, and analyze the role of SOI to enhance sustainable performance in SMEs, combining the perspectives of institutional-based view (IBV)industry-based view and resource-based view (RBV). The practical contribution comprises delivering insights for SME managers about the benefits of engaging in CE and SOI and providing policymakers with evidence about the impact of governmental support in the transition of SMEs to more sustainable activities.

The rest of the paper is structured as follows: Section 2 introduces the background of the study. Section 3 describes the theoretical underpinning, the conceptual model is proposed, and the associated hypotheses are given. Section 4 introduces the methodological process including the survey development, sampling, and the data analysis approach. Section 5 presents the results of the data analysis using SEM and Section 6 discusses the results and findings. Finally, Section 7 concludes the study.

2. Background

This section explores the main concepts examined in the article, namely CE, SOI, and sustainable performance and it links them to the SME context.

2.1. Circular economy

This concept was first adopted in China, where the classical flow of traditional business models (take–make–consume–dispose) was

transformed into a restorative and regenerative approach to extend the value of used resources using energy and materials in a circular way (EMF, 2013; Lopes de Sousa Jabbour et al., 2018). CE shifts the focus from becoming profitable from selling artifacts to producing profit from the flow of products and resources over time (Bocken et al., 2016). CE requires changes at the macro-level (e.g., nations), meso-level (e.g., supply networks), and micro-level (e.g., company) (Ghisellini et al., 2016; Lüdeke-Freund et al., 2019).

CE promotes the recirculation of resources in the ecosystem (Ormazabal et al., 2018) through three main strategies: narrowing resource flows, slowing resource loops or closing resource loops. Narrowing resource flows involves the use of fewer resources per product. Slowing resource loops focuses on extending the utilization period of products, and closing resource loops means creating a circular use of resources by connecting the post-use stage with the production stage (Bocken et al., 2016). These three strategies are closely linked to CE capabilities, described in this article as CE principles, namely: reduce, reuse, and recycle (Ghisellini et al., 2016; Goyal et al., 2018; Reh, 2013; Yong, 2007; Zeng et al., 2017). The reduce principle comprises the minimization of non-renewable resource consumption through input substitution, process improvement, and the increase of monitoring and managing the production and consumption stages (Geng and Doberstein, 2008; Goyal et al., 2018). It involves producing products with greater value, using less resources, and avoiding products which can damage the ecosystem (Figge et al., 2014). The reuse principle reintroduces end-of-life products into the supply chain in various ways to extend their lifecycle and avoid wasting them (Goyal et al., 2018; Lüdeke-Freund et al., 2019). Reuse can be encouraged through the introduction of subsidies and from customer awareness (Ghisellini et al., 2016). Recycling is more commonly known than reducing and reusing, but it can be less efficient and profitable (Ghisellini et al., 2016). It involves re-processing waste materials "into products, materials or substances whether for the original or other purposes" (EU, 2008). Using these three principles can promote an optimal utilization of resources and efficient management of resources to gain economic, environmental, and social benefits (Prieto-Sandoval et al., 2018a).

2.2. Sustainable-oriented innovation

SOI can be seen as a direction promoting competitiveness, human and social well-being, and attaining environmentally friendly practices (Adams et al., 2016; Khurana et al., 2021; Klewitz and Hansen, 2014). Adams et al. (2016) identify innovation practices supporting SOI at the product, process, and organization level. Product innovation involves introducing improvements or completely new products or services to enhance sustainable performance (Klewitz and Hansen, 2014). The rapidly growing field of SOI has focused heavily on product innovation, but it has evolved to include process and organization changes as well (Adams et al., 2016). At the process level, SOI encourages organizations to redesign their operations to reduce the use of resources, improve the way non-product items are managed, and to introduce eco-efficiency in their activities (Klewitz and Hansen, 2014). Innovation at the organizational level requires introducing strategic sustainability behavior. It involves a change of culture fostered by using product lifecycle thinking, implementing integrated environment strategies, and instigating environmental management systems (Adams et al., 2016). The motivation is to consolidate organizational practices and values with respect to process, product, and workforce to achieve environmental and social objectives, leading to economic productivity (Abdul-Rashid Salwa et al., 2017; Wu, 2017).

2.3. Sustainable performance

Sustainability has been defined in different ways. From the perspective of the triple bottom line, sustainability is the integration of economic, social, and environmental pillars guiding the activities of different stakeholders (Dey et al., 2020b). Although sustainability was initially considered an extra cost for companies, recent evidence has shown that sustainable activities can deliver value for organizations (Van Holt et al., 2020). In fact, Kiron et al. (2013) argue that the majority of managers recognize the benefits of sustainable practices, which has supported a shift in the priorities and operational activities of different companies.

Sustainable activities should incorporate social, environmental, and economic benefits to achieve the goals established by customers and stakeholders (Aktin and Gergin, 2016) through collaborative efforts (Rodríguez-Espíndola et al., 2020). It is necessary to look at the potential impact of sustainable activities to companies in order to understand potential benefits on these dimensions (Meehan and Bryde, 2011). Although there are challenges in adding social and environmental dimensions to the traditional financial performance goal (Epstein and Roy, 2003), an increasing number of articles have addressed sustainable performance in recent years, with positive feedback (Pinto, 2020). The purpose is to help firms achieve economically efficient business models that are able to thrive with increasingly finite resources and to overcome social challenges (Geradts and Bocken, 2019).

2.4. Sustainability in SMEs

SMEs constitute the foundation of several economies globally (Moore and Manring, 2009). SMEs are under tremendous stress to survive in the market as they operate with constrained resources, which makes them risk-averse in general (Games and Rendi, 2019). Findings from López-Pérez et al. (2017) suggest that firm size should not be overlooked as it can affect the impact of the implementation of sustainable activities. The level of investment required is often a barrier for smaller companies, which have more evident and urgent tasks requiring their limited resources. Motivating SMEs to invest in sustainable initiatives involves showing the potential benefits in different dimensions (Katz-Gerro and López Sintas, 2019), with environmental and social factors becoming increasingly prominent for the overall performance of the companies (Pinto, 2020).

SOI may differ between SMEs and large firms because of the impact of firm size on their activities (Klewitz and Hansen, 2014). The availability of resources for investment, the readiness for change, and the localized nature of the markets served are factors shaping activities in SMEs. Focusing on the latter, although SOI has been commonly related to developed countries, SOI can thrive in developing countries. The importance of SOI for future development and the enormous potential and creativity shown in developing economies makes its study in their context very important (Sarkar and Pansera, 2017). However, there is limited empirical evidence about the role of SOI in these economies (Neutzling et al., 2018). Similarly, studies on SMEs' adoption of CE in emerging countries are limited as well (Dey et al., 2020a; Katz-Gerro and López Sintas, 2019; Mangla et al., 2018). Hence, this article focuses on the impact on the triple bottom line of implementing technological solutions and CE to promote SOI in SMEs in emerging countries.

3. Theoretical lens and hypothesis development

This section summarizes the theoretical lens underpinning the analysis and the empirical evidence from the literature which is used to support the different hypotheses examined in the model.

3.1. Theoretical lens

We have used a multidimensional theoretical approach to develop the model by combining three theoretical frameworks: institutional-based view (IBV), industry-based view and resource-based view (RBV), often referred to as a strategy tripod in the management literature (Peng et al., 2009). This approach follows the recent call from Panwar and Niesten (2020), and recommendations in the extant CE and

sustainability literature (Ibn-Mohammed et al., 2021; Kalmykova et al., 2018; Kumar et al., 2021a) to investigate the significance and implications of internal capabilities, external market dynamics, and sustainable innovation in CE practices to achieve sustainable performance. By linking the three views it is possible to explain holistically the antecedents to achieving sustainable performance in SMEs through the adoption of CE practices and sustainable-oriented innovation (SOI).

According to the industry-based view, the external environment (e.g., market dynamics and conditions) determines an organization's strategy, practices, and initiatives, which are aligned to its business goals (Porter, 1980). Using this perspective, we can posit that a key dimension impacting a firm's ability to adapt dynamically and remain competitive in any business environment, especially in emerging economies, is uncertainty. The uncertainty stems from changing customer needs and demands, the growing complexity of the interconnected global supply-chain ecosystem, and government initiatives and policies (O'Connor, 2008). On the other hand, RBV is a widely applied theoretical perspective, which can be used to explain how internal resources can facilitate the development of valuable, rare, difficult to imitate, and non-substitutable capabilities within an organization which can lead to competitive advantage and sustainable business performance (Wernerfelt, 1984). According to Braganza et al. (2017), technology adoption (such as the case of digital platforms) within organizations can be an internal tangible resource which can provide competitive advantage and dynamic capability to manage and optimize operations in a sustainable way. In this context, Srinivasan and Swink (2018) argue that digital platforms enhance data processing and the analytical capability of firms to efficiently formulate operational decisions. This leads to avoiding expensive actions such as overtime production (operational and resource efficiency), lost sales (productivity) and excess inventories (lean management) in manufacturing organizations. Finally, the IBV extends the industry-based view, focusing on the role of government initiatives as a key factor influencing business strategy, practices, and growth. IBV suggests that customer pressure and government policies, initiatives, and dynamism are radically different in emerging nations when compared to developed economies (Peng et al., 2008). However, the impact of these pressures and policies on an organization's ability to adopt and implement circular economy and SOI, especially in the context of emerging economies, is inconclusive according to the literature. RBV theory sheds light on the adoption of both digital platforms and process innovation by addressing the interrelationships and coordination among stakeholders, and the focal organization.

Previous studies attempt to integrate IBV and RBV to explain organizational decision-making as independent constructs for organizations (Oliver, 1997) and the different roles of external pressures and internal resources, and their relationships (Tatoglu et al., 2016; Zhang and Dhaliwal, 2009; Zheng et al., 2013). The findings of prior studies on how institutional factors affect organizations' decisions regarding resources and innovation are mixed (Liu et al., 2010). Nevertheless, Liang et al. (2007) and Zheng et al. (2013) discuss and provide insightful arguments suggesting that social pressure (customer and government) tends to influence process innovation (such as the use of CE principles), and technology innovation (e.g., the adoption of digital platforms). Finally, according to Grant (1991), the consolidation of resources helps to create capability within organizations, which also follows the RBV principles used in our research.

In general, IBV and institutional-based views are employed to account for the impact of external stakeholders (Meyer and Rowan, 1977; Meyer and Scott, 1983) In this research, that involves the pressure exerted from the customer, the uncertainty in the market, and the level of support from the government. All of these can have a considerable impact on the implementation of CE practices (Batista et al., 2019). The use of IBV aligns with the approach undertaken by Bag et al. (2021a) and Ranta et al. (2018), which accounts for pressures from external stakeholders and the institutional environment, respectively. The industry-based view has been used to underpin the uncertainty and variation in the market, as seen in previous studies focused on sustainability (Fonseka et al., 2014). The RBV is based on internal organizational resources (Wernerfelt, 1984), and in our study it is used to consider the role of digital organizational capabilities in implementing CE practices. Jakhar et al. (2019) state that CE principles are advanced practices which are generated using intellectual and physical resources. They suggest RBV is a good theoretical lens through which to examine the impact of CE principles on company performance and gaining competitive advantage. This aligns with the use of RBV by Bag et al. (2021a) and Soh and Wong (2021). Therefore, we include the key elements of resource (aligning with RBV (Priem and Butler, 2001),), external market (aligning with industry-based view, Porter, 1980) and governmental support (aligning with IBV, Peng et al., 2008 and 2009), in our model to examine CE practices, SOI and sustainable performance.

3.2. Hypothesis development

This section summarizes the empirical evidence supporting the different hypotheses to be tested (Baumeister and Leary, 1997). Initially, the literature was surveyed to identify the most relevant contributions related to CE, SOI, and sustainable performance from various sources, which were filtered using their titles and summaries. The most relevant articles were reviewed by three academics and information was extracted about the different themes related to the objective of this paper. The literature included focuses on the current state of knowledge on CE, SOI, and their links to stakeholder pressures, digital platforms, and sustainable performance in the context of SMEs throughout the world. The findings were used to gather information on the main areas of study, identify the key research gaps, and develop the model examined in this research.

3.2.1. Stakeholder pressure affecting CE adoption in SMEs

The IBV and industry-based view highlight the value of considering stakeholder pressures in the implementation of process improvements in companies. Chiappetta Jabbour et al. (2020) recognize supply-chain actors, the government and customers as an important part of the implementation of CE (Agamuthu et al., 2009; Ageron et al., 2012; Govindan and Hasanagic, 2018; Ilić and Nikolić, 2016; Wognum et al., 2011) and technology (Chavez et al., 2016; Kumar et al., 2020; Paulraj and Chen, 2007; Zeng et al., 2017, 2020). Furthermore, these stakeholders are key for companies to remain competitive (O'Connor, 2008). This research focuses on the effect of customer pressure, market uncertainty and governmental support in the adoption of CE principles and digital platforms in SMEs in developing countries, and the impact these components have on SOI and sustainable performance. Some of the main articles highlighting these relationships are presented in Table 1.

Liu and Bai (2014) find that, although organizations have a positive view of CE, they are not enthusiastic about it because of the challenges in implementation. This becomes even more relevant when the differences between large and smaller firms are considered (López-Pérez et al., 2017). Indeed, in their analysis of CE adoption, Katz-Gerro and López Sintas (2019) claim that the main difference between SMEs and large enterprises is the level of organizational slack, and that this affects how

Table 1
Factors impacting CE and technology adoption.

Factors impacting CE and technology adoption	Authors
Customer pressure	Bag et al. (2021a); Ilić and Nikolić (2016); Kumar et al. (2020); Mostaghel and Chirumalla (2021)
Governmental pressure	Govindan and Hasanagic (2018); Ilić and Nikolić (2016); Lopes de Sousa Jabbour et al. (2018); Tseng et al. (2018)
Market uncertainty	de Jesus and Mendonça (2018); Geissdoerfer et al. (2017); Govindan and Hasanagic (2018); Prause (2019)

new knowledge becomes embedded into routines. Therefore, it is important to look at the factors affecting CE adoption in the SME context. The transition to CE needs to take into account stakeholder pressure, as government, supply-chain actors, and customers all influence CE adoption. However, these relationships are still underexplored (Chiappetta Jabbour et al., 2020). Therefore, this study examines the impact of these stakeholder pressures coming from market uncertainty, governmental pressure, and customer pressure on the adoption of circular economy in SMEs.

The adoption of circular economy by SMEs in developing economies is still at an early stage compared to that of developed economies, where a substantial effort has already been made by government, regulatory bodies and policy-makers to promote CE implementation (Hutner et al., 2017; Tseng et al., 2018). This is because of the lack of a proper strategy, which is required to establish a dialogue facilitating symbiotic partnerships between businesses and regulatory bodies (Preston and Lehne, 2017). In order to provide a reliable analysis of the benefits of CE and SOI for SMEs, it is essential to take into account constraints presented by local markets, customers, and governmental policies.

An organization's shift to CE needs to satisfy customers (Mostaghel and Chirumalla, 2021) because their stance influences the results of CE implementation (Lüdeke-Freund et al., 2019). Evidence suggests society plays a role in policy development (Balyer and Tabancalı, 2019), including in environmental protection (Zhang et al., 2018). There is evidence that customer pressure affects environmental plans (Wang et al., 2020), as seen in Europe through the impact of public opinion on energy policies (Brilé et al., 2017), because of the effect of public scrutiny on policy outputs (Burstein, 2003). This link is relevant because governmental support such as subsidies and incentives affecting the interests of decision-makers can, in turn, promote the implementation of circular principles (Munaro et al., 2020). Therefore, this study looks at the potential impact of customer pressure on the development of governmental support in the case of SMEs in developing countries in the first hypothesis:

- **H1:** Customer pressure has a positive effect on governmental support for the implementation of CE in SMEs in developing countries.

The industry-based view considers the industry environment, which often involves uncertainty in the market. There is a degree of complexity added to CE by market uncertainty (Peng et al., 2020). Market uncertainty involves the rate of change over time and within an industry in the composition of customers and their preferences (Kohli and Jaworski, 1990). The impact of market uncertainty on individual firms depends on the organizational mindset, capability, and capacity to innovate, which must account for financial and resource constraints (Dey et al., 2020a; Jambulingam et al., 2005). A lack of certainty in the market combined with the importance of financial stability forces companies to become risk-averse (Games and Rendi, 2019) and to prioritize urgent and short-term profitable needs over long-term initiatives such as CE. So, there is an added pressure on governments to develop incentives to attract organizations to invest in CE to meet sustainability goals. These often take the form of programs, incentives, and policies (Lin and Ho, 2011; Munaro et al., 2020). Conversely, a lack of engagement from governments with the different stakeholders in the market can lead to the limited implementation of CE, increased resistance, and the transfer of the pressure for implementation from companies to suppliers (Kazancoglu et al., 2021; Rizos et al., 2016). Therefore, understanding the relationship between uncertainty in the market and the development of governmental support for CE can be valuable for SMEs, often immersed in uncertain market conditions (Healy et al., 2018). Therefore, the second hypothesis addressed by this study is as follows:

- **H2:** A higher level of uncertainty in the market has a positive effect on governmental support for the implementation of CE in SMEs in developing countries.

IBV accounts for the impact of stakeholders in company activities (Meyer and Rowan, 1977; Meyer and Scott, 1983). One of the key factors driving changes in organizations is customer awareness and expectations (Chavez et al., 2016; Gong et al., 2019; Yina et al., 2019). Evidence suggests customers expect organizations to engage in environmental-friendly practices to improve their sustainable performance (Chu et al., 2019; Rattalino, 2018; Sarkis et al., 2010). Research suggest that consumers can be essential to promote circular supply chains (Batista et al., 2019).

Customers seek innovative and technically advanced products which require investment in digital platforms. Digital platforms are beneficial for customers as well, because they can lead to better customer-relationship management and reduced response times since firms are able to connect and communicate with them faster (Schröder, 2016). Furthermore, Rojko (2017) states that digital platforms could result in better working environments, a more effective use of natural resources, and increased energy efficiency, which are also appreciated by customers. Nowadays, customers are pressuring organizations to adopt new technologies because of the requirements for more complex and customizable products, along with the potential to reduce waste and resource circularity (Kumar et al., 2020). Looking at the evidence that these pressures can influence the adoption of new technologies to configure company capabilities (Bag et al., 2021a), this study provides an analysis in the context of SMEs in developing countries using the following hypothesis:

- **H3:** Customer pressure has a positive effect on technology adoption in SMEs in developing countries.

Although it is believed that an awareness of desirable environmental properties, such as reusability, recyclability, energy efficiency, and sustainable procurement, has a major impact on the adoption of sustainable practices (Vanalle et al., 2017; Zhu et al., 2008), there has been some debate in the literature about their effect in the implementation of CE. On the one hand, there are claims that customers' increasing environmental awareness has prompted companies to make supply chains more sustainable (Ageron et al., 2012; Chan and Wong Christina, 2012; Ilić and Nikolić, 2016). As a result, customers' willingness is one of the starting points for organizations' implementation of CE (Wognum et al., 2011). The adoption of CE is encouraged when customers are willing to pay a premium for green products (Aguilar and Vlosky, 2007), or discouraged when customers have negative attitudes about refurbished or reused products as sales are directly affected (Zhou et al., 2013). On the other hand, articles focused on the United States and European countries have found that even environmentally aware customers do not necessarily decide to buy environmentally friendly products (Shao et al., 2016; Song et al., 2019). In fact, Song et al. (2019) state that most customers fail to evaluate information about the product and that actual purchases of green products are lower than the declared preference and purchasing intention.

Despite the opposing views in the literature about the role of customer pressure, Bag et al. (2021a) and Mostaghel and Chirumalla (2021) argue the importance of accounting for customer pressure and its impact on the adoption of circular principles. Companies need to understand the attitude of customers and prepare in advance and evaluate their investment (Batista et al., 2019). A key argument is the importance of satisfying customer needs at the same time as upholding aspects such as brand, image and reputation (Agamuthu et al., 2009). Regarding the differences in the literature, it is worth considering whether research results are linked to the location of customers. So, this study examines the relationship between customer pressure and CE implementation in the context of SMEs in Mexico with the following hypothesis:

- **H4:** Customer pressure has a positive effect on circular economy implementation in SMEs in developing countries.

Market uncertainty is expected to play a major role in the effective adoption and implementation of CE across the SMEs' supply chain. It causes firms to strategically plan their activities and innovate their processes (Paulraj and Chen, 2007; Thanki and Thakkar, 2018). In Mexico, market uncertainty is a common characteristic and affects all businesses, especially SMEs (Petersen, 2018). Research studies so far have found that organizations that used elements of Industry 4.0 were able to transform their operational business models, to reduce costs and achieve better customer experience.

The adoption of digital platforms to support CE within the SMEs' supply chain ought to depend not only on the internal strategy of the organization but also on the external environment. Technology adoption has been found to be significantly impacted by the relative uncertainty in a market (Zeng et al., 2020), as it can affect the willingness of companies to invest in new technologies. For instance, Peltier et al. (2012) show that small businesses tend to invest in technology with the idea of gaining competitive advantage in highly uncertain markets. Prause (2019) states that technology adoption in highly uncertain markets can help organizations to balance the tension between the internal and external complexities. So, our research examines the following hypothesis:

- **H5:** Uncertainty in the market has a positive effect on technology adoption in SMEs in developing countries.

As consumers grow more aware of environmental issues, it is important for organizations to act more sustainably in order to retain their customer trust and the business image (Agamuthu et al., 2009). They need to retain their image because it is a reassurance factor for customers and it affects the mindset of other stakeholders such as employees, influencers and sponsors. Manufacturing industries are starting to forego traditional methods and embrace cleaner forms of production, and thereby increasing goodwill (Agamuthu et al., 2009).

Companies adopt CE to stay sustainable through managing discarded products as resources (Batista et al., 2019). That is the reason de Jesus and Mendonça (2018) and Govindan and Hasanagic (2018) identify the market as a major antecedent to CE. Indeed, higher levels of uncertainty and turbulent conditions from external factors can make organizations more risk-averse (Games and Rendi, 2019), which can affect the implementation of sustainable practices. Market readiness for circular products is yet to be realized, so companies are discouraged from making the massive investments required for the adoption of digital platforms and CE implementation (Kirchherr et al., 2018). This research examines the relationship between market uncertainty and CE in the context of SMEs in developing countries with the following hypothesis:

- **H6:** Uncertainty in the market has a positive effect on CE implementation in SMEs in developing countries.

IBV accounts for the pressure of the government and the way it can affect operations in SMEs. Governmental policy and regulations are considered important factors affecting internal practices implemented in organizations (Kumar et al., 2020; Lu et al., 2020; Zeng et al., 2017) and sustainable operations in general (Demirel and Kesidou, 2019), because of the need for compliance (Govindan et al., 2013). Emerging countries often lack appropriate government policies which support the adoption of digital platforms, and this may inhibit SMEs' technology use. Katz-Gerro and López Sintas (2019) argue that governments should be active participants in the transition of SMEs toward sustainability by encouraging and supporting SMEs to become involved in efficiency improvement practices first and, once they have realized the benefits, then transform their technology to reap the benefits of sustainable practices.

Companies require large amounts of investment to adopt the latest technologies. When governmental support is absent, it may demotivate companies because of added pressures of profitability and responsibility (Horváth and Szabó, 2019). Sometimes companies will not make the financial resources available for these initiatives as they do not guarantee an instant return on investment. Even though adopting technology is likely to be cost effective in the long run, many companies are put off by the huge initial investment (Horváth and Szabó, 2019). Some researchers state the need of having the government cooperate with different stakeholders to make sure the lack of guidance and support does not become a barrier impeding innovation (Kazancoglu et al., 2021). Hernandez (2018) provides evidence of the importance of governmental support to promote green IT adoption in SMEs, which is aligned to the potential of governments to provide incentives and programs to allow companies to invest in new technologies (Munaro et al., 2020). Since it is important to analyze the role of governmental regulations and support to encourage organizations to invest in digital platforms for CE in SMEs in developing countries, we propose the following hypothesis:

- **H7:** Governmental support has a positive effect on technology adoption in SMEs in developing countries.

García-Quevedo et al. (2020) suggest that regulatory obstacles, costs of meeting regulations and the lack of human resources are barriers for the adoption of CE in SMEs. There is agreement about the increasing pressure from regulation in the engagement of sustainable practices (Demirel and Kesidou, 2019; Lawrence et al., 2006). Different studies have found that the pressure of governmental regulations in consumption is driving many companies to adopt CE (Govindan and Hasanagic, 2018; Ilić and Nikolić, 2016). Introducing CE effectively and making businesses accountable for non-adherence to these principles require collective and strategic initiatives from policy-makers (Kirchherr et al., 2017, 2018). China, some European countries, and the United Kingdom have implemented regulations, policies and incentives (funding support) to encourage business organizations to pursue the integration of CE and to adhere to the needs of regulatory bodies to minimize environmental impacts (Kalmykova et al., 2018). Nonetheless, implementation is limited globally (Kirchherr et al., 2018), and not always successful given the lack of appropriate auditing, regulating, and monitoring (Kazancoglu et al., 2021).

The impact of government policies on effective and efficient implementation of CE within the SMEs' supply chain is manifold, and often not well understood by SMEs, owing to a lack of awareness and guidance building upon successful business cases. The introduction of incentives fostering sustainable initiatives by the government can have significant influence on SMEs (Khurana et al., 2021). These policies can enhance management performance, i.e., organization sustainability goals, through uptake of various activities such as certifications, accreditations committing to sustainable development goals and CE philosophy, i.e. (recycling, reuse and optimizing waste management) (Liu and Bai, 2014). Therefore, looking at the influence of relevant government policies in the form of support that could enable the adoption of CE in developing economies, the following hypothesis is tested:

- **H8:** Governmental support has a positive effect on CE implementation in SMEs in developing countries.

3.2.2. *Effect of digital platforms and CE on SOI*

Waste reduction and technology implementation (digital platforms providing analytical and processing capability to support decision-making) are components of SOI (Adams et al., 2016). There are different factors contributing to SOI. This research examines the influence of CE and digital platforms on SOI and Table 2 summarizes some of the articles looking into these relationships.

Digital platforms are an aggregation of several technologies such as database, cloud computing, big data analytics, visual computing (dashboards) and computational algorithms. These platforms can enable companies to modify their processes to become more flexible and reconfigurable (Wang et al., 2016) to achieve sustainable business

Table 2
SOI and its interaction with CE and technology adoption.

Relationships	Authors
Technology adoption & CE	de Jesus and Mendonça (2018); Geng and Doberstein (2008); Govindan and Hasanagic (2018); Kumar et al. (2020); Kumar et al. (2021b); Su et al. (2013)
SOI & CE	Adams et al. (2016); Brown et al. (2019); Klewitz and Hansen (2014); Metz et al. (2016)
SOI & technology adoption	Adams et al. (2016); Khurana et al. (2020); Klewitz and Hansen (2014); Luthra et al. (2020)

performance (Gunasekaran et al., 2017; Gupta and George, 2016), and to reduce risk (Rodríguez-Espíndola et al., 2022). The transition to the use of these technologies allows organizations to employ large amounts of data from multiple sources to optimize the use of resources and improve current processes. Products, being fully traceable, will find their own route in the smart factory, making individualized mass production cost-efficient (Hofmann and Rüsch, 2017). The future state-of-the-art smart factory will function as a social network where people, machines and products will interact with each other naturally (Kagermann et al., 2013).

There are claims that increased sustainable performance is associated with technology adoption (Dey et al., 2020b), as technology is one of the dimensions of SOI (Adams et al., 2016; Katz-Gerro and López Sintas, 2019). SMEs in developing countries are facing unique challenges in terms of technology adoption and sustainability which need further study (Patwa et al., 2021). An examination of the impact of technology adoption (i.e., digital platforms) on SOI and sustainable performance in the SMEs' supply chain is needed (De et al., 2020; Dey et al., 2020a; Machado et al., 2020), especially in developing countries. This study examines the impact of the adoption of digital platforms on SOI through the following hypothesis:

- **H9:** Technology adoption has a positive effect on SOI in SMEs in developing countries.

CE is focused on the reduction of waste (Kalmykova et al., 2018) through the implementation of principles such as reduce, reuse and recycle (Ghisellini et al., 2016). There are well-known benefits of CE identified for developed economies (Bastein et al., 2013), but implementing CE can have benefits for developing economies as well, such as GDP growth, job creation and carbon emissions reduction (WEF, 2017). Research on CE on SMEs has often been carried out in different European countries (Dey et al., 2020a; García-Quevedo et al., 2020; Prieto--Sandoval et al., 2018b). Despite the potential of CE to provide customers with higher quality and safer products (Beske et al., 2014), reduce waste, improve brand image (Govindan and Hasanagic, 2018) and produce long-term profits (Geissdoerfer et al., 2017), there is an absence of articles in the literature focused on CE in SMEs in developing countries.

SOI can be supported by the use of closed-loop production at the process level (Klewitz and Hansen, 2014) because of the value of moving from linear paradigms to more innovative configurations underpinned by CE (Adams et al., 2016). It promotes the modification of processes and operations aiming to achieve sustainable growth (Brown et al., 2019). Adams et al. (2016) and Brown et al. (2019) place CE at the system level of SOI because SOI can be supported by the use of closed-loop production (Klewitz and Hansen, 2014).

As some organizations lack the experience and expertise to implement innovative solutions for sustainability, the introduction of CE principles can help to provide innovative solutions balancing sustainability and company growth (Rattalino, 2018). The combination of sustainability-based practices and existing innovation practices promotes SOI (Metz et al., 2016). Moreover, substantial benefits of implementing circular principles can be achieved when these principles interact with SOI (Rattalino, 2018). Therefore, understanding the link between CE and SOI is valuable to support the transition of organizations towards sustainability (Brown et al., 2019). Nevertheless, little attention has been given to the link between them, especially in SMEs in developing economies. Hence, hypothesis H10 is tested:

- **H10:** CE has a positive effect on SOI in SMEs in developing countries.

3.2.3. *Effect of SOI on sustainable performance*

The existing literature has investigated the critical factors for the implementation of SOI (Khurana et al., 2021) and the relationship between SOI (product innovation; product and process innovation; product, process and organizational innovation) and environmental and social practices (Adams et al., 2016), corporate social responsibility and business process innovation (Martinez-Conesa et al., 2017), inter-organizational relationships (Neutzling et al., 2018), market demands and pressure (Adebanjo et al., 2016), and lean management practices (Arena et al., 2018; Hallam and Contreras, 2016). In terms of the outcomes, SOI is positively associated with potential improvements in sustainable performance (Dey et al., 2020b) as shown in Table 3.

Technology and emerging innovation can drive SOI and lead to better environmental performance (Luthra et al., 2020). However, this can have a significant impact on economic performance because of the operational and set-up costs involved. Intense competition makes SMEs adapt to the dynamic business environment and focus only on economic gains (Boiral et al., 2014), which can prevent them from reaping the benefits represented by the transition toward sustainable practices. This is even more the case in developing economies, where empirical analyses of the role of SOI to achieve sustainable benefits are limited (Khurana et al., 2020; Neutzling et al., 2018).

As shown by Khurana et al. (2021), several contributions in the literature focus on the environmental dimension of sustainability, but organizations need to consider initiatives supporting the environment and society which are not detrimental to economic performance. Hence, the effect of SOI needs to be analyzed taking into account the social, environmental, and economic aspects of sustainable performance, rather than a single measure, especially in the context of SMEs in developing countries. Accordingly, hypotheses H11–H13 are proposed:

- **H11:** SOI has a positive effect on economic performance in SMEs in developing countries.
- **H12:** SOI has a positive effect on environmental performance in SMEs in developing countries.
- **H13:** SOI has a positive effect on social performance in SMEs in developing countries.

3.2.4. *Indirect effects*

The introduction of relevant government policies and support is considered a key element for the transition to CE (Geng and Doberstein, 2008; Prieto-Sandoval et al., 2018b). Indeed, from IBV and the industry-based view, government authorities play a significant role in the implementation of CE in different countries through programs and incentives (Munaro et al., 2020). Governmental support can affect relevant stakeholders such as customers and retailers to promote the transition toward more sustainable activities (Perry, 2012). Findings in the literature suggest that governmental support can influence the effect of customer interest and willingness to pay for the transition towards CE (Shao et al., 2020).

Governmental support can also inspire changes in the market and

Table 3
SOI and sustainable performance.

Relationship	Authors
SOI & sustainability performance	Abdul-Rashid Salwa et al. (2017); Boiral et al. (2014); De et al. (2020); Khurana et al. (2021); Neutzling et al. (2018); Wu (2017)

incentivize innovation activities (Roh et al., 2021), including the implementation of CE in SMEs (Kazancoglu et al., 2021). The purpose of government-led initiatives is to create a business ecosystem in which the market can take the lead in the environmental shift (Roh et al., 2021). A common example is the implementation of new digital platforms or innovative solutions, in which companies which are vulnerable to the various costs involved, such as SMEs, can be supported by the provision of incentives and the integration of collaboration hubs, allowing companies to introduce changes (Roh et al., 2021). Therefore, governments can encourage and support SMEs to adopt efficiency improvement practices and transform their technology to reap the benefits of sustainable practices (Katz-Gerro and López Sintas, 2019).

To consider the central role of governmental support for the implementation of digital platforms and CE, this research tested governmental support as a mediator between the relationships of uncertainty in the market and customer pressure with the adoption of digital platforms and CE principles. The following indirect effects are tested in the model:

- **H14:** Governmental support mediates the relationship of customer pressure to technology adoption in SMEs in developing countries.
- **H15:** Governmental support mediates the relationship of uncertainty in the market to technology adoption in SMEs in developing countries.
- **H16:** Governmental support mediates the relationship of customer pressure to the implementation of CE in SMEs in developing countries.
- **H17:** Governmental support mediates the relationship of uncertainty in the market to the implementation of CE in SMEs in developing countries.

RBV argues that the bundle of resources available for companies allow them to gain competitive advantage (Wernerfelt, 1984). However, Kim and Han (2012) argue that, in the supply-chain context, in order to leverage those resources, it is essential to acquire the learning necessary to generate new knowledge. Similarly, Jain et al. (2020) state that firms with abundant human resources and intensive infrastructures need environmental capabilities to become sustainable. The increasingly connected business environment resulting from the implementation of digital platforms creates significant potential for innovation (Kava et al., 2021). The expertise gained by the introduction of CE can be leveraged by companies to enable smart manufacturing and data-driven decision-making, which can facilitate the adoption of SOI (Lin, 2018). There is evidence suggesting that a lack of information in organizations and management can lead to suboptimal resource consumption, inefficient waste management and ineffective process optimization (Geng and Doberstein, 2008; Su et al., 2013). Therefore, combining the increasingly popular and largely separate topics of Industry 4.0 (digital platforms) and CE in empirical studies will help to identify synergies between them, which will provide additional skills for firms to adopt CE and for government decision-makers to keep track of firms' compliance to the regulatory requirements (Lopes de Sousa Jabbour et al., 2018; Tseng et al., 2018) and support the transition to SOI.

Initial strides to understand the link between the implementation of Industry 4.0 technologies and the adoption of CE through the use of sustainable manufacturing have already been made by Bag et al. (2021b). Even though SOI involves technology implementation (Adams et al., 2016) and technology can also be important for the transition to CE (Kumar et al., 2021b), more information is needed about the effect of the potential role of CE to mediate the relationship between digital platform adoption and SOI. Digital platforms can certainly promote innovation, but SOI requires introducing improvements or completely new products looking at sustainable objectives (Klewitz and Hansen, 2014). CE principles can become the vehicle to link the implementation of digital platforms and SOI, as they balance sustainability and company growth (Rattalino, 2018). The knowledge and capabilities stemming from the implementation of CE can guide and strengthen the use of digital platforms to achieve SOI. In fact, Metz et al. (2016) suggest that organizations that are successful in introducing SOI show the need to implement sustainability practices as drivers. Using the RBV lens, capabilities are often associated with a mediating role between a company's resources and improved performance (Hong et al., 2018). The experience and skills developed through the use of CE principles can be essential to leverage the use of digital platforms and develop SOI. This effect is tested with the following hypothesis:

- **H18:** CE mediates the relationship of technology adoption to SOI in SMEs in developing countries.

The representation of the model proposed and the hypotheses tested can be seen in Fig. 1. The purpose of this research is to provide insights about the direct and indirect effects between the different constructs in SMEs in Mexico.

4. Methodology

4.1. Measures and survey development

The hypotheses described have been tested using a survey instrument derived from the literature. The constructs used are based on existing constructs (identified through the literature review) to enhance their reliability and validity (Churchill, 1979). The different dimensions have been measured using a five-point Likert scale (1 = completely disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = completely agree).

The questionnaire has three parts. The first part includes questions about customer pressure, uncertainty in the market, and governmental support as external factors that possibly impact CE. In the second part of the questionnaire, questions about the adoption of digital platforms, and the implementation of CE principles are included. The third part includes questions about sustainable-oriented innovation and sustainability performance.

Based on the literature review presented in Section 2, different scales have been identified to provide the items used for this research. Considering the underpinning of IBV and the industry-based view, the impact of governmental support, customer pressure and uncertainty in the market have been included. Governmental support means providing guidance and incentives for organizations making the transition to environmentally friendly activities. The questions for this construct have been based on the items obtained from the literature looking at environmental policy changes (Kirchherr et al., 2017; Liu and Bai, 2014), and policy guidance for implementation (Mahpour, 2018; Zeng et al., 2017). Customer pressure involves the environmental awareness of customers and their influence on the adoption of environmentally friendly principles. The items have been based on the findings from Gadenne et al. (2009) looking at customer choices (Kohli and Jaworski, 1990) and the items used by Slater and Narver (1994) regarding customers' evolving needs. Market uncertainty includes competitors' actions and lack of knowledge about changes in the environment, reflected by the items obtained from Kohli and Jaworski (1990) and Jambulingam et al. (2005).

The implementation of digital platforms is also introduced in the model. It includes different items discussed in Bürklin and Wynants (2020), focusing on efficiency and optimization (Chen, 2020), and decision-making and practices (Cainelli et al., 2020). CE is based on the implementation of the reuse, reduce, and recycle principles in organizations. The items have been obtained from the indicators of product performance on CE (Cayzer et al., 2017) and items about CE principles in industry (Goyal et al., 2018; Kannan et al., 2014; Zeng et al., 2017). Sustainable-oriented innovation includes the changes in organizations to reap social, environmental, and economic benefits. The items for study have been obtained from the speed to innovate in organizations (Tellis et al., 2009) and the introduction of circular thinking at the

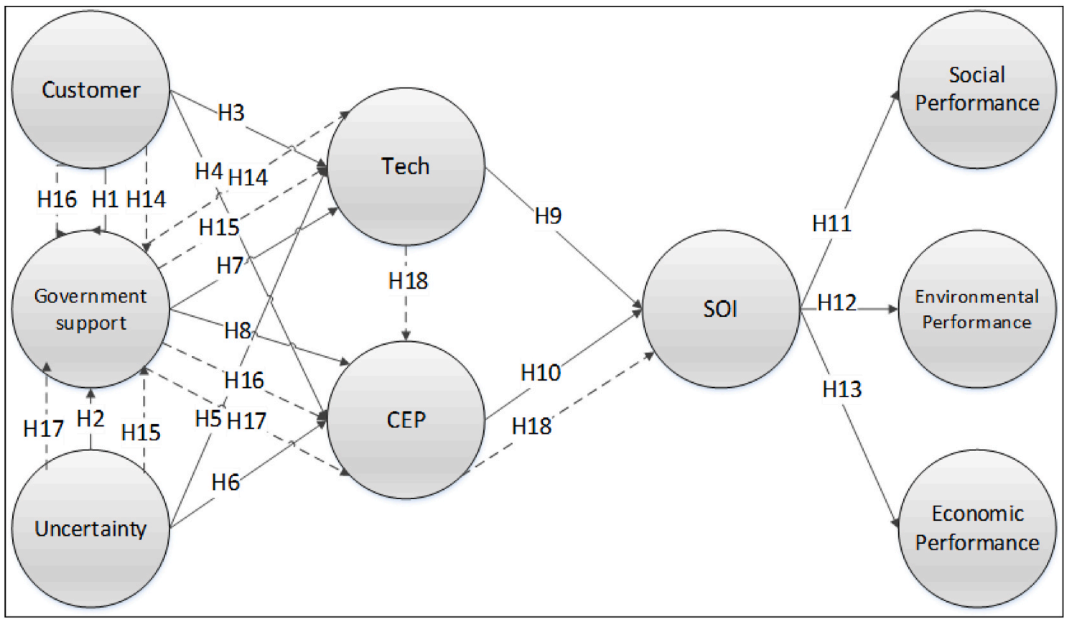

Fig. 1. Model structure and hypotheses.

design stage (Dey et al., 2020b; Kannan et al., 2014; Zeng et al., 2017).

An important part of the model involves social, economic, and environmental performance. Subjective measure for performance are used because of the reluctance of organizations to share sensitive information and the difficulties of gathering objective measures publicly because of the size and context of the SMEs (Dubey et al., 2019). The items have been obtained from the scales tested by Dey et al. (2020b) and based on the work of Abdul-Rashid Salwa et al. (2017); Adebanjo et al. (2016); Inman and Green (2018); Zhu et al. (2008).

After the questionnaire was designed, it was pre-tested by three academics and three industry experts. The wording of some questions was improved using the input provided, aiming to reduce ambiguity and enhance readability. The full list of the constructs used in this study can be found in Table A1 in the Appendix. To ensure the reliability of the scales used, the statistical analysis introduces tests including Cronbach's alpha and the percentage of variance explained.

4.2. Sampling

SMEs face a complicated environment, and survival is foremost, which makes managers risk-averse (Games and Rendi, 2019). This leads to a degree of reluctance to integrate new technology and invest in more sustainable practices (OECD, 2016; Waugh, 2019). The scenario is even more complicated for Mexican SMEs, which operate in a particularly challenging environment in terms of survival and obtaining support (Pymnts, 2019). As of 2015, SMEs in Mexico represented around 99.7% of the total enterprises in the country and over 62.6% of employment in the country, but at the same time only 2% invested in innovation leading to patents (OECD, 2020). Hence, SMEs in Mexico can provide insightful results about the drivers and challenges for the transition toward sustainability.

The information for the study has been gathered using a cross-sectional e-mail survey. The survey was translated to Spanish by two academics and checked by two Mexican colleagues. The survey was uploaded as an online survey questionnaire set-up in Qualtrics (https://www.qualtrics.com) and the link distributed among the organizations that agreed to take part in the study. The study has followed a snowballing sampling approach to identify respondents for the questionnaire as used in previous studies (See Mangla et al., 2018). Snowball sampling is a relevant and irreplaceable technique in research (Waters, 2015) that employs natural social networks to identify informants that can be reached directly, and use them to reach other informants (Noy, 2008). Contacts were used from the University of Celaya with SMEs and requests made to access to other SMEs through those contacts. This approach was useful because of the need to pre-establish relationships with SMEs assuring trustworthiness in order to successfully obtain information or data from them because of security concerns in the country.

The sampling criterion involved SMEs operating in the Celaya region. Celaya is located in the southeast quadrant of the state of Guanajuato with a population of 681,000 people in 2020 (Macrotrends, 2020). The combination of a very economically active region, the significant investment in the area, a strategic location, and prosperous large organizations has allowed for the growth of SMEs in the area (Ruth Del Castillo et al., 2019). The sample of respondents included owners, managers and directors with decision-making power and first-hand knowledge regarding the operations of the company. The data was

Table 4
Descriptive statistics of the sample.

Title	Number	Percentage (%)
Industry		
Commerce	49	29.7
Services	29	17.6
Food	29	17.6
Construction	16	9.7
Manufacturing	13	7.9
Agri-food	9	5.5
Automotive	8	4.8
Mining	4	2.4
Other	3	1.8
Not specified	5	3.0
Number of employees		
Less than 10	93	56.4
11–50	56	33.9
51–100	6	3.6
101–250	4	2.4
Not specified	6	3.6
Time since the company was established (years)		
Less than 1	12	7.3
1–5	52	31.5
5–10	40	24.2
10+	55	33.3
Not specified	6	3.6

collected from December 2018 to October 2019. The descriptive statistics of the sample can be seen in Table 4.

The sample size was decided according to the nature of data analysis to obtain robust and reliable results. Different thresholds and rules of thumb have been proposed to determine an adequate sample size for SEM. Although some traditional sources suggest including ten times as many participants as variables (Nunnally, 1978), more recent articles suggest a minimum of 100 and 200 responses (Boomsma, 1985) with at least 100 respondents (Bollen and Noble, 2011). This indicates that a sample size of 165 responses is adequate. In fact, recent studies based on a Monte Carlo simulation analysis re-evaluate the standard rules of thumb for sample size selection with suggestions below these thresholds (Sideridis et al., 2014; Wolf et al., 2013a). The SME sample of this study (n = 165) comes from a population in a specific location in Mexico. The medium complexity, strong associations and correlations between the items, and no missing values indicate that the sample size of 165 responses is sufficient for correct model identification (see Sideridis et al. (2014); Wolf et al. (2013b)). Further confirmation of the adequacy of the sample size has been undertaken using the Kaiser-Meyer-Olkin (KMO) measure.

We have additionally tested for potential questionnaire non-response bias in the collected data from the SMEs. Specifically, we have compared between early (first 24%) and late (last 24%) respondents (Abdel-Maksoud et al., 2020; Wallace and Mellor, 1988) for questionnaire items related to basic characteristics of the SMEs, such as the industry type, size and sales, based upon the Mann-Whitney non-parametric test. Results indicate the absence of non-response bias in the selected sample of SMEs.

4.3. Data analysis method

SEM (Bollen, 1989) with AMOS (Arbuckle, 2006) has been utilized in order to test empirically the direct hypotheses H1–H13 posed in Section 3 of the paper. SEM has been used to process the quantitative information of each SME, by testing the associations between each proxy of drivers of sustainable supply-chain performance with the latter. This is considered the most appropriate method to derive causal relationships among constructs in an objective way.

Further, complex interrelations between the independent variables can be imposed, such as the indirect hypotheses H14–H18. In order to examine the validity of indirect hypotheses H14–H18, the bootstrap approach introduced by Preacher and Hayes (2004) has been utilized. The SEM model has been fitted to the data via the method of weighted least squares (WLS) (Joreskog, 1994), due to the Likert scale formulation of the collected information by the managers/owners of the Mexican SMEs.

5. Results of the statistical analysis

5.1. Examining the validity of constructs utilized for SEM analysis

In order to determine the reliability and validity of the latent constructs, these were tested using the Cronbach's alpha, correlation coefficient and exploratory factor analysis (EFA). Analyses were conducted using the Statistical Package for the Social Sciences software.

Results to test convergent validity are shown in Table 5, namely Cronbach's alpha, correlation coefficient and percentage of variance obtained by running EFA. Values of Cronbach's α for most latent constructs are adequate (Bryman and Cramer, 2011; Hair, 2003; van Griethuijsen et al., 2015), whereas all correlations of observed items for the latent constructs are statistically significant (p-value<0.01). Percentage of variance of the observed items explained by the latent constructs is adequate, ensuring the validity of the performed analysis (percentages are above 50%, except for SOI being at the borderline).

Table 6 presents the test results concerning discriminant validity in the latent constructs of the SEM model, in the form of average variance extracted (AVE) and correlations between the latent factors. The results confirm that the latent constructs comply with discriminant validity requirements (Fornell and Larcker, 1981) since AVE values are above 0.5 (the only exception is social performance construct) and correlations between the constructs are below 0.6 (the only exception being SOI construct).

Table 5
Reliability and validity measures for constructs (Cronbach's α, correlations and % of explained variance).

Latent construct	Cronbach's α	Correlation	% of explained variance
Customer	0.693	0.534*	76.71
Government support	0.729	0.575*	78.74
Uncertainty	0.53	0.361*	68.05
Technology	0.695	–	62.28
CE principles	0.658	–	59.46
SOI	0.640	–	48.16
Social performance	0.732	0.578*	78.88
Environmental performance	0.713	–	63.54
Economic performance	0.681	0.517*	75.85

*Correlation is significant at the 0.01 level of significance.

5.2. Goodness-of-fit of the SEM model

Various goodness-of-fit (GoF) measures have been calculated to test the fit of the SEM model to the data. We used the root mean square error of approximation (RMS), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI) and the comparative fit index (CFI). The obtained indices were RMS = 0.041, GFI = 0.853, AGFI = 0.813 and CFI = 0.836. The GoF values are generally acceptable, indicating the good fit of the data to the hypothesized model structure.

5.3. Parameter estimation and hypotheses testing results

The standardized path coefficient estimates are shown in Fig. 2. Dashed lines in the graphical representation of the estimated SEM model indicate the non-significance of the association between the two latent structures. Along with the estimated values of the standardized path coefficients, the statistical significance of each association is also indicated in the relative graph.

Research hypothesis H1 has been fully verified since the analysis conducted shows that the latent factor of customer pressure has a significant and positive effect on the latent factor of governmental support (beta = 0.363, p-value<0.001). Conversely, uncertainty in the market has no effect on governmental support (H2), as deduced by the SEM model results (beta = 0.075, p-value>0.1). This is also true for the association between customer pressure and technology adoption (H3), uncertainty in the market and technology adoption (H5), uncertainty in the market on CE implementation (H6), governmental support on CE implementation (H8), and technology adoption on SOI (H9).

Statistically significant direct effects have been shown for the association between customer pressure and CE implementation (beta = 0.483, p-value<0.001), verifying research hypothesis H4. On the other hand, governmental support has significant direct effect on the implementation of technology (H7) (beta = 0.501, p-value<0.001). Also, CE implementation is an important factor influencing SOI (H10) as revealed by the current analysis (beta = 0.964, p-value<0.001).

SOI has been shown to be statistically significant in all three relations with sub-constructs of sustainability performance. Indeed, SOI influences positively the economic performance (beta = 0.616, p-value<0.001), verifying research hypothesis H13, a result which also holds for the effect on environmental performance (beta = 0.862, p-value<0.001), thus verifying hypothesis H12. Similarly, the effect of SOI on social performance is statistically significant at a 1% significance level (beta = 0.622, p-value<0.001), an indication that research hypothesis

Table 6
Discriminant validity results (diagonal elements of the table are the AVE values; non-diagonal elements are the correlations between the latent factors).

	Customer	Government support	Uncertainty	Technology	CE principles	SOI	Social performance	Environmental performance	Economic performance
Customer	0.512								
Government support	0.269	0.696							
Uncertainty	0.136	0.176	0.863						
Technology	0.150	0.374	0.087	0.502					
CE principles	0.417	0.241	−0.049	0.225	0.524				
SOI	0.349	0.355	0.093	0.272	0.669	0.535			
Social performance	0.300	0.191	0.108	0.126	0.411	0.335	0.468		
Environmental performance	0.217	0.208	0.056	0.257	0.568	0.576	0.486	0.527	
Economic performance	0.297	0.097	−0.016	−0.030	0.383	0.376	0.400	0.401	0.599

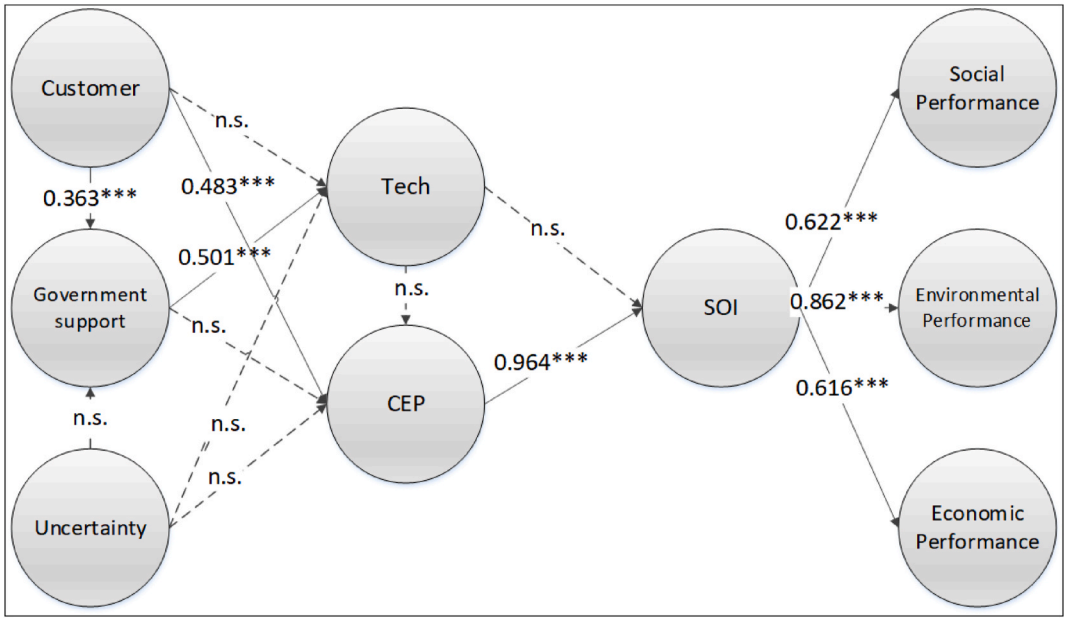

Fig. 2. Standardized path coefficient estimates obtained through the WLS method. *: p < 0.1; **: p < 0.05; ***: p < 0.001.

H11 is valid.

Table A2 in the Appendix presents a more refined level of parameter estimates results, showing the standardized coefficient estimates of the associations between the latent constructs and the corresponding observed items used for their construction.

5.4. Bootstrap test for indirect mediation effects

Indirect effects hypotheses, namely hypotheses H14–H18, have been empirically tested via the use of the bootstrap test. Table 7 presents the results of the bootstrap tests for the validity of indirect hypotheses H14–H18.

Regarding research hypothesis H14, examining the mediation effect of the latent construct of governmental support on the association between the customer pressure and technology adoption factors, the bootstrap test has partly verified that hypothesis (beta = 0.182, p-value<0.1). This finding is important, when combined with the rejection of direct hypothesis H3 indicating no direct effects of the customer construct on technology.

On the other hand, the analysis of results has not found any evidence to support the statistical significance of indirect hypotheses H15–H17, since the results of bootstrap test for indirect effects has returned non-significant results.

Lastly, research hypothesis H18 has also been partly verified (beta = 0.143, p-value<0.1) at the 10% of statistical significance level, indicating that the mediation effect of CE implementation in the relation between technology and SOI is significant. This finding is important since the fit of the SEM has not shown statistically significant direct effects of technology on SOI (rejection of hypothesis H9).

Table 7
Mediation bootstrap test of indirect research hypotheses H12–H16.

Effects	Hypotheses	Estimate	Significance
Direct effect	H14	0.034	n.s.
Indirect effect		0.182	*
Total effect		0.216	**
Direct effect	H15	−0.067	n.s.
Indirect effect		0.037	n.s.
Total effect		−0.030	n.s.
Direct effect	H16	0.483	***
Indirect effect		0.045	n.s.
Total effect		0.5528	***
Direct effect	H17	−0.077	n.s.
Indirect effect		0.009	n.s.
Total effect		−0.068	n.s.
Direct effect	H18	0.041	n.s.
Indirect effect		0.143	*
Total effect		0.184	*

*: p < 0.1; **: p < 0.05; ***: p < 0.001.

6. Discussion

6.1. Theoretical implications

Although there are several calls for the need to engage SMEs in sustainable activities (Aghelie, 2017; Ghisellini et al., 2016; Ormazabal et al., 2018), these organizations operate with capital and resource constraints, which make them very cautious about embarking in expensive and resource-intensive projects (Katz-Gerro and López Sintas, 2019). Therefore, it is important to develop research that can guide their transition toward sustainability.

Using the lenses of IBV, RBV, and industry-based view, this research examines the influence of external pressures in the implementation of CE principles and the use of an SOI orientation, the relationship between the implementation of CE principles and internal resources (digital platforms) with SOI, and the subsequent impact of SOI on sustainable performance. Considering the importance of SMEs for developing economies, specifically to the case of Mexico (INEGI, 2016), this research has gathered information from managers of SMEs to address the research questions stated using SEM.

The first research question looks at the influence of external pressures on the implementation of CE principles. IBV considers the impact of stakeholders in the operations of an organization (Meyer and Rowan, 1977; Meyer and Scott, 1983), whereas the industry-based view accounts for the environment in the industry (Porter, 1980). In this research, those aspects are represented through governmental support, customer pressure and uncertainty in the market. Customer awareness and expectations have been identified as a relevant construct affecting an organization's engagement with sustainable activities (Chavez et al., 2016; de Jesus and Mendonça, 2018; Gong et al., 2019; Yina et al., 2019). Those claims are consistent with the findings of this study, which show a significant influence of customer pressure on the implementation of CE principles in Mexico. This outcome contradicts findings from developed countries (Shao et al., 2016; Song et al., 2019) and highlights the importance of accounting for the impact of contextual factors such as the country of origin in similar studies. Similarly, do Paço et al. (2013), looking at environmental issues and the purchase behaviors of young consumers, find that aspects such as environmental concern and buying behavior vary across countries. Hence, our results provide empirical evidence of the impact of customer pressure on the implementation of CE principles of SMEs in Mexico.

This study did not find support for the hypotheses suggesting governmental support and uncertainty in the market directly affect the implementation of CE principles. However, governmental support seems to influence the implementation of digital platforms in organizations. Kumar et al. (2021b) find that lack of governmental support and incentives can represent a major challenge for the introduction of digital technologies. This research provides empirical evidence that governmental support and incentives are enablers for the adoption of digital platforms, especially in companies with constrained resources such as SMEs. In fact, governmental support represents a major aspect in the model. Kazancoglu et al. (2021) argue that governmental support can stimulate the transition of SMEs toward CE because they play "the role of being a coordinator, mediator, and facilitator for different parties". This research looks into that engagement with other stakeholders (Perry, 2012) to analyze the mediating role played by governmental support between external pressures and the implementation of digital platforms and CE principles. The discussion on the literature about the relationship between public pressure and policy has shown divided views (Burstein, 2003). The results of this research show that more environmentally aware customers can incentivize the development of governmental support for the implementation of CE principles in SMEs in Mexico. This outcome aligns with previous research suggesting the increasing environmental awareness of the public (Wognum et al., 2011) and the way public pressure can enhance the development of environmental protection (Zhang et al., 2018). Our findings suggest that there is a need to develop forums to allow enhanced community involvement (Lawrence et al., 2006). On the other hand, governmental support is found to act as a mediator between customer pressure and the adoption of digital platforms. This means the existence of governmental support can allow SMEs to invest in digital platforms as a response to pressure from the public. This result supports evidence about the role that governments play in the development of programs to raise awareness about the implementation of Industry 4.0 technology in SMEs (Kumar et al., 2020) and financially helping companies to invest in these technologies (Kumar et al., 2021b), particularly in developing economies.

The second research question of this study is focused on the relationship between CE and SOI. This article argues the value of closed-loop activities to support a SOI toward more sustainable activities. The results from the analysis suggest that the implementation of CE has a direct effect on the SOI orientation of SMEs. This finding confirms that the implementation of CE is aligned to the introduction of innovation at the product, process, and organizational level (Klewitz and Hansen, 2014). Moreover, the mediation tests show that the implementation of CE is a mediating variable between the adoption of digital platforms and SOI. Although the use of new technology in business and society has been associated with SOI before (Adams et al., 2016), findings from this research contend that the adoption of digital platforms has an impact on SOI if, and only if, it is preceded by a change in the organizational mindset fostered by the integration of CE principles. Understanding and applying those principles can help organizations to realize the potential of digital platforms to support SOI. This result is consistent with RBV, because it supports the idea that leveraging internal capabilities with the mindset of sustainability can lead to all members of the organization having a better understanding of potential benefits (Neutzling et al., 2018).

The final research question of this study looks at the significance of SOI to achieve social, economic and environmental benefits. Khurana et al. (2021) state that it is essential to gain a better understanding of the effect of SOI and sustainable activities on performance. The results of the analysis agree with previous research and suggest there is a strong relationship between SOI and sustainable performance (Adams et al., 2016; Dey et al., 2020b; Neutzling et al., 2018). To the best of our knowledge, this is the first study providing empirical evidence of the potential benefits of SOI in the three dimensions of sustainability for SMEs in developing countries. Findings suggest that, even in instances with constraints such as the ones faced by Mexican SMEs, there are significant benefits to be had from engaging in the implementation of new technologies and the adoption of CE. This research shows that the use of an SOI strategy can lead to environmental and social benefits without being detrimental to the economic dimension of the company. That is particularly important for SMEs, as the implementation of new initiatives need to account for economic returns to support their survival.

Overall, this paper has contributed to knowledge about sustainability in SMEs in developing countries, using the case of Mexico. It has looked at the influence of external pressures and internal resources for the implementation of CE, enhanced our understanding of the link between CE and SOI, and confirmed the benefits of SOI on sustainable performance.

6.2. Practical implications

The findings of this research provide relevant insights for practitioners:

- Governmental support represents a key aspect for the transition of SMEs toward digital transformation – Governmental support enables SMEs to invest in digital platforms and skills development to promote the implementation of sustainable activities. This finding can help policymakers to understand the impact of current programs

supporting digital transformation with the objective of supporting regional development.

- Customer pressure is a relevant factor for the adoption of CE in Mexican SMEs – Results suggest that customer awareness and pressure should be considered by SMEs as a motivator to implement CE. Managers from SMEs can use these findings to leverage that level of information and understanding to brand and advertise their activities to attract customers.
- The implementation of CE can support SOI – This research suggests that improvements obtained from the adoption of CE can enable organizations to support product, process, and organizational innovation to implement SOI. Moreover, CE is essential to ensure that the implementation of digital platforms supports SOI. This result highlights to SME managers the importance of a change from the linear to the circular paradigm to support the transition of SMEs toward sustainability.
- SOI can lead to economic, social, and environmental benefits for SMEs in Mexico – This research is relevant for Mexican managers because it can be used to justify investment in equipment, training, and process improvements to implement SOI.

6.3. Limitations of the study

The results of our analysis must be carefully considered within the context of this study. The analysis was based on a sample of Mexican SMEs. Similar studies in other emergent economies are needed before the findings can be generalized to different contexts. Also, the focus of this analysis was on SMEs in developing countries, such as Mexico, because of the absence of articles on this subject focused in smaller organizations. Studies looking at a particular sector could unveil details about the specific relationships for that sector. The external factors included in this study have been determined from our literature review and theoretical lens. Further research could incorporate other drivers including investment programs to explore their impact on performance. Additionally, this study cannot confirm the lack of existence of factors moderating the relationships between the constructs studied. On top of that, the analysis has been focused on the influence of CE on the adoption of SOI. However, the specific contribution to each one of the three levels of SOI (process, product, and organization) is presented as an opportunity for future research. We propose the use of case-based research to investigate any other aspects that could affect the implementation of CE in SMEs and their impact on SOI.

7. Conclusions

The transition of SMEs toward sustainability with the aim of reducing environmental impact is a priority in the global agenda. The implementation of sustainable measures, however, can be complicated for SMEs because of resource constraints and limited market reach. Although CE and SOI have a significant overlap that can potentially support that transition, there is an absence of research looking into their relationship. This article introduces novel research analyzing the relationship between CE and SOI and their effect on sustainable performance in SMEs in a developing economy with consideration of external factors. To do so, this article combines three theoretical lenses: RBV, IBV and industry-based view. After testing the link between CE and SOI using SEM, the results suggest that the adoption of CE in SMEs can underpin changes at the product, process, and organization level to promote innovation. Furthermore, it was found that circular thinking is important to leverage digital platforms to successfully introduce SOI.

According to IBV and the industry-based view, external stakeholders and the competitive environment can affect the activities of companies. The empirical analysis shows the significance of customer pressure to engage in CE and to incentivize the development of governmental support for the adoption of sustainability for SMEs. Customers in Mexico have shown a high level of awareness regarding the value of sustainability and demand organizations to implement it. Additionally, results suggest support and guidance positively encourage the use of digital platforms and act as a mediator between customer pressure and the adoption of digital platforms. This finding highlights the impact that policy is having on SMEs in Mexico. The investment from government in plans such as Fondo PYME (http://www.fondopyme.gob.mx/) and guidance from the Estrategia Nacional Visión 10-20-40 De Cambio Climático (https://www.gob.mx/cms/uploads/attachment/file/41978/Estrategia-Nacional-Cambio-Climatico-2013.pdf) underpinning tax breaks in different sectors are having real impacts on organizations. These findings can be used to encourage policymakers in the country to continue developing that support for the transition of SMEs toward sustainability.

There are different avenues for future research. Cross-country comparisons between different developing economies could give more insights about the specific characteristics of SMEs and the effect of specific markets in the relationship between the constructs analyzed. More exploration about regulatory frameworks and their impact on the implementation of CE and SOI in SMEs could provide specific advice to policymakers about opportunities to encourage the transition of SMEs to invest in sustainable solutions. The impact of the rebound effect (See Druckman et al., 2011) in the link between technology and SOI is a very interesting opportunity for further research, as the savings obtained from technology implementation could also encourage their use on other "polluting" activities (Bocken et al., 2016).

APPENDIX

Table A1
Construct titles, items, and their sources

Construct title	Items	Source
Uncertainty in the market	• The company's competitive environment has proven to be unpredictable • In our company we have been unable to predict many of the key changes taking place in our competitive environment • The business climate in our industry is very competitive • Competitors are quick to take advantages of any mistakes	Based on Kohli and Jaworski (1990) and Jambulingam et al. (2005)
Customer pressure	• Environmental issues critically affect the buying decisions of my customers • Our customers often mention environmental factors when making choices • Evolving customer requirements have been difficult to predict • In this market, customers' preferences change quite a bit over time	Based on Gadenne et al. (2009); Kohli and Jaworski (1990); Slater and Narver (1994)
Governmental support	• Laws and regulations have provided guidance for the company on environmental protection and green production • Information is available about what is "best practice" for environmental practices in Mexico • There are environmental rules and regulations in our sector • There are programs and incentives supporting the introduction of environmental practices	Based on Mahpour (2018); Zeng et al. (2017)

(continued on next page)

Table A1 (*continued*)

Construct title	Items	Source
	• In our company we are subject to reviews and audits of environmental practices from our suppliers/customers • Environmental regulations are constantly changing	
Technology adoption	• In our company we use digital platforms and/or contemporary technology to monitor and track products in the value chain • In our company we use digital platforms and/or contemporary technology for virtualization of digital channels • In our company we use digital platforms and/or contemporary technology to optimize resource utilization, e.g. using waste as a resource, optimal energy consumption • In our company we use digital platforms and/or contemporary technology to attract new customers and understand their evolving needs • In our company we use digital platforms and/or contemporary technology for making decisions to support reuse and recycling • In our company we use digital platforms and/or contemporary technology to enhance renovation of products and operational practices	Based on Bürklin and Wynants (2020); Cainelli et al. (2020); Chen (2020)
Circular Economy principles	• In our company we have replaced non-recyclable raw materials with renewable, recyclable, or biodegradable inputs • In our company we have introduced alternative ways to use our products once they have served their initial purpose • In our company we have found new revenue streams for products/services after they have served their initial purpose • In our company we have ways to decrease the usage of non-recyclable raw materials in our processes • In our company we use environmentally friendly packaging • In our company we have processes with low environmental impact • In our company we have found new revenue streams for products/services after they have served their initial purpose • In our company we work with our suppliers to find ways to reintroduce end-of-life items into our supply chain or someone else's supply chain • Leftover raw material can be used again in our processes • In our company we have initiatives to collect leftover products from customers to recycle them • In our company we are using recycled materials as inputs in our processes • Waste product from our processes is recycled	Based on Zeng et al. (2017)
Sustainable-oriented innovation	• On average, each year our company introduces more new products/services than our key competitors • Top management support the introduction of innovative practices/products/services • In our company we consider the potential of recycling at the design stage of our products/services • During the design stage our company considers the possibility to reuse products after they have served their initial purpose	Based on Dey et al. (2020b)
Economic performance	• In our company we have improved our productivity in recent years • In our company we have improved our turnover in recent years • In our company we have reduced our operation costs in recent years • Our business is experiencing growth in recent years • Our level of customer loyalty has increased in recent years • Our level of customer satisfaction has increased in recent years	Based on Abdul-Rashid Salwa et al. (2017); Adebanjo et al. (2016); Dey et al. (2020b)
Environmental performance	• In our company we have reduced waste across our processes • In our company we have achieved resource efficiency across our processes • In our company we have improved compliance with environmental standards	Based on Abdul-Rashid Salwa et al. (2017); Adebanjo et al. (2016); Dey et al. (2020b)
Social performance	• In our company we have improved work safety in recent years • In our company we have improved work environment in recent years • In our company we have improved our relationship with the community and/or stakeholders in recent years • In our company we have improved living quality of surrounding community in recent years	Based on Abdul-Rashid Salwa et al. (2017); Adebanjo et al. (2016); Dey et al. (2020b)

Table A2
Standardized regression coefficients for the association between the observed indicators and the corresponding latent constructs.

Latent factor		Observed item	Standardized path estimate	p-value
CEP	→	**CEP2**	**0.677**	***
CEP	→	**CEP1**	**0.729**	***
CEP	→	**CEP3**	**0.689**	***
CEP	→	**CEP4**	**0.628**	***
SOI	→	**SOI1**	**0.502**	***
SOI	→	**SOI2**	**0.559**	***
SOI	→	**SOI3**	**0.612**	***
SOI	→	**SOI4**	**0.567**	***
Customer	→	**CP2**	**0.808**	***
Customer	→	**CP1**	**0.654**	***
Governmental support	→	**GS2**	**0.730**	***
Governmental support	→	**GS1**	**0.848**	***
Tech	→	**TI1**	**0.542**	***

(*continued on next page*)

Table A2 (*continued*)

Latent factor		Observed item	Standardized path estimate	p-value
Tech	→	**TI2**	**0.700**	***
Uncertainty	→	**UM2**	**0.997**	***
Uncertainty	→	**UM1**	**0.327**	*
Economic performance	→	**EP1**	**0.823**	***
Economic performance	→	**EP2**	**0.653**	***
Environmental performance	→	**AP1**	**0.701**	***
Environmental performance	→	**AP2**	**0.780**	***
Social performance	→	**S1**	**0.746**	***
Social performance	→	**S2**	**0.773**	***

*: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.001$.

References

Abdel-Maksoud, A., Jabbour, M., Abdel-Kader, M., 2020. Stakeholder pressure, eco-control systems, and firms' performance: empirical evidence from UK manufacturers. Account. Forum 1–28.

Abdul-Rashid Salwa, H., Sakundarini, N., Raja Ghazilla Raja, A., Thurasamy, R., 2017. The impact of sustainable manufacturing practices on sustainability performance: empirical evidence from Malaysia. Int. J. Oper. Prod. Manag. 37, 182–204.

Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D., Overy, P., 2016. Sustainability-oriented innovation: a systematic review. Int. J. Manag. Rev. 18, 180–205.

Adebanjo, D., Teh, P.-L., Ahmed Pervaiz, K., 2016. The impact of external pressure and sustainable management practices on manufacturing performance and environmental outcomes. Int. J. Oper. Prod. Manag. 36, 995–1013.

Agamuthu, P., Khidzir, K.M., Hamid, F.S., 2009. Drivers of sustainable waste management in Asia. Waste Manag. Res. 27, 625–633.

Ageron, B., Gunasekaran, A., Spalanzani, A., 2012. Sustainable supply management: an empirical study. Int. J. Prod. Econ. 140, 168–182.

Aghelie, A., 2017. Exploring drivers and barriers to sustainability green business practices within small medium sized enterprises: primary findings. Int. J. Bus. Econ. Dev. 5 (1), 41–48, 2017), 41.

Aguilar, F.X., Vlosky, R.P., 2007. Consumer willingness to pay price premiums for environmentally certified wood products in the. U.S. For. Pol. Econ. 9, 1100–1112.

Aktin, T., Gergin, Z., 2016. Mathematical modelling of sustainable procurement strategies: three case studies. J. Clean. Prod. 113, 767–780.

Araya, Ú., 2003. Análisis comparativo de las necesidades ambientales de las PYME en chile, Colombia y México, Santiago de chile, chile.

Arbuckle, J.L., 2006. Amos 7.0 User's Guide. SPSS, Chicago, IL.

Arena, C., Michelon, G., Trojanowski, G., 2018. Big egos can Be green: a study of CEO hubris and environmental innovation. Br. J. Manag. 29, 316–336.

Asgary, A., Ozdemir, A.I., Özyürek, H., 2020. Small and medium enterprises and global risks: evidence from manufacturing SMEs in Turkey. Int. J. Dis. Risk Sci. 11, 59–73.

Bag, S., Pretorius, J.H.C., Gupta, S., Dwivedi, Y.K., 2021a. Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities. Technol. Forecast. Soc. Change 163, 120420.

Bag, S., Yadav, G., Dhamija, P., Kataria, K.K., 2021b. Key resources for industry 4.0 adoption and its effect on sustainable production and circular economy: an empirical study. J. Clean. Prod. 281, 125233.

Balyer, A., Tabancalı, E., 2019. The Roles of Interest and Pressure Groups in Developing Sustainable Educational Policies in Turkey, vol. 11, p. 7052.

Bastein, A.G.T.M., Roelofs, E., Rietveld, E., Hoogendoorn, A., 2013. Opportunities for a Circular Economy in the Netherlands. TNO, pp. 1–13.

Batista, L., Gong, Y., Pereira, S., Jia, F., Bittar, A., 2019. Circular supply chains in emerging economies – a comparative study of packaging recovery ecosystems in China and Brazil. Int. J. Prod. Res. 57, 7248–7268.

Baumeister, R.F., Leary, M.R., 1997. Writing narrative literature reviews. Rev. Gen. Psychol. 1, 311–320.

Beske, P., Land, A., Seuring, S., 2014. Sustainable supply chain management practices and dynamic capabilities in the food industry: a critical analysis of the literature. Int. J. Prod. Econ. 152, 131–143.

Bocken, N.M.P., de Pauw, I., Bakker, C., van der Grinten, B., 2016. Product design and business model strategies for a circular economy. J. Indust. Prod. Eng. 33, 308–320.

Boiral, O., Baron, C., Gunnlaugson, O., 2014. Environmental leadership and consciousness development: a case study among Canadian SMEs. J. Bus. Ethics 123, 363–383.

Bollen, K.A., 1989. Structural Equations with Latent Variables. Wiley.

Bollen, K.A., Noble, M.D., 2011. Structural equation models and the quantification of behavior. Proc. Natl. Acad. Sci. U. S. A. 108 (Suppl. 3), 15639–15646.

Boomsma, A., 1985. Nonconvergence, improper solutions, and starting values in lisrel maximum likelihood estimation. Psychometrika 50, 229–242.

Braganza, A., Brooks, L., Nepelski, D., Ali, M., Moro, R., 2017. Resource management in big data initiatives: processes and dynamic capabilities. J. Bus. Res. 70, 328–337.

Brilé, A., Tobias, B., Hugh, W., 2017. Public opinion and environmental policy output: a cross-national analysis of energy policies in Europe. Environ. Res. Lett. 12, 1-1.

British_Chamber_of_Commerce, 2021. Carbon Footprint a Mystery to 9 Out of 10 Small Businesses.

Brown, P., Bocken, N., Balkenende, R., 2019. Why do companies pursue collaborative circular Oriented Innovation? Sustainability 11, 635.

Bryman, A., Cramer, D., 2011. Quantitative data analysis with IBM SPSS 17. In: 18 and 19. [electronic Resource] : a Guide for Social Scientists. Routledge.

Bürklin, N., Wynants, J., 2020. Opening new opportunities to close the loop: how technology influences the circular economy. In: Vignali, G., Reid, L., Ryding, D., Henninger, C. (Eds.), Technology-Driven Sustainability, pp. 219–240.

Burstein, P., 2003. The impact of public opinion on public policy: a review and an agenda. Polit. Res. Q. 56, 29–40.

Cainelli, G., D'Amato, A., Mazzanti, M., 2020. Resource efficient eco-innovations for a circular economy: evidence from EU firms. Res. Pol. 49, 103827.

Carbons_Majors_Database, 2017. CDP Carbon Majors Report, p. 15.

Cayzer, S., Griffiths, P., Beghetto, V., 2017. Design of indicators for measuring product performance in the circular economy. Int. J. Sustain. Eng. 10, 289–298.

Chan, T.y., Wong Christina, W.Y., 2012. The consumption side of sustainable fashion supply chain: understanding fashion consumer eco-fashion consumption decision. J. Fash. Mark. Manag.: Int. J. 16, 193–215.

Charonis, G., 2012. Degrowth, Steady State Economics and the Circular Economy: Three Distinct yet Increasingly Converging Alternative Discourses to Economic Growth for Achieving Environmental Sustainability and Social Equity. World Economic Association Sustainability Conference 2012.

Chavez, R., Yu, W., Feng, M., Wiengarten, F., 2016. The effect of customer-centric green supply chain management on operational performance and customer satisfaction. Bus. Strat. Environ. 25, 205–220.

Chen, C.W., 2020. Improving circular economy business models: opportunities for Business and Innovation A new framework for businesses to create a truly circular economy. Johnson Matthey Technol. Rev. 64, 48–58.

Chiappetta Jabbour, C.J., Seuring, S., Lopes de Sousa Jabbour, A.B., Jugend, D., De Camargo Fiorini, P., Latan, H., Izeppi, W.C., 2020. Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids. J. Environ. Manag. 264, 110416.

Chu, Z., Wang, L., Lai, F., 2019. Customer pressure and green innovations at third party logistics providers in China: the moderation effect of organizational culture. Int. J. Logist. Manag. 30, 57–75.

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

Córdova-Rangel, A., 2011. An Analysis of Economic Development At the PyMES in Aguascalientes, Coloquio Predoctoral CLADEA (Consejo Latinoamericano de Escuelas de Administración) 2008. Escuela de Negocios de la Universidad de las Américas Puebla.

De, D., Chowdhury, S., Dey, P.K., Ghosh, S.K., 2020. Impact of lean and sustainability oriented innovation on sustainability performance of small and medium sized enterprises: a data envelopment analysis-based framework. Int. J. Prod. Econ. 219, 416–430.

de Jesus, A., Mendonça, S., 2018. Lost in transition? Drivers and barriers in the eco-innovation road to the circular economy. Ecol. Econ. 145, 75–89.

Demirel, P., Kesidou, E., 2019. Sustainability-oriented capabilities for eco-innovation: meeting the regulatory, technology, and market demands. Bus. Strat. Environ. 28, 847–857.

Dey, P.K., Malesios, C., De, D., Budhwar, P., Chowdhury, S., Cheffi, W., 2020a. Circular Economy to Enhance Sustainability of Small and Medium-Sized Enterprises. Business Strategy and the Environment n/a.

Dey, P.K., Malesios, C., De, D., Chowdhury, S., Abdelaziz, F.B., 2020b. The impact of lean management practices and sustainably-oriented innovation on sustainability performance of small and medium-sized enterprises: empirical evidence from the UK. Br. J. Manag. 31, 141–161.

Diéguez-Santana, K., Rodríguez Rudi, G., Acevedo Urquiaga, A.J., Muñoz, E., Sablón-Cossio, N., 2021. An assessment tool for the evaluation of circular economy implementation. Academia. Rev. Latinoam. Adm. 34, 316–328.

do Paço, A., Alves, H., Shiel, C., Filho, W.L., 2013. A multi-country level analysis of the environmental attitudes and behaviours among young consumers. J. Environ. Plann. Manag. 56, 1532–1548.

Druckman, A., Chitnis, M., Sorrell, S., Jackson, T., 2011. Missing carbon reductions? Exploring rebound and backfire effects in UK households. Energy Pol. 39, 3572–3581.

Dubey, R., Gunasekaran, A., Childe, S.J., Blome, C., Papadopoulos, T., 2019. Big data and predictive analytics and manufacturing performance: integrating institutional theory, resource-based view and big data culture. Br. J. Manag. 30, 341–361.

EC, 2019. Executive Summary of SME Annual Report 2018-2019.

EMF, 2013. Growth within: a Circular Economy Vision for a Competitive Europe, Going for Growth: A Practical Route to a Circular Economy.

Epstein, M.J., Roy, M.-J., 2003. Making the business case for sustainability: linking social and environmental actions to financial performance. J. Corp. Citizen. 79–96.
EU, 2008. Official journal of EU, L 312, 19.11.2008., Directive 2008/98/EC of the European Parliament and of the Council of 19 november 2008 on waste and repealing certain directives.
Figge, F., Young, W.i., r, R.a.B., 2014. Sufficiency or efficiency to achieve lower resource consumption and emissions? The role of the rebound effect. J. Clean. Prod. 69, 216–224.
Fonseka, M.M., Gao-liang, T., Liu-chuang, L., 2014. Impact of financial capability on firms' competitiveness and sustainability. Chin. Manag. Stud. 8, 593–623.
Gadenne, D.L., Kennedy, J., McKeiver, C., 2009. An empirical study of environmental awareness and practices in SMEs. J. Bus. Ethics 84, 45–63.
Games, D., Rendi, R.P., 2019. The effects of knowledge management and risk taking on SME financial performance in creative industries in an emerging market: the mediating effect of innovation outcomes. J. Glob. Entrep. Res. 9, 44.
García-Quevedo, J., Jové-Llopis, E., Martínez-Ros, E., 2020. Barriers to the Circular Economy in European Small and Medium-Sized Firms. Business Strategy and the Environment n/a.
Garetti, M., Taisch, M., 2012. Sustainable manufacturing: trends and research challenges. Prod. Plann. Control 23, 83–104.
Geissdoerfer, M., Savaget, P., Bocken, N.M.P., Hultink, E.J., 2017. The Circular Economy – a new sustainability paradigm? J. Clean. Prod. 143, 757–768.
Geng, Y., Doberstein, B., 2008. Developing the circular economy in China: challenges and opportunities for achieving 'leapfrog development. Int. J. Sustain. Dev. World Ecol. 15, 231–239.
Geradts, T.H.J., Bocken, N.M.P., 2019. Driving Sustainability-Oriented Innovation, vol. 78. MIT Sloan Management Review.
Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32.
Gong, M., Gao, Y., Koh, L., Sutcliffe, C., Cullen, J., 2019. The role of customer awareness in promoting firm sustainability and sustainable supply chain management. Int. J. Prod. Econ. 217, 88–96.
Govindan, K., Hasanagic, M., 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. Int. J. Prod. Res. 56, 278–311.
Govindan, K., Khodaverdi, R., Jafarian, A., 2013. A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. J. Clean. Prod. 47, 345–354.
Goyal, S., Esposito, M., Kapoor, A., 2018. Circular economy business models in developing economies: lessons from India on reduce, recycle, and reuse paradigms. Thunderbird Int. Bus. Rev. 60, 729–740.
Grant, R.M., 1991. The resource-based theory of competitive advantage: implications for strategy formulation. California Manag. Rev. 33, 114–135.
Gunasekaran, A., Papadopoulos, T., Dubey, R., Fosso-Wamba, S., Childe, S.J., Hazen, B., Akter, S., 2017. Big data and predictive analytics for supply chain and organizational performance. J. Bus. Res. 70, 308–317.
Gupta, M., George, J.F., 2016. Toward the development of a big data analytics capability. Inf. Manag. 53, 1049–1064.
Hair, J.F., 2003. Essentials of Business Research Methods/Joseph F. Hair, Jr [et al.]. In: Hoboken, N.J. (Ed.), International ed. Wiley. c2003.
Hallam, C., Contreras, C., 2016. Integrating lean and green management. Manag. Decis. 54, 2157–2187.
Healy, B., Michele, O.D., Ledwith, A., 2018. An exploration of product advantage and its antecedents in SMEs. J. Small Bus. Enterprise Dev. 25, 129–146.
Hernandez, A.A., 2018. Exploring the factors to green IT adoption of SMEs in the Philippines. J. Cases Inf. Technol. 20, 49–66.
Hofmann, E., Rüsch, M., 2017. Industry 4.0 and the current status as well as future prospects on logistics. Comput. Ind. 89, 23–34.
Hong, J., Zhang, Y., Ding, M., 2018. Sustainable supply chain management practices, supply chain dynamic capabilities, and enterprise performance. J. Clean. Prod. 172, 3508–3519.
Hong, P., Jeong, J., 2006. Supply chain management practices of SMEs: from a business growth perspective. J. Enterprise Inf. Manag. 19, 292–302.
Horváth, D., Szabó, R.o.Z., 2019. Driving forces and barriers of Industry 4.0: do multinational and small and medium-sized companies have equal opportunities? Technol. Forecast. Soc. Change 146, 119–132. September 2019.
Hutner, P., Thorenz, A., Tuma, A., 2017. Waste prevention in communities: a comprehensive survey analyzing status quo, potentials, barriers and measures. J. Clean. Prod. 141, 837–851.
Ibn-Mohammed, T., Mustapha, K.B., Godsell, J., Adamu, Z., Babatunde, K.A., Akintade, D.D., Acquaye, A., Fujii, H., Ndiaye, M.M., Yamoah, F.A., Koh, S.C.L., 2021. A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies. Resour. Conserv. Recycl. 164, 105169.
Ilić, M., Nikolić, M., 2016. Drivers for development of circular economy – a case study of Serbia. Habitat Int. 56, 191–200.
INEGI, 2016. Se difunden estadísticas detalladas sobre las micro, pequeñas y medianas empresas del país.
Inman, R.A., Green, K.W., 2018. Lean and green combine to impact environmental and operational performance. Int. J. Prod. Res. 56, 4802–4818.
Jain, N.K., Panda, A., Choudhary, P., 2020. Institutional pressures and circular economy performance: the role of environmental management system and organizational flexibility in oil and gas sector. Bus. Strat. Environ. 29, 3509–3525.
Jakhar, S.K., Mangla, S.K., Luthra, S., Kusi-Sarpong, S., 2019. When stakeholder pressure drives the circular economy. Manag. Decis. 57, 904–920.
Jambulingam, T., Kathuria, R., Doucette, W.R., 2005. Entrepreneurial orientation as a basis for classification within a service industry: the case of retail pharmacy industry. J. Oper. Manag. 23, 23–42.
Johnson, M.P., Schaltegger, S., 2016. Two decades of sustainability management tools for SMEs: how far have we come? J. Small Bus. Manag. 54, 481–505.
Joreskog, K.G., 1994. PRELIS 2 User's Guide. Routledge.
Kagermann, H., Helbig, J., Hellinger, A., Wahlster, W., 2013. Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0, Final Report of the Industrie 4.0 Working Group. Acatech, Berlin.
Kalmykova, Y., Sadagopan, M., Rosado, L., 2018. Circular economy – from review of theories and practices to development of implementation tools. Resour. Conserv. Recycl. 135, 190–201.
Kannan, D., Jabbour, A.B.L.d.S., Jabbour, C.J.C., 2014. Selecting green suppliers based on GSCM practices: using fuzzy TOPSIS applied to a Brazilian electronics company. Eur. J. Oper. Res. 233, 432–447.
Katz-Gerro, T., López Sintas, J., 2019. Mapping circular economy activities in the European Union: patterns of implementation and their correlates in small and medium-sized enterprises. Bus. Strat. Environ. 28, 485–496.
Kava, H., Spanaki, K., Papadopoulos, T., Despoudi, S., Rodríguez-Espindola, O., Fakhimi, M., 2021. Data analytics diffusion in the UK renewable energy sector: an innovation perspective. Ann. Oper. Res. https://doi.org/10.1007/s10479-021-04263-1.
Kazancoglu, I., Sagnak, M., Kumar Mangla, S., Kazancoglu, Y., 2021. Circular economy and the policy: a framework for improving the corporate environmental management in supply chains. Bus. Strat. Environ. 30, 590–608.
Khurana, S., Haleem, A., Luthra, S., Mannan, B., 2021. Evaluating critical factors to implement sustainable oriented innovation practices: an analysis of micro, small, and medium manufacturing enterprises. J. Clean. Prod. 285, 125377.
Khurana, S., Mannan, B., Haleem, A., 2020. Total interpretive structural modelling of critical factors of sustainable-oriented innovation for Indian manufacturing MSMEs. In: Kumar, H., Jain, P.K. (Eds.), Recent Advances in Mechanical Engineering. Springer Singapore, Singapore, pp. 95–106.
Kim, S.-T., Han, C.-H., 2012. The role of organisational learning in the adoption of environmental logistics practices: empirical evidence from Korea. Int. J. Logist. Res. Appl. 15, 147–161.
Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., Hekkert, M., 2018. Barriers to the circular economy: evidence from the European union (EU). Ecol. Econ. 150, 264–272.
Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: an analysis of 114 definitions. Resour. Conserv. Recycl. 127, 221–232.
Kiron, D., Kruschwitz, N., Reeves, M., Goh, E., 2013. The benefits of sustainability-driven innovation. MIT Sloan Manag. Rev. 54, 69–73.
Klewitz, J., Hansen, E.G., 2014. Sustainability-oriented innovation of SMEs: a systematic review. J. Clean. Prod. 65, 57–75.
Kohli, A.K., Jaworski, B.J., 1990. Market orientation: the construct, research propositions, and managerial implications. J. Market. 54, 1–18.
Kumar, P., Singh, R.K., Kumar, V., 2021a. Managing supply chains for sustainable operations in the era of industry 4.0 and circular economy: analysis of barriers. Resour. Conserv. Recycl. 164, 105215.
Kumar, R., Singh, R.K., Dwivedi, Y.K., 2020. Application of industry 4.0 technologies in SMEs for ethical and sustainable operations: analysis of challenges. J. Clean. Prod. 275, 124063.
Kumar, S., Raut, R.D., Nayal, K., Kraus, S., Yadav, V.S., Narkhede, B.E., 2021b. To identify industry 4.0 and circular economy adoption barriers in the agriculture supply chain by using ISM-ANP. J. Clean. Prod. 293, 126023.
Lawrence, S.R., Collins, E., Pavlovich, K., Arunachalam, M., 2006. Sustainability practices of SMEs: the case of NZ. Bus. Strat. Environ. 15, 242–257.
Liang, H., Saraf, N., Hu, Q., Xue, Y., 2007. Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. MIS Q. 31, 59–87.
Lii, P., Kuo, F.-I., 2016. Innovation-oriented supply chain integration for combined competitiveness and firm performance. Int. J. Prod. Econ. 174, 142–155.
Lin, C.Y., Ho, Y.H., 2011. Determinants of green practice adoption for logistics companies in China. J. Bus. Ethics 98, 67–83.
Lin, K.-Y., 2018. User experience-based product design for smart production to empower industry 4.0 in the glass recycling circular economy. Comput. Ind. Eng. 125, 729–738.
Liu, H., Ke, W., Wei, K.K., Gu, J., Chen, H., 2010. The role of institutional pressures and organizational culture in the firm's intention to adopt internet-enabled supply chain management systems. J. Oper. Manag. 28, 372–384.
Liu, Y., Bai, Y., 2014. An exploration of firms' awareness and behavior of developing circular economy: an empirical research in China. Resour. Conserv. Recycl. 87, 145–152.
Lopes de Sousa Jabbour, A.B., Jabbour, C.J.C., Godinho Filho, M., Roubaud, D., 2018. Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. Ann. Oper. Res. 270, 273.
López-Pérez, M.E., Melero, I., Javier Sese, F., 2017. Management for sustainable development and its impact on firm value in the SME context: does size matter? Bus. Strat. Environ. 26, 985–999.
Lu, J., Ren, L., Zhang, C., Rong, D., Ahmed, R.R., Streimikis, J., 2020. Modified Carroll's pyramid of corporate social responsibility to enhance organizational performance of SMEs industry. J. Clean. Prod. 271, 122456.
Lüdeke-Freund, F., Gold, S., Bocken, N.M.P., 2019. A review and typology of circular economy business model patterns. J. Ind. Ecol. 23, 36–61.

Luthra, S., Kumar, A., Zavadskas, E.K., Mangla, S.K., Garza-Reyes, J.A., 2020. Industry 4.0 as an enabler of sustainability diffusion in supply chain: an analysis of influential strength of drivers in an emerging economy. Int. J. Prod. Res. 58, 1505–1521.
Machado, C.G., Winroth, M.P., Ribeiro da Silva, E.H.D., 2020. Sustainable manufacturing in Industry 4.0: an emerging research agenda. Int. J. Prod. Res. 58, 1462–1484.
Macrotrends, 2020. Celaya, Mexico Population 1950-2020.
Mahpour, A., 2018. Prioritizing barriers to adopt circular economy in construction and demolition waste management. Resour. Conserv. Recycl. 134, 216–227.
Maletič, M., Maletič, D., Dahlgaard, J.J., Dahlgaard-Park, S.M., Gomišček, B., 2016. Effect of sustainability-oriented innovation practices on the overall organisational performance: an empirical examination. Total Qual. Manag. Bus. Excel. 27, 1171–1190.
Mangla, S.K., Luthra, S., Mishra, N., Singh, A., Rana, N.P., Dora, M., Dwivedi, Y., 2018. Barriers to effective circular supply chain management in a developing country context. Prod. Plann. Control 29, 551–569.
Martinez-Conesa, I., Soto-Acosta, P., Carayannis Elias, G., 2017. On the path towards open innovation: assessing the role of knowledge management capability and environmental dynamism in SMEs. J. Knowl. Manag. 21, 553–570.
Meehan, J., Bryde, D., 2011. Sustainable procurement practice. Bus. Strat. Environ. 20, 94–106.
Metz, P., Burek, S., Hultgren, T.R., Kogan, S., Schwartz, L., 2016. The path to sustainability-driven innovation. Res. Technol. Manag. 59, 50–61.
Meyer, J.W., Rowan, B., 1977. Institutionalized organizations: formal structure as myth and ceremony. Am. J. Sociol. 83, 340–363.
Meyer, J.W., Scott, W.R., 1983. Organizational Environments : Ritual and Rationality. Sage.
Miller, K., Neubauer, A., Varma, A., Williams, E., 2011. First Assessment of the Environmental Compliance Assistance Programme for SMEs (ECAP). European Commission DG Environment and Climate Action and AEA Technology.
Moore, S.B., Manring, S.L., 2009. Strategy development in small and medium sized enterprises for sustainability and increased value creation. J. Clean. Prod. 17, 276–282.
Mostaghel, R., Chirumalla, K., 2021. Role of customers in circular business models. J. Bus. Res. 127, 35–44.
Munaro, M.R., Tavares, S.F., Bragança, L., 2020. Towards circular and more sustainable buildings: a systematic literature review on the circular economy in the built environment. J. Clean. Prod. 260, 121134.
Mwangi, G.M., Despoudi, S., Espindola, O.R., Spanaki, K., Papadopoulos, T., 2021. A planetary boundaries perspective on the sustainability: resilience relationship in the Kenyan tea supply chain. Ann. Oper. Res. https://doi.org/10.1007/s10479-021-04096-y.
Neutzling, D.M., Land, A., Seuring, S., Nascimento, L.F.M.d., 2018. Linking sustainability-oriented innovation to supply chain relationship integration. J. Clean. Prod. 172, 3448–3458.
Noci, G., Verganti, R., 1999. Managing 'green' product innovation in small firms. R D Manag. 29, 3–15.
Noy, C., 2008. Sampling knowledge: the hermeneutics of snowball sampling in qualitative research. Int. J. Soc. Res. Methodol. 11, 327–344.
Ntsondé, J., Aggeri, F., 2021. Stimulating innovation and creating new markets – the potential of circular public procurement. J. Clean. Prod. 308, 127303.
Nunnally, J.C., 1978. Psychometric Theory. McGraw-Hill, New York, 1978.
O'Connor, G.C., 2008. Major innovation as a dynamic capability: a systems approach. J. Prod. Innovat. Manag. 25, 313–330.
OECD, 2016. Environmental Policy Toolkit for Greening SMEs.
OECD, 2018a. Environmental Policy Toolkit for SME Greening in EU Eastern Partnership Countries.
OECD, 2018b. SMEs: Key Drivers of Green and Inclusive Growth. GGKP6 2018 & Forum Annual Conference, Paris, France.
OECD, 2020. Financing SMEs and Entrepreneurs 2020 : an OECD Scoreboard.
Oliver, C., 1997. Sustainable competitive advantage: combining institutional and resource-based views. Strat. Manag. J. 18, 697–713.
Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., Jaca, C., 2018. Circular economy in Spanish SMEs: challenges and opportunities. J. Clean. Prod. 185, 157–167.
Panwar, R., Niesten, E., 2020. Advancing circular economy. Bus. Strat. Environ. 29, 2890–2892.
Parker, C.M., Redmond, J., Simpson, M., 2009. A review of interventions to encourage SMEs to make. Environ. Improv. 27, 279–301.
Patwa, N., Sivarajah, U., Seetharaman, A., Sarkar, S., Maiti, K., Hingorani, K., 2021. Towards a circular economy: an emerging economies context. J. Bus. Res. 122, 725–735.
Paulraj, A., Chen, I.J., 2007. Environmental uncertainty and strategic supply management: a resource dependence perspective and performance implications. J. Supply Chain Manag. 43, 29–42.
Peltier, J.W., Zhao, Y., Schibrowsky, J.A., 2012. Technology adoption by small businesses: an exploratory study of the interrelationships of owner and environmental factors. Int. Small Bus. J. 30, 406–431.
Peng, H., Shen, N., Liao, H., Xue, H., Wang, Q., 2020. Uncertainty factors, methods, and solutions of closed-loop supply chain — a review for current situation and future prospects. J. Clean. Prod. 254, 120032.
Peng, M.W., Sun, S.L., Pinkham, B., Chen, H., 2009. The institution-based view as a third leg for a strategy tripod. Acad. Manag. Perspect. 23, 63–81.
Peng, M.W., Wang, D.Y.L., Jiang, Y., 2008. An institution-based view of international business strategy: a focus on emerging economies. J. Int. Bus. Stud. 39, 920–936.
Perry, P., 2012. Exploring the influence of national cultural context on CSR implementation. J. Fash. Mark. Manag.: Int. J. 16, 141–160.
Petersen, C., 2018. Volatility and Uncertainty: A New Normal for Mexico. Americas Quarterly.
Pinto, L., 2020. Green Supply Chain Practices and Company Performance in Portuguese Manufacturing Sector. Business Strategy and the Environment n/a.
Porter, M.E., 1980. Competitive Strategy : Techniques for Analyzing Industries and Competitors. Free Press.
Prause, M., 2019. Challenges of industry 4.0 technology adoption for SMEs. Case Jpn. 11, 5807.
Preacher, K.J., Hayes, A.F., 2004. SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav. Res. Methods Instrum. Comput. 36, 717–731.
Preston, F., Lehne, J., 2017. A Wider Circle? the Circular Economy in Developing Countries (London).
Priem, R.L., Butler, J.E., 2001. Is the resource-based "view" a useful perspective for strategic management research? Acad. Manag. Rev. 26, 22–40.
Prieto-Sandoval, V., Jaca, C., Ormazabal, M., 2018a. Towards a consensus on the circular economy. J. Clean. Prod. 179, 605–615.
Prieto-Sandoval, V., Ormazabal, M., Jaca, C., Viles, E., 2018b. Key elements in assessing circular economy implementation in small and medium-sized enterprises. Bus. Strat. Environ. 27, 1525–1534.
Pymnts, 2019. FinTech Pressures FI Giants to Strengthen SMB Lending in Mexico.
Ranta, V., Aarikka-Stenroos, L., Ritala, P., Mäkinen, S.J., 2018. Exploring institutional drivers and barriers of the circular economy: a cross-regional comparison of China, the US, and Europe. Resour. Conserv. Recycl. 135, 70–82.
Rattalino, F., 2018. Circular advantage anyone? Sustainability-driven innovation and circularity at Patagonia, Inc. Thunderbird Int. Bus. Rev. 60, 747–755.
Reh, L., 2013. Process engineering in circular economy. Particuology 11, 119–133.
Revell, A., Stokes, D., Chen, H., 2010. Small businesses and the environment: turning over a new leaf? Bus. Strat. Environ. 19, 273–288.
Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., Topi, C., 2016. Implementation of circular economy business models by small and medium-sized enterprises (SMEs). Barriers Enablers 8, 1212.
Rodríguez-Espíndola, O., Alem, D., Pelegrin Da Silva, L., 2020. A shortage risk mitigation model for multi-agency coordination in logistics planning. Comput. Ind. Eng. 148, 106676.
Rodríguez-Espíndola, O., Chowdhury, S., Dey, P.K., Albores, P., Emrouznejad, A., 2022. Analysis of the adoption of emergent technologies for risk management in the era of digital manufacturing. Technol. Forecast. Soc. Change 178, 121562.
Roh, T., Lee, K., Yang, J.Y., 2021. How do intellectual property rights and government support drive a firm's green innovation? The mediating role of open innovation. J. Clean. Prod. 317, 128422.
Rojko, A., 2017. Industry 4.0 concept: background and overview. Int. J. Interact. Mob. Technol. 11, 77–90.
Ruth Del Castillo, R., Celina, L.-M., Manuela, C.-E., 2019. Employment dynamics and outsourcing in Celaya, Mexico: an analysis by economic sector. Rev. Archéol. Narbonnaise 5, 69–84.
Sarkar, S., Pansera, M., 2017. Sustainability-driven innovation at the bottom: insights from grassroots ecopreneurs. Technol. Forecast. Soc. Change 114, 327–338.
Sarkis, J., Gonzalez-Torre, P., Adenso-Diaz, B., 2010. Stakeholder pressure and the adoption of environmental practices: the mediating effect of training. J. Oper. Manag. 28, 163–176.
Schaltegger, S., Wagner, M., 2011. Sustainable entrepreneurship and sustainability innovation: categories and interactions. Bus. Strat. Environ. 20, 222–237.
Schröder, C., 2016. The Challenges of Industry 4.0 for Small and Medium-Sized Enterprises. Friedrich-Ebert-Stiftung, Bonn, Germany.
Shao, J., Huang, S., Lemus-Aguilar, I., Ünal, E., 2020. Circular business models generation for automobile remanufacturing industry in China. J. Manuf. Technol. Manag. 31, 542–571.
Shao, J., Taisch, M., Ortega-Mier, M., 2016. A grey-DEcision-MAking Trial and Evaluation Laboratory (DEMATEL) analysis on the barriers between environmentally friendly products and consumers: practitioners' viewpoints on the European automobile industry. J. Clean. Prod. 112, 3185–3194.
Sideridis, G., Simos, P., Papanicolaou, A., Fletcher, J., 2014. Using structural equation modeling to assess functional connectivity in the brain: power and sample size considerations. Educ. Psychol. Meas. 74, 733–758.
Slater, S.F., Narver, J.C., 1994. Does competitive environment moderate the market orientation-performance relationship? J. Market. 58, 46–55.
Soh, K.L., Wong, W.P., 2021. Circular economy transition: exploiting innovative eco-design capabilities and customer involvement. J. Clean. Prod. 320, 128858.
Song, L., Lim, Y., Chang, P., Guo, Y., Zhang, M., Wang, X., Yu, X., Lehto, M.R., Cai, H., 2019. Ecolabel's role in informing sustainable consumption: a naturalistic decision making study using eye tracking glasses. J. Clean. Prod. 218, 685–695.
Srinivasan, R., Swink, M., 2018. An investigation of visibility and flexibility as complements to supply chain analytics: an organizational information processing theory perspective. Prod. Oper. Manag. 27, 1849–1867.
Su, B., Heshmati, A., Geng, Y., Yu, X., 2013. A review of the circular economy in China: moving from rhetoric to implementation. J. Clean. Prod. 42, 215–227.
Sullivan-Taylor, B., Branicki, L., 2011. Creating resilient SMEs: why one size might not fit all. Int. J. Prod. Res. 49, 5565–5579.
Tatoglu, E., Glaister, A.J., Demirbag, M., 2016. Talent management motives and practices in an emerging market: a comparison between MNEs and local firms. J. World Bus. 51, 278–293.
Tellis, G.J., Prabhu, J.C., Chandy, R.K., 2009. Radical innovation across nations. Preeminence Corpor. Cult. 73, 3–23.
Thanki, S., Thakkar, J., 2018. A quantitative framework for lean and green assessment of supply chain performance. Int. J. Prod. Perform. Manag. 67, 366–400.

Tseng, M.-L., Tan, R.R., Chiu, A.S.F., Chien, C.-F., Kuo, T.C., 2018. Circular economy meets industry 4.0: can big data drive industrial symbiosis? Resour. Conserv. Recycl. 131, 146–147.
UN, 2015. Resolution Adopted by the General Assembly on 25 September 2015.
van Griethuijsen, R.A.L.F., van Eijck, M.W., Haste, H., den Brok, P.J., Skinner, N.C., Mansour, N., Savran Gencer, A., BouJaoude, S., 2015. Global patterns in students' views of science and interest in science. Res. Sci. Educ. 45, 581–603.
Van Holt, T., Statler, M., Atz, U., Whelan, T., van Loggerenberg, M., Cebulla, J., 2020. The cultural consensus of sustainability-driven innovation: strategies for success. Bus. Strat. Environ. 29, 3399–3409.
Vanalle, R.M., Ganga, G.M.D., Godinho Filho, M., Lucato, W.C., 2017. Green supply chain management: an investigation of pressures, practices, and performance within the Brazilian automotive supply chain. J. Clean. Prod. 151, 250–259.
Wallace, R.S.O., Mellor, C.J., 1988. Nonresponse bias in mail accounting surveys: a pedagogical note. Br. Account. Rev. 20, 131–139.
Wang, B., Zhao, J.-y., Wan, Z.-G., Ma, J.-h., Li, H., Ma, J., 2016. Lean Intelligent Production System and Value Stream Practice. Trans. Econ. Manag.
Wang, L., Li, W., Qi, L., 2020. Stakeholder pressures and corporate environmental strategies: a meta-analysis. Sustainability 12, 1172.
Waters, J., 2015. Snowball sampling: a cautionary tale involving a study of older drug users. Int. J. Soc. Res. Methodol. 18, 367–380.
Waugh, Rob, 2019. How well do SMEs budget for technology? Telegraph. https://www.telegraph.co.uk/business/challenges/budgeting-for-technology/. (Accessed 12 September 2020).
WEF, 2017. The Inclusive Growth and Development Report 2017.
Wernerfelt, B., 1984. A resource-based view of the firm. Strat. Manag. J. 5, 171–180.
Wognum, P.M., Bremmers, H., Trienekens, J.H., van der Vorst, J.G.A.J., Bloemhof, J.M., 2011. Systems for sustainability and transparency of food supply chains – current status and challenges. Adv. Eng. Inf. 25, 65–76.
Wolf, E.J., Harrington, K.M., Clark, S.L., Miller, M.W., 2013a. Sample Size Requirements for Structural Equation Models: an Evaluation of Power, Bias, and Solution Propriety. Educational and Psychological Measurement, pp. 913–934.
Wolf, E.J., Harrington, K.M., Clark, S.L., Miller, M.W., 2013b. Sample size requirements for structural equation models: an evaluation of power, bias, and solution propriety. Educ. Psychol. Meas. 76, 913–934.
Wu, G.-C., 2017. Effects of socially responsible supplier development and sustainability-oriented innovation on sustainable development: empirical evidence from SMEs. Corp. Soc. Responsib. Environ. Manag. 24, 661–675.
Yina, L., Fei, Y., Jing, D., Xiande, Z., Chwen, S., 2019. The adoption of green practices by Chinese firms : assessing the determinants and effects of top management championship. Int. J. Oper. Prod. Manag. 39, 550–572.
Yong, R., 2007. The circular economy in China. J. Mater. Cycles Waste Manag. 9, 121–129.
Zeng, B., Zhu, L., Yao, X., 2020. Policy choice for end-of-pipe abatement technology adoption under technological uncertainty. Econ. Modell. 87, 121–130.
Zeng, H., Chen, X., Xiao, X., Zhou, Z., 2017. Institutional pressures, sustainable supply chain management, and circular economy capability: empirical evidence from Chinese eco-industrial park firms. J. Clean. Prod. 155, 54–65.
Zhang, C., Dhaliwal, J., 2009. An investigation of resource-based and institutional theoretic factors in technology adoption for operations and supply chain management. Int. J. Prod. Econ. 120, 252–269.
Zhang, S., Li, Y., Hao, Y., Zhang, Y., 2018. Does public opinion affect air quality? Evidence based on the monthly data of 109 prefecture-level cities in China. Energy Pol. 116, 299–311.
Zheng, D., Chen, J., Huang, L., Zhang, C., 2013. E-government adoption in public administration organizations: integrating institutional theory perspective and resource-based view. Eur. J. Inf. Syst. 22, 221–234.
Zhou, Y., Thøgersen, J., Ruan, Y., Huang, G., 2013. The moderating role of human values in planned behavior: the case of Chinese consumers' intention to buy organic food. J. Consum. Market. 30, 335–344.
Zhu, Q., Sarkis, J., Lai, K.-h., Geng, Y., 2008. The role of organizational size in the adoption of green supply chain management practices in China. Corp. Soc. Responsib. Environ. Manag. 15, 322–337.

Further reading

Fornell, C., Larcker, D.F., 1981. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research (JMR) 18, 39–50. https://doi.org/10.2307/3151312.