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The interplay among paradoxical leadership, industry 4.0 technologies, organisational ambidexterity, strategic flexibility and corporate sustainable performance in manufacturing SMEs of Malaysia

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Abstract

Purpose – Manufacturing firms must embrace smart technologies and develop complex leadership approaches to achieve sustainability. Using the dynamic capability theory, this paper aims to examine the influence of the adoption of industry 4.0 technologies (AT) and paradoxical leadership (PL) on corporate sustainable performance (CSP) of manufacturing small-medium enterprises (SMEs) in Malaysia. Moreover, organisational ambidexterity (OA) is a mediator and strategic flexibility (SF) is a moderator in the study.

Design/methodology/approach – The study is a cross-sectional, quantitative study design that collected 395 usable responses through a simple random sampling technique and a close-ended structured questionnaire. Structural equation modelling (SEM) procedures were followed to analyse the data.

Findings – The statistical outcome implies that the AT significantly influence CSP and OA and mediate with CSP in the presence of OA. Moreover, PL shows a significant impact on OA, is insignificant on CSP and mediates with OA and CSP. The authors found a significant association between OA and CSP; however, SF did not provide evidence of a moderate effect.

Research limitations/implications – The findings of this study clarify the role that organisational capabilities (OA, AT, PL and SF) play in fostering sustainability. The authors suggest incorporating SMEs from different geographies in other sectors by applying diverse methodologies and relevant constructs.

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Practical implications – The result injects new perspectives into policy, managerial and individual levels. Installing OA, AT, PL and SF makes SMEs sustainable.

Originality/value – The empirical validation of the influence of OA and AT on CSP and the interaction of PL and SF enriches the organisational and entrepreneurial literature.

Keywords SMEs, Industry 4.0 technologies, Ambidexterity, Paradoxical leadership, Sustainability, Malaysia

Paper type Research paper

Abbreviations

AT = adoption of industry 4.0 technologies;
AVE = average variance extracted;
CMB = common method bias;
CR = composite reliability;
CSP = corporate sustainable performance;
CA = cronbach's alpha;
HTMT = heterotrait–Monotrait;
OA = organisational ambidexterity;
PL = paradoxical leadership;
SMEs = small-medium enterprises;
SF = strategic flexibility;
SEM = structural equation modelling;
SDGs = sustainable development goals;
IR4.0 = the fourth industrial revolution;
SPSS = the statistical package for the social sciences; and
VUCA = volatility, uncertainty, complexity and ambiguity.

Introduction

Businesses must balance ecological preservation and sustainable consumption globally, especially manufacturing enterprises confronting substantial environmental challenges (Albitar *et al.*, 2022; Hossain *et al.*, 2022a, 2022b). In recent years, manufacturers have gained extensive access to new markets, extending their product lines and interacting with diverse customer demographics (Csutora, 2012; Hadler *et al.*, 2022). In response to increasing global environmental pressure, green practices have emerged as one of the main strategic tools for manufacturing businesses to achieve sustainable growth.

The literature evidenced that manufacturing small-medium enterprises (SMEs) cause 60–70% of global pollution (Jayeola, 2015), despite being the economic backbone of any nation due to their considerable contribution to production and employment creation. Even though the COVID-19 outbreak has substantially impacted the present global manufacturing growth rate, achieving the 2030 Sustainable Development Goals (SDGs) remains essential for all nations (United Nations Development Programme, 2020). Business sustainability is crucial from this perspective.

The scope of this study is Malaysian manufacturing SMEs. In comparison, Malaysian small firms create more significant environmental damage than large firms (Fong *et al.*, 2023). Air Quality Index (AQI) evidenced that Malaysia had the 58th-worst air quality among 106 countries in 2020 (AQI, 2022). According to the SDG index (2022) and reports, Malaysia ranks 65th out of 193 countries, scoring 70.88 out of a possible 100. On 7 March 2019, a hazardous industrial pollution disaster happened in the Kim Kim River in Johor, Malaysia, reportedly harming almost 6,000 people (Ghouri *et al.*, 2020). As a result of the increasing social awareness in Malaysia, particularly in the wake of this news, regarding ecological sustainability, firms strategically emphasise green practices to enhance corporate sustainable performance (CSP) and acquire a competitive advantage (Deshpande and Swaminathan, 2020; Hossain *et al.*, 2022a, 2022b). Yusoff *et al.* (2022) mentioned that Sungai Klang (Klang river) and Sungai Gombak (Gombak river) were contaminated with oil, food and debris, causing flooding in neighbouring locations. The Sungai Kinta (Kinta river) is also contaminated due to the presence of effluent from nearby businesses.

However, in this volatility, uncertainty, complexity and ambiguous (VUCA) environment, pollution prevention and pollution control are becoming more challenging for businesses due to the increasing adoption of the fourth industrial revolution (IR4.0) technologies. IR4.0 represents a transformative era, amalgamating cutting-edge technological breakthroughs in digital realms such as big data, augmented reality and cyber-physical systems. These innovations are poised to revolutionise the manufacturing sector, optimising energy resource use (Balakrishnan *et al.*, 2021). The Boston Consulting Group has identified and expounded upon nine pivotal technological pillars that constitute the core of IR4.0. These include big data and analytics, autonomous robots, 3D Simulation, universal system integration, industrial internet of things (IoT), cyber security, cloud computing, additive manufacturing and augmented reality (Rüßmann *et al.*, 2015; Thoben *et al.*, 2017).

As a technology-dependent industry, the manufacturing sector may seek the full potential of sophisticated technologies to promote the sustainability of enterprises and communities (Soni *et al.*, 2016). Culot *et al.* (2020) backed this position by noting that manufacturing firms embrace IR4.0, combining physical and cyber realities. Continuous and drastic technological disruption makes the setting more complex and turbulent. IR4.0 comprises many digital technologies altering industrial and service businesses (Nimawat and Gidwani, 2021). These technologies are divided into two categories: (1) front-end and (2) base technologies. The front-end technologies comprise “smart manufacturing, smart products, smart supply chain and smart working”, The base technologies include “the IoT, cloud services, big data and analytics”. With this alignment, SMEs embrace IR4.0 technologies to preserve competitiveness, engage in external cooperation and nurture innovations vital to their existence (Balakrishnan *et al.*, 2021; Shehzad *et al.*, 2023). Oláh *et al.* (2020) and Kamble *et al.* (2018) assert that using Industry 4.0’s cutting-edge technology will boost SME product quality and sustainability. However, this research did not specify how this could be accomplished. In addition, the literature lacks clarification regarding how IR4.0 technologies facilitate the transition to sustainability (de Sousa Jabbour *et al.*, 2018). The literature has limited evidence on the relationships between IR4.0 technologies and sustainable performance.

In IR4.0 endeavours, SMEs have limited knowledge, budgetary constraints, operational complexities, cyber security, technological uncertainty, data acquisition and technology dissemination (Reza *et al.*, 2017). Moreover, organisations need help to adopt IR4.0 technology due to several obstacles. Lack of transparency regarding the benefits of investing in IR4.0 technologies, lack of commitment (Kamble *et al.*, 2018), absence of benchmarking (Lu *et al.*, 2020), security issues (Viale Pereira *et al.*, 2017) and poor level of skills (Pinzone *et al.*, 2017) are significant barriers to sustainability. To tackle these complex and multifaced challenges, there is a requirement to integrate IR4.0 and CSP with a high level of organisational ambidexterity (OA) (Wamba *et al.*, 2020). OA is the organisational capacity to maintain both exploratory and non-exploratory activities (Sahi *et al.*, 2020; Wamba *et al.*, 2020).

Management is in the dilemma to adopt IR4.0 technologies and maintain exploitation and exploration simultaneously (Hossain *et al.*, 2022a, 2022b), as they assume adoption of industry 4.0 technologies (AT) can create disruption and the payback investment period in AT is longer. Previous research has demonstrated that business sustainability depends on balancing and managing these paradoxical situations (Tseng *et al.*, 2018; Rossi *et al.*, 2020), which is aligned with the fundamental concept of this study: ambidexterity. However, Klonek *et al.* (2021) claimed that paradoxical leaders who manage the tensions arising from exploration and exploitation requirements and are adept at managing paradoxes can make strategic decisions that optimise resources, foster creativity and enable the organisation to thrive in complex environments. Paradoxical leaders excel at managing the tension between risk aversion and risk-taking. They make decisions that prioritise both short-term gains and long-term sustainability, ensuring SMEs remain resilient despite evolving market conditions with limited resources (Trieu *et al.*, 2023). Paradoxical leaders create an organisational climate that values agility and stability, allowing SMEs to respond to market shifts while maintaining a solid foundation and fostering collaboration (Oluwafemi *et al.*, 2020). Foo *et al.* (2021) added that this leadership substantially affects CSP. Thus, this study embraces paradoxical leadership (PL) as a predictor of OA and CSP. From another perspective in the strategic management domain, CSP is a corporate strategy, a combination of strategic analysis of internal and external company environments, choice of corporate strategies as strategy formulation and implementation of those strategies (Zhang *et al.*, 2013). Engert *et al.* (2016), Labuschagne *et al.* (2005) and Baumgartner (2014) propose the integration of corporate sustainability at the normative, strategic and operational levels. Among them, the strategic management level gets more priority due to its proximity to sustainability strategies and ensures that effectiveness is being considered and long-term objectives can be reached (David, 1989). Although OA synergy makes the organisational environment more dynamic and complex and increases the need for strategic integration and flexibility and relevant leadership styles such as PL (Hossain *et al.*, 2022a, 2022b), many companies still lack a strategic approach concerning corporate sustainability integration (Zhao *et al.*, 2023; Ed-Dafali *et al.*, 2023).

PL is a comparatively new type of leadership gaining attention due to the increasing complexity of businesses and the ability to simultaneously manage organisations in contradictions and inconsistencies, particularly in VUCA situations (Hossain *et al.*, 2022a, 2022b; Tao *et al.*, 2023). In this leadership style, leaders use formal and situational leadership approaches concurrently and combine them to address organisational perplexity. Aware of the issue, paradoxical leaders move from ambiguity to positive transformation, instantaneously managing short- and long-term objectives (Pearce and Tombs, 2019). Moreover, the PL and CSP association is scant and equivocal in the existing literature. A basic Google Scholar search revealed 49 items on these themes Sanusi and Sopiah (2022); nevertheless, most research is systematic literature reviews, such as Sanusi and Sopiah (2022). Hossain *et al.* (2022a, 2022b) and Lu *et al.* (2018) completed the most pertinent empirical investigations. It was established in both research that PL substantially impacts CSP; however, the investigations were conducted in another context. Thus, there is a need for research in the context of manufacturing SMEs in Malaysia.

In this volatile, dynamic and competitive business climate context, strategic flexibility (SF) enables enterprises to embrace AT and OA and optimise resources to attain CSP (Nwachukwu and Vu, 2020). However, we need to fully comprehend the function of SF in promoting sustainability in emerging markets. SF refers to an organisation's capacity to detect shifts in its business setting and strategically use available resources. SF permits businesses to reconfigure and reorganise strategic resources more quickly and effectively in response to ecological changes (Majid *et al.*, 2019). Attaining SF is challenging and multifaceted (Brozovic, 2018). Fachrunnisa *et al.* (2020) correlated SF with strategic sensitivity, leadership cohesion and resource fluidity that enhance technological capabilities. The effects are a higher level of exploration and shifting constraints for the company (Zhou and Wu, 2009). Moreover, the context in which SF should operate needs to be clarified (Ahmadi and Mohd. Osman, 2018), as it differs between organisations (Brinckmann *et al.*, 2019). Existing literature emphasises the significance of SF in a variety of situations, such as product development (Sanchez, 1995), organisational redesigning (Schilling and Steensma, 2001) and contingent alliance development (Sanchez, 1995; Schilling and Steensma, 2001). Other research indicates a connection between SF and company success in dynamic contexts (e.g. Combe *et al.*, 2012; Nandakumar *et al.*, 2014; Momaya *et al.*, 2017). Several empirical studies have produced contradictory findings concerning the association between SF and business performance (e.g. Wei *et al.*, 2014). Nonetheless, more research is required on SF and CSP, particularly in emerging economies.

Previous research has yet to explore the relationships between SF, PL, IR4.0 technologies, OA and sustainable corporate performance, especially in manufacturing SMEs in developing countries. This paper addresses this knowledge gap. Understanding the study's components and their interaction relationships is crucial to achieving business sustainability and successfully navigating the challenges offered by a company's internal and external contexts.

Literature review and hypothesis development

Theoretical underpinning

Organisations have been driven to use AT to redesign conventional systems in response to rapid shifts in consumer preferences and intensified competition. Intensified automation, data sharing and manufacturing system integration are hallmarks of IR4.0, which provides a technological advantage in today's market (Cheah and Tan, 2020). According to recent studies (Kamble *et al.*, 2018; Müller *et al.*, 2018), firms adopting IR4.0 have seen significant competitive advantages in both strategic and operational areas. One strategic gain is the potential for novel business model development and the emergence of data-driven, differentiated problem-solving approaches (Laudien and Daxböck, 2017). This research defines IR4.0 technologies as a collection of precious assets that companies hold, providing exceptional capabilities for integrating products and manufacturing procedures. Our current investigation of organisational capability theory is supported by the insights from the literature mentioned earlier.

Under the dynamic capabilities perspective, it is hypothesised that companies get an edge in a competitive market by leveraging their internal resources to create and market novel products and services (Teece *et al.*, 1997). According to Teece (2018a, 2018b), a firm's dynamic capabilities enable the pace and associated expenses of synchronising organisational resources and business model(s) with consumer expectations. Companies with dynamic capabilities can better identify opportunities, mitigate risks and rapidly adjust their product lines and marketing strategies (Barrales-Molina *et al.*, 2014). Companies can gain a competitive advantage by constantly updating their resources and capacities. An organisation's intangible assets are its dynamic capabilities, consisting of well-defined procedures, well-established routines and cohesive operations groups. According to Rindova and Kotha (2001), a company's ability to constantly adapt gives it a strategic edge, a competitive advantage and increased agility in the marketplace. Business sustainability can be attained and maintained through various organisational and managerial procedures. Here, we discuss intangible resources like SF and leadership that might improve a company's long-term viability. Significant problems with the dynamic capability view still need to be solved despite the rapid pace of publishing (Wilden *et al.*, 2016).

Industry 4.0 technologies and corporate sustainable performance

Industry 4.0 involves integrating various high-end technologies that improve industrial performance and response time. The six design elements inherent to IR4.0 include decentralisation, virtualisation, interconnectivity, customizability, prompt responsiveness and service orientation. The IR4.0 technologies added an adaptable networked manufacturing system that improves response pace (Alcácer *et al.*, 2022). It is asserted that the IR4.0 technologies positively impact the CSP. IoT devices such as sensors monitor resource consumption in real-time, enabling companies to identify inefficiencies, reduce waste in manufacturing firms and ensure workplace safety (Reuter *et al.*, 2017). AI-driven predictive maintenance optimises machinery and equipment usage, reducing unnecessary wear and tear and minimising resource consumption. 3D printing/additive manufacturing allows firms to on-demand production, reducing excess inventory and waste associated with traditional manufacturing methods. Blockchain provides end-to-end visibility in the supply chain, allowing companies to make informed decisions that reduce waste and emissions. Smart grids and energy management systems enable companies to manage and optimise their energy usage, reducing their carbon footprint (Chakraborty and Mishra, 2018). The intelligent products developed in the IR4.0 ecosystem bring substantial advantages (Kamble *et al.*, 2018; Luthra and Mangla, 2018). The performance enhancements lead to higher profitability, enhanced resource use and less wastage (Tseng *et al.*, 2018). According to Müller, Kiel and Voigt (2018), IR4.0 technologies help organisations to fulfil sustainability compliance. Therefore, we hypothesise that:

H1. AT positively and significantly influences CSP.

Paradoxical leadership and corporate sustainable performance

In PL, leaders simultaneously address organisational structure needs and subordinates' job needs, besides managing conflicting but connected paradigms (Smith *et al.*, 2012). Lewis *et al.* (2014) asserted that paradoxical leaders adopt a paradoxical perspective to manage contradictory situations, such as investing in sustainable practices that may not yield immediate financial returns but contribute to long-term success (Smith and Lewis, 2011). To be sustainable, businesses focus on developing good quality and energy-efficient goods in an innovative way (Pham and Kim, 2019). Since PL empowers employees to exploit initiatives to build green products, it guides them to use current knowledge for developing green products (Berraies and Zine El Abidine, 2019) and empowers employees to take ownership of sustainability initiatives while ensuring that their efforts align with the overall corporate strategy (Bansal and DesJardine, 2014). Paradoxical leaders combine authoritative decision-making (hard power) with collaborative and persuasive approaches (soft power) to drive sustainable change (Simsek *et al.*, 2015). Thus, PL can enhance CSP more effectively:

H2. PL positively and significantly influences CSP.

Industry 4.0 technologies and organisational ambidexterity

Adopting 4.0 technologies fosters exploitation (Stein and Zwass, 1995; Malhotra, 2005) and efficiently ensures resource use (Gastaldi *et al.*, 2018), which is essential for SMEs. AT provides manufacturing firms with advanced analytics capabilities that enhance decision-making for exploiting current operations and exploring new opportunities (Teece, 2018a, 2018b).

Adopting IoT and AI makes firms agile and supports the exploitation of existing capabilities while also allowing manufacturing SMEs to explore new processes and products (Rothaermel and Alexandre, 2009). AT improves data acquisition and processing, predictability and adaptation to radical market changes (Chaudhuri *et al.*, 2011). Organisational transformation through AT involves rethinking and redesigning business processes, products and services, which requires exploiting existing capabilities and exploring new digital opportunities (Teece, 2018a, 2018b). AT provides platforms for experimentation and prototyping, allowing SMEs to explore new ideas and technologies. This fosters an innovative culture necessary for OA (Gupta *et al.*, 2006):

H3. AT positively and significantly influences OA.

Paradoxical leadership and organisational ambidexterity

PL and OA are closely related concepts in the realm of leadership and organisational effectiveness. PL enhances resource efficiency and flexibility synchronicity (Lewis *et al.*, 2014). Paradoxical leaders balance seemingly contradictory objectives, such as focusing on short-term profitability and long-term innovation (Smith and Lewis, 2011). This aligns with the core concept of OA, which involves the simultaneous pursuit of exploitation (optimising existing processes) and exploration (seeking new opportunities) (Tushman and O'Reilly, 1996).

In response to conflicting values, paradoxical leaders adapt their leadership approaches according to the circumstances. They are committed to fostering teamwork besides using precise and strict procedures (Lewis *et al.*, 2014). Paradoxical leaders manage the competing interests of various stakeholders, including shareholders, customers, employees and communities (Smith and Lewis, 2011), and that is crucial in achieving OA, as it involves balancing the needs and expectations of different internal and external stakeholders (Gibson and Birkinshaw, 2004). Paradoxical leaders are skilled at maintaining stability in core business operations while driving necessary changes to support innovation and sustainability (Simsek *et al.*, 2015). This ability is critical for ambidextrous organisations, which must balance stability in current operations with the need for change and adaptation (Tushman and O'Reilly, 1996). They also possess specific skills and a mindset that can accommodate ambidextrous tensions and paradoxes (Patel, 2019):

H4. PL positively and significantly influences OA

Organisational ambidexterity and corporate sustainable performance

OA is a firm's core competency, demonstrating its dual attitude towards exploitation and exploration (Lubatkin *et al.*, 2006). Consequently, ambidextrous organisations can exploit incremental and radical innovation to achieve competitive advantage. OA fosters innovation, allowing manufacturing SMEs to develop new products, services and processes that align with sustainability goals (Hossain *et al.*, 2022b). Exploration makes businesses more open to experimentation and learning, which is crucial for identifying and implementing sustainable practices (Gupta *et al.*, 2006). On the other hand, OA also promotes active learning and knowledge augmentation, enhancing a company's capacity for innovation and risk-taking and anticipating future sustainable green prospects ahead of the competition (Hill and Birkinshaw, 2014). Ambidextrous organisations are also better equipped to respond to changing regulatory and stakeholder pressures related to sustainability (Gibson and Birkinshaw, 2004). OA allows firms to allocate resources effectively between exploration and exploitation activities, ensuring that investments in sustainability initiatives do not come at the expense of core operations (Raisch and Birkinshaw, 2008). This balance leads to improved financial performance while also advancing sustainability objectives. Moreover, OA improves firm's absorptive ability and control (Severgnini *et al.*, 2018) to balance exploration and exploitation activities, and these build a foundation for CSP and competitiveness in a rapidly changing business environment (Teece, 2018a, 2018b; Shahzad *et al.*, 2020, 2021):

H5. OA positively and significantly influences CSP.

The mediating role of organisational ambidexterity (OA)

AT is viewed as a prelude to exploitation (Malhotra, 2005) by using resources properly (Gastaldi *et al.*, 2018). AT improves data collecting and processing skills, allowing businesses to adapt to radical market shifts (Soto-Acosta *et al.*, 2018). OA allows firms to simultaneously exploit IR4.0 technologies for efficiency gains and explore their potential for sustainable innovation (Gibson and Birkinshaw, 2004). Moreover, OA helps effectively integrate and use these technologies within existing operations for sustainability gains (Raisch and Birkinshaw, 2008). Industry 4.0 technologies require a learning orientation to leverage their potential for sustainability fully (Schuh *et al.*, 2018), and OA fosters a culture of learning, allowing companies to adapt and innovate in response to sustainability challenges posed by the adoption of these technologies (Gupta *et al.*, 2006). The role of OA as a mediator is well established. Gastaldi *et al.* (2018) found that AT positively improved innovation performance in the presence of OA. Belhadi *et al.* (2022) discovered that OA mediates on IR4.0 capabilities and sustainability:

H6. OA mediates between AT and CSP.

The influence of leadership styles on ambidexterity varies based on the types of firms (Rao-Nicholson *et al.*, 2016) and settings. A complex leadership style needs to be adopted for complex settings. OA uses current resources and practices innovation (Hughes *et al.*, 2018). Vargas (2015) proved that PL manages contradictory elements, such as stability and change, and short-term efficiency with long-term innovation and integrates different types of leadership (Bucevschi and Keller, 2021) to improve CSP. OA complements PL by providing a framework for exploring new sustainability initiatives while exploiting existing capabilities for efficiency and sustainable performance (Gibson and Birkinshaw, 2004). Burawat (2019) claimed that CSP demands resource efficacy, carbon footprint minimisation, green promotion and stakeholder amalgamation through adopting PL (Alzawahrah and Alkhaffaf, 2021). OA enables firms to translate paradoxical leaders' innovative ideas into action by providing the structures and processes needed to simultaneously explore and exploit for sustainable performance gains (O'Reilly and Tushman, 2013). Paradoxical leaders excel at engaging diverse stakeholders and managing conflicting expectations, which make SMEs more sustainable (Shafique *et al.*, 2021), and OA complements this by providing the framework for translating stakeholder input into actionable sustainability initiatives, ultimately enhancing CSP (O'Reilly and Tushman, 2013):

H7. OA mediates between PL and CSP.

The moderating role of strategic flexibility (SF)

SF enables businesses to sustain in dynamic competition (Eisenhardt and Martin, 2000) and dynamically adjust their strategies and operations based on the evolving landscape of IR4.0

technologies. Strategic adaptability is essential to overcome organisational complacency (Talapatra *et al.*, 2019). It makes organisational forms, resource management and processes flexible (Matthyssens *et al.*, 2005; Contador *et al.*, 2020). Strategic adaptability facilitates restructuring company structures, organisational systems and departments (Zander and Kogut, 1995). Firms can better support their sustainability objectives by dynamically reallocating resources based on emerging opportunities and challenges related to IR4.0.

The manufacturing company and nature association are changed due to applying 10R (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover) (Ghobakhloo, 2020; Bag *et al.*, 2021) and SF equips organisations with the agility to navigate this transition effectively. AT presents a problem in SME management due to its high cost, extended payback period and resistance to quick organisational transformation. SF can act as a moderating factor between AT and CSP in these areas. It enables organisations to adaptively implement these technologies, optimise resource allocation, respond to stakeholder expectations and navigate uncertainties associated with technological advancements. This ultimately leads to a more effective integration of IR4.0 technologies for sustainable performance improvement:

H8. SF moderates between AT and CSP.

From the dynamic capability theory perspective, SF complements PL (Smith and Lewis, 2011) by providing the organisational capability to dynamically adjust strategies and operations in response to emerging paradoxes, ensuring that sustainability goals are not compromised in the process. SF highlights the importance of organisations' prompt response to developments in the external dynamic environment, which relies on flexible internal resources and the organisational capacity to exploit these resources (Brozovic, 2018).

SF provides high flexibility in the supply chain environment; consequently, firm performance can be enhanced (Martínez Sánchez and Pérez Pérez, 2005) and vice versa. Strategically flexible organisations can reconfigure resources easily, quickly and cost-effectively (Matthyssens *et al.*, 2005). SF provides the organisational infrastructure that allows firms to effectively allocate resources in ways that balance contradictory demands implement and adjust sustainability initiatives through PL (Andriopoulos and Lewis, 2009) (Figure 1):

H9. SF moderates between PL and CSP.

Methodology

Methodologically, this research follows positivism philosophy, quantitative methodology, cross-sectional time horizon, survey strategy and probability sampling method with random sampling technique.

Data collection

Manufacturing SMEs in Malaysia are explored in this study. We screened the list of manufacturing SMEs in the Federation of Malaysian Manufacturers directory (52 editions). The specific SMEs were separated based on the number of employees. In Malaysia, *SMEs* in the manufacturing sector are defined (Figure 2) as enterprises having a sales turnover of less than RM 50m or fewer than 200 full-time workers (SME Corporation Malaysia, 2023). Then, a survey was conducted from June to December 2022 using a random sampling method. In

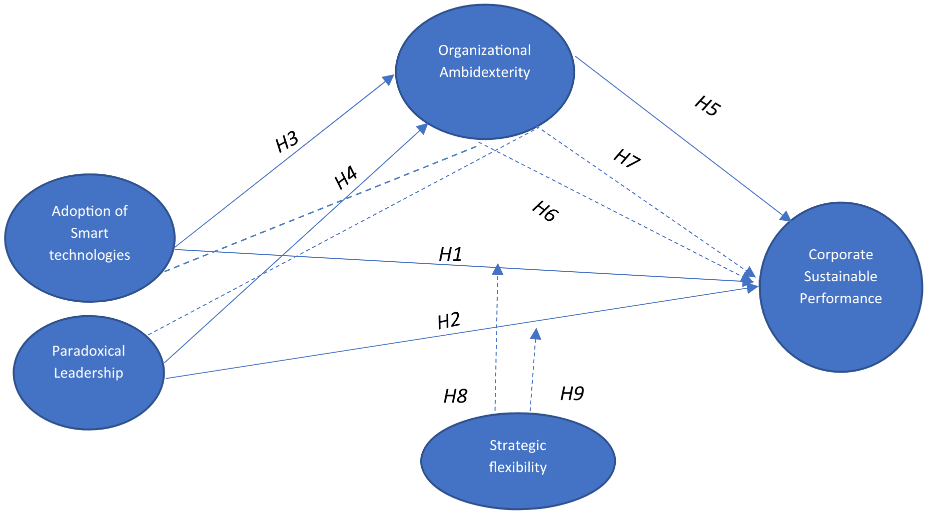
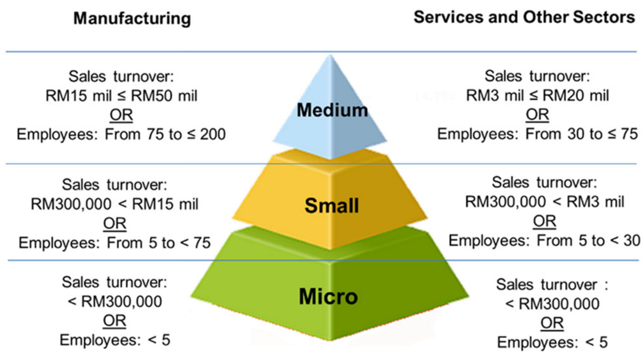


Figure 1.
Conceptual framework developed by authors



Source: SME Corporation Malaysia (2023)

Figure 2.
SME definitions in Malaysia

total, 600 questionnaires were circulated psychically via LinkedIn and emails and shared a Google Form link to fill up. Participation was optional and confidential.

Finally, 403 responses were returned. In total, 395 were considered valid and taken for further analysis after the screening. The response rate was 67.17%. Demographic details of both company and respondents are provided in Table 1. Measurement of constructs was adapted (Appendix) ranging Likert five-point scale (1 = strongly disagree to agree, 5 = strongly).

Result

Common method bias (CMB) Common method bias (CMB) issues exist in most cross-sectional, quantitative studies when the data is collected using a single source or through a self-reporting survey. Podsakoff *et al.* (2003) recommended several strategies to deal with CMB issues. The current study has adopted two strategies to deal with CMB. Firstly, the

Variable	Company information Category	Frequency	%
Type of company	Food, beverage and tobacco	120	30.38
	Chemicals	35	8.86
	Fabricated metals	20	5.05
	Plastic	27	6.83
	Electrical and electronics	35	8.86
	Machinery and equipment	17	4.29
	Non-metallic mineral	12	3.08
	Transport, vehicle and equipment	35	8.86
	Rubber	29	7.34
	Basic metals	15	3.79
	Paper, printing and publishing	10	2.52
	Medical, precision and optical instruments, watches and clocks	11	2.79
	Textile, wearing apparel and leather	10	2.53
	Wood and wood products, excluding furniture	4	1.01
	Recycling	5	1.27
	Office, accounting and computing machinery	5	1.27
	Furniture	5	1.27
Years of the company's business operation	Less than 1 year	175	44.30
	1–10 years	95	24.05
	11–20 years	77	19.50
	21–30 years	48	12.15
	Above 30 years		
Respondent profile			
Gender	Male	320	81.01
	Female	70	17.72
	Prefer not to say	5	1.27
Age	20–25 years	155	39.24
	26–31 years	90	22.78
	32–37 years	78	19.75
	38–43 years	55	13.93
	More than 43 years	17	4.30
Years of experience in the company	Less than 2 years	88	22.28
	2 – 4 years	176	44.56
	5 – 7 years	105	26.58
	8–10 Years	16	4.05
	More than 10 years	10	2.53
Education	No formal education	27	6.84
	Vocational	38	9.63
	Foundation	26	6.58
	SPM	33	8.35
	STPM	67	16.96
	Diploma	74	18.73
	Bachelor	70	17.72
	Masters	35	8.86
	PhD	25	6.33

Source: By authors

Table 1. Demographic information of the respondents

respondents were ensured confidentiality; secondly, Harman's single-factor test assessed CMB statistically (Podsakoff *et al.*, 2003). The Statistical Package for the Social Sciences (SPSS) v.26 software was used to perform Harman's single-factor test. The test result revealed that 48.008% of the total variance was extracted in a single factor. As the total extracted factor was below 50%, it can be claimed that there is no issue with the CMB.

Measurement model The current study used Smart-PLS (v.4.0) software. The measurement model was assessed through construct reliability and discriminant validity. The value of factor loadings, composite reliability (CR), Cronbach's alpha (CA) and average variance extracted (AVE) was used to evaluate the construct reliability and validity of the measurement model (see Table 2). Table 2 indicates that all the factor loading values range from 0.523 to 0.952, which is in the acceptable range recommended by Chin (1998). In addition, all the CA and CR values were found above 0.8, greater than the acceptable value of CA and CR (Hair *et al.*, 2021). Moreover, the AVE values range from 0.543 to 0.869, which ensures construct validity (Hair *et al.*, 2021).

Discriminant validity was checked by Fornell and Larcker's (1981) criterion (FLC) and heterotrait–monotrait (HTMT) ratio of correlations (see Table 3). FLC is a traditional way to assess discriminant validity. FLC result indicated that the square root of all the AVE values is higher than the correlation with other constructs in the respective rows and columns, confirming significant discriminant validity. HTMT is an alternate way to assess the constructs' discriminant validity. Henseler *et al.* (2015) recommended that the HTMT value ranging from 0.1 to 10 confirms the existence of discriminant validity. The maximum and minimum values of HTMT are evidenced at 0.983 and 0.026, respectively, confirming the establishment of discriminant validity (see Table 3).

Structural model The structural model assessment was evaluated through the coefficient of determination (R^2), predictive relevancy (Q^2), effect size (f^2), multicollinearity test (inner VIF), T statistics and *p*-value. A bootstrapping procedure of 5,000 sub-samples was conducted to perform this process. The coefficient of determination (R^2) is an extensively used method for evaluating the strength of a structural model. In the present study, the R^2 values have been found CSP= 0.910 and OA= 0.502, respectively, indicating that all the constructs have explained 91% of the variance in CSP and 50.2% in OA. The results of R^2 for CSP can be described as substantial and OA as moderate (Hair *et al.*, 2021). In addition, the presence of predictive relevancy was assessed through the Q^2 value. According to Hair *et al.* (2021), a Q^2 value above zero (0) evidenced the presence of predictive relevancy in the path model. Therefore, the Q^2 value of the present study (CSP= 0.612, OA= 0.485) indicates the presence of predictive relevancy in the study.

Furthermore, the authors have assessed the effect size of one construct on another construct through the f^2 value, as presented in Table 4. Cohen (2013) classified the effect size above 0.02 as small, above 0.15 as a medium and above 0.35 as large. The result indicated that PL has a large effect on OA, and OA has a large effect on CSP. AL has a medium effect on CSP and a large effect on OA. Whereas PL did not affect CSP, no effect was found in both moderating relationships (SF × AT → CSP and SF × PL → CSP). In addition, the multicollinearity was evaluated through the inner VIF value. The statistical outcome revealed that the minimum and maximum value of inner VIF was found 1.222 and 4.394, respectively, which confirms no existence of multicollinearity issues in the present study as recommended by Pallant (2020) (see Table 4).

The researchers evaluated the association between constructs in the structural model based on the *p*-value and t-statistics value. The hypothesised relationship was perceived as significantly accepted when *p* values were less than 0.05 and T statistics were above 1.96 (Hair *et al.*, 2021). Table 5 indicates that AT has a significant relationship with CSP ($T =$

Construct	Items	Factor loading	CA	CR	AVE
Adoption of industry 4.0 technologies (AT)	AT1	0.815	0.844	0.889	0.618
	AT2	0.838			
	AT3	0.670			
	AT4	0.837			
	AT5	0.759			
Corporate sustainable performance (CSP)	CSP1	0.883	0.906	0.924	0.543
	CSP2	0.825			
	CSP3	0.827			
	CSP4	0.873			
	CSP5	0.898			
	CSP6	0.623			
	CSP7	0.523			
	CSP8	0.571			
	CSP9	0.830			
	CSP10	0.805			
	CSP11	0.660			
Organizational ambidexterity (OA)	OA1	0.729	0.964	0.969	0.706
	OA2	0.849			
	OA3	0.871			
	OA4	0.898			
	OA5	0.839			
	OA6	0.843			
	OA7	0.856			
	OA8	0.831			
	OA9	0.643			
	OA10	0.902			
	OA11	0.856			
	OA12	0.877			
	OA13	0.890			
Paradoxical leadership (PL)	PL1	0.938	0.949	0.964	0.869
	PL2	0.912			
	PL3	0.963			
	PL4	0.913			
Strategic flexibility (SF)	SF1	0.718	0.923	0.943	0.771
	SF2	0.951			
	SF3	0.952			
	SF4	0.874			
	SF5	0.875			

Source: By authors

Table 2.
Construct reliability and validity

3.247, $p = 0.001$) and OA ($T = 3.638$, $p = 0.00$). In addition, PL has a significant relationship with OA ($T = 9.832$, $p = 0.000$), and OA has a significant relationship with CSP ($T = 15.368$, $p = 0.000$). In contrast, no significant association was evidenced between PL and CSP ($T =$ 0.954, $p = 0.340$). Therefore, *H1*, *H3*, *H4* and *H5* were accepted, and *H2* was rejected (see Table 5). The result indicated that OA significantly mediates the relationship between AT and CSP ($T = 3.480$, $p = 0.001$) as well as PL and CSP ($T = 8.257$, $p = 0.000$) (see Table 5). Thus, hypotheses *H6* and *H7* were accepted. The present study hypothesised that SF would moderate the AT, PL and CSP relationships. As seen in Figure 3, SF did not have any moderating influence on any of the hypothesised associations, and thus *H8* and *H9* were not supported.

Construct	At	CSP	OA	PL	SF
Fornell and Larcker criterion					
AT	0.786				
CSP	0.499	0.737			
OA	0.459	0.947	0.840		
PL	0.427	0.695	0.684	0.932	
SF	0.424	0.858	0.862	0.660	0.878
Heterotrait–Monotrait (HTMT) ratio					
CSP	0.600				
OA	0.498	0.983			
PL	0.471	0.739	0.711		
SF	0.471	0.913	0.918	0.711	

Notes: Adoption of industry 4.0 technologies = AT; paradoxical leadership = PL; strategic flexibility = SF; organizational ambidexterity = OA; corporate sustainable performance = CSP
Source: By authors

Table 3.
Discriminant validity

	Effect size (f2)		Multicollinearity test (inner VIF)	
Constructs	CSP	OA	CSP	OA
AT	0.038	0.068	1.311	1.222
CSP				
OA	1.444		4.394	
PL	0.017	0.585	2.004	1.222
SF	0.055		4.073	
SF × AT	0.010		1.850	
SF × PL	0.005		1.848	

Notes: Adoption of Industry 4.0 Technologies = AT; paradoxical leadership = PL; strategic flexibility = SF; organizational ambidexterity = OA; corporate sustainable performance = CSP
Source: By authors

Table 4.
Effect size and multicollinearity test result

Hypotheses	Relation	Original sample	Sample mean	Standard deviation	T statistics	*p* values	Result
H1	AT → CSP	0.067	0.067	0.021	3.247	0.001	Accepted
H2	PL → CSP	0.055	0.051	0.058	0.954	0.340	Rejected
H3	AT → OA	0.204	0.207	0.056	3.638	0.000	Accepted
H4	PL → OA	0.597	0.594	0.061	9.832	0.000	Accepted
H5	OA → CSP	0.757	0.759	0.049	15.368	0.000	Accepted
H6	AT → OA → CSP	0.154	0.158	0.044	3.480	0.001	Accepted
H7	PL → OA → CSP	0.452	0.451	0.055	8.257	0.000	Accepted
H8	SF × AT → CSP	−0.030	−0.026	0.023	1.328	0.184	Rejected
H9	SF × PL → CSP	0.014	0.014	0.022	0.647	0.517	Rejected

Notes: Adoption of industry 4.0 technologies = AT; paradoxical leadership = PL; strategic flexibility = SF; organizational ambidexterity = OA; corporate sustainable performance = CSP
Source: By authors

Table 5.
Hypothesis test result

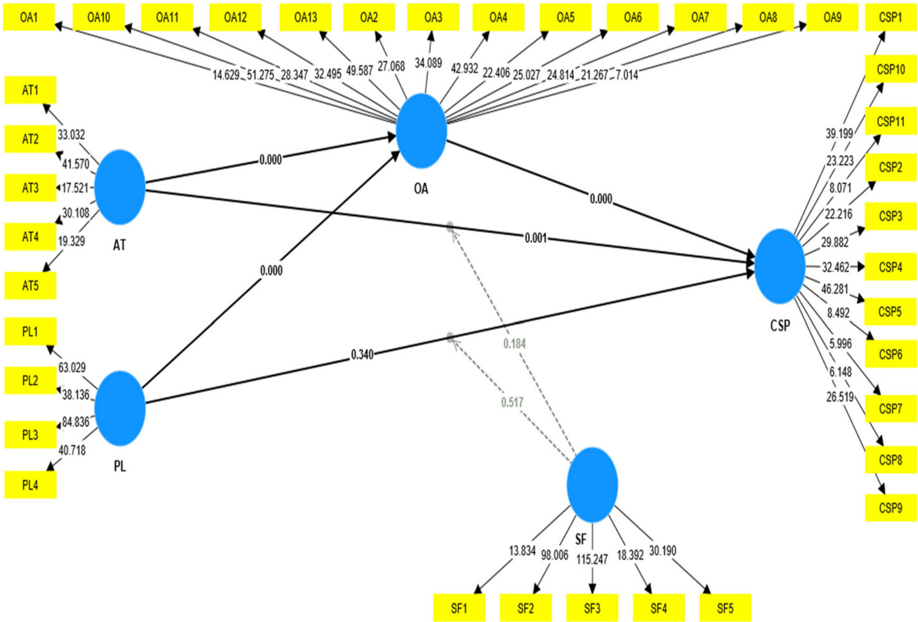


Figure 3.
Bootstrapping result of the statistical model developed by authors

Discussion

The current study investigates the influence of PL and AT on the CSP of manufacturing SMEs in Malaysia. Findings suggest AT can be effective for positive CSP. This outcome aligned with the findings of Hossain *et al.* (2022a, 2022b), Luthra and Mangla (2018), Kamble *et al.* (2018) and Abdullah *et al.* (2023). The adoption of industry 4.0 technologies can significantly contribute to corporate sustainability performance by improving resource efficiency, enabling predictive maintenance and real-time monitoring, enhancing supply chain transparency, fostering innovation, prolonging the life of machinery, reducing energy consumption, minimising waste generation, facilitating the tracking and recycling of products, promoting circular economy practices and ensuring compliance with ethical and environmental standards.

Contrary to previous studies, we find that PL is insignificant with CSP. The rationale behind this finding could be that Malaysian SMEs face issues with an innovative culture and organisational learning (Hanifah *et al.*, 2017; Abdul-Halim *et al.*, 2019; Gorondutse and Hilman, 2019). PL demands sufficient knowledge-sharing culture and flexibility, creating an interaction in the firms to foster sustainability (Gebert *et al.*, 2010). SMEs in the Malaysian manufacturing sector might lack awareness or different priorities or face unique challenges that make PL less of a focus compared to other factors.

Thirdly, we find that AT is significantly and positively associated with OA. Similar results were found by Gastaldi *et al.* (2022), Malhotra (2005) and Stein and Zwass (1995). A company adopting Industry 4.0 technologies enables SMEs to innovate and automate processes. This innovation can be exploited for efficiency gains (exploitation) while also exploring new opportunities for sustainable practices (exploration) (Gibson and Birkinshaw, 2004). AT allows SMEs to adapt to a changing business landscape, allocate resources efficiently between exploration and exploitation activities, enhance global competitiveness and improve stakeholder engagement and firm reputation.

Fourthly, PL evidenced a significant and positive impact on OA. PL influences organisational exploratory innovation (Lavie and Rosenkopf, 2006), absorbs holistic thinking and synchronises paradoxes without reservation (Yi *et al.*, 2019). This leadership promotes the necessary mindset to navigate and leverage conflicting demands and encourages new ideas and experiments for implementing sustainability initiatives. PL fosters learning orientation, resource allocation and diverse stakeholder engagement skills that develop OA. This can lead to increased adaptability and effectiveness in managing exploration and exploitation activities within the organisation.

Fifth, the result indicates that OA influences CSP. OA allows SMEs to pursue innovative sustainability initiatives while simultaneously helping firms respond quickly to sustainability challenges or opportunities while maintaining their core operations. The importance of CSP is supported by the strategic dynamic capability of OA, which helps to take critical and sound decision-making (Shafique *et al.*, 2021; Tung *et al.*, 2018). OA's preeminent processing outcomes are used in applications that provide in-depth analyses of CSP.

OA mediates for both hypothesised associations: AT → OA → CSP and PL → OA → CSP. Gastaldi *et al.* (2022) confirmed that AT advances a firm's ability to pursue exploitation and exploration, which means OA. Furthermore, AT improves organisations' responsiveness (Chaudhuri *et al.*, 2011). AT was coined as a determinant of exploitation (Xue *et al.*, 2012; Hansen *et al.*, 2020). Supported by the paradox theory of leadership, it is conclusive that firms' outcomes are enhanced with the enhancement of PL (Rosing *et al.*, 2011). PL can install ambidexterity in an organisation's core dynamics (Zakrzewska-Bielawska, 2021) to minimise conflicts or rigidities (Cunha *et al.*, 2019).

SF did not moderate with AT and PL. This outcome contradicts Celuch and Murphy (2010) and Schneider and Spieth (2014). The reports from DOSM (2022) and (Ghobakhloo and Ching, 2019) evidenced poor technological adoption and provided statistics that only 37% of manufacturing enterprises use high technology. Malaysian SMEs have limited competence to tackle the challenges of adaptability and flexibility due to having a lower capacity for technology management, resource constraints, low digital-literate levels, weak readiness (Fachrunnisa *et al.*, 2020) and lack of knowledge and information systems (Najmaei and Sadeghinejad, 2009). SMEs lack the necessary organisational structures and processes but have rigid decision-making hierarchies or limited communication channels, which can hinder the effective implementation of flexible strategies.

Moreover, SMEs lack the competencies and skills among their workforce to fully integrate AT into their operations in a way that allows for seamless adaptation and flexibility. SMEs' organisational culture and leadership style may prioritise stability and consistency over adaptability. SF requires a solid long-term focus on adaptability and responsiveness, skills, quality, communication, embracing new practices, flexibility and mutability (Fachrunnisa *et al.*, 2020), which will support AT and PL.

Implications

Theoretical implications

The current study enriches the body of knowledge by integrating AT, PL, OA, SF and CSP into a single model and testing the model empirically. This study provides precious insights, considering organisational capability theory and ambidexterity theory to examine the impact of tangible and intangible capabilities and resources on the CSP of Malaysian SMEs. The current study develops a holistic framework for CSP by incorporating a range of factors that show robust indications of CSP of SMEs. Previous research on organisational complexity and paradoxes has contributed to our understanding of how to manage contradictions (Trieu *et al.*, 2023). This study builds upon these insights by exploring how AT, PL and SF can leverage paradoxes in strategy.

Second, this research has also taken a step towards resolving a critical debate about how AT and PL help SMEs achieve sustainable performance outcomes in complex and conflicted environments. These two constructs are found important to ensure CSP in Malaysian SMEs through the mediation of OA. Thus, organisational ambidexter capability by SMEs occurs in response to the adoption of high-end technologies and leadership, which shape SMEs' better understanding of proactive ways. This proactive way is the SMEs' willingness to align and adapt to smart technologies and leadership to respond to changing demands to overcome challenges and competitive uncertainty, thereby ensuring current viability and future success. This study investigates leadership approaches that may effectively address paradoxes and promote OA and CSP at the firm level.

Third, our research advances knowledge about SF as a moderator in an uncertain environment in the manufacturing industry and makes another theoretical contribution. SF is essential for coping with day-to-day challenges and disruptions (Trieu *et al.*, 2023). However, the empirical results indicate that SF did not moderate with AT, PL and CSP. SF operates differently in different contexts and organisations (Hillmann and Guenther, 2021). However, the existing literature generally regards SF as an independent or a mediator variable while ignoring it as a moderator that affects performance.

Managerial implications

The study offers several managerial implications. The research framework and empirical findings provide a guideline for managing manufacturing small and medium firms to understand the impacts of AT, PL, SF and OA on CSP.

Current sustainability issues have prompted entrepreneurs and leaders worldwide to respond urgently, especially manufacturing SMEs, which contribute immensely to Malaysia's gross domestic product. This study helps to fill the gap for SMEs in rapidly developing countries, including Malaysia, since existing studies have concentrated on big organisations in developed economies.

SMEs have resource constraint which restricts them from carrying out various innovative and sustainable activities. Especially in a complex market environment emphasising corporate responsibility, the importance of high technology in the industry is more prominent, such as automation technology. This is because the vertical and horizontal manufacturing process integration and product connectivity of Industry 4.0 can assist organisations in gaining outstanding firm performance. With a fierce market environment and uncertain demand, SME owners should actively adopt advanced technology to improve performance and overcome resource slack. Therefore, by adopting IR4.0 technologies, SMEs can improve sustainable production in complex market competition.

Dealing with paradoxes is becoming more important in complex situations. PL considers the needs of all parties in the organisation and motivates employees to improve internal capability and foster innovation. In other words, paradoxically solid leadership gives employees more initiative and enhanced self-efficacy. Facing a turbulent environment and business uncertainties, SME owners prioritise PL over conventional leadership to influence, coordinate and make decisions. SMEs have gradually installed PL in organisation development and exploration to mobilise their younger workforce to achieve sustainable goals. To establish a productive workplace fostering innovation, leaders must balance conflicting factors by blending self-interest with altruism, maintaining a strategic equilibrium between distance and closeness, adopting a uniform approach to subordinates while allowing for individualisation, upholding work standards alongside flexibility and retaining decision control while granting autonomy.

In this study, besides investigating the direct effect of OA on CSP, the indirect effects of SF and OA were verified. Improving SMEs' OA is an effective way to improve sustainable performance through creating a balance between innovation and operational efficiency, fostering a culture of adaptability and learning and strategically navigating the complexities of the business environment. This approach is instrumental in improving sustainable performance, allowing SMEs to thrive in a dynamic and competitive landscape. Cultivating PL and high-tech applications is an effective way for SMEs to increase OA to promote positive outcomes. SMEs can build a firm's OA through AT and PL, representing technical resources and employee motivation developed harmoniously and consistently in daily operations. The ability to engage in exploitative and exploratory innovation indicates the dual orientation of the organisation, which enhances the employee mindset, improves the effectiveness of high-tech applications and leads to higher performance. In other words, using available technology, exploring new resources, actively mobilising and exploring the potential of employees and carrying out innovative activities are necessary for the survival and development of the organisations. OA's exploration and development activities will bring sustainable competitive advantages and performance. If the organisation agrees on exploration and development, it can lead to employee inertia and technology obsolescence, or too radical changes will lead to organisational chaos.

However, the study reported that the contingent role of SF does not moderate the association between AT, CSP and PL and CSP. SMEs' resources, capabilities, knowledge constraints and contextual diversity justified the insignificant outcome of SF. SMEs have to ensure these resources' availability while applying SF so that they can effectively and timely respond to the action adjustments that need to be made and ensure their CSP. SF is practically important for CSP as it empowers organisations to navigate a dynamic business environment, seize opportunities, mitigate risks, foster innovation, optimise resources and build resilience over the long term.

Limitations and future research directions

Despite significant theoretical and empirical contributions, this study acknowledges a few limitations. First, a single survey method can cause CMB issues (Fuller *et al.*, 2016). However, statistical post hoc procedures were taken into account to eradicate this issue. Secondly, this study examines a single country (Malaysia) and its industry (manufacturing SMEs). Both small and large-size service firms from other regions can be explored. Thirdly, this study used a single method: a cross-sectional quantitative survey. Other researchers can use comparative, qualitative, mixed or longitudinal studies to enhance generability. Other variables, such as knowledge bricolage and strategic vigilance, can be considered with this model.

Conclusion

Recovery solutions that rely on an organisation's flexibility and adaptability are crucial in the current dynamic, volatile economic environment that began before the COVID-19 pandemic and continues. Moreover, pressure to transact business from conventional to sustainable is paramount. SMEs must plan, prepare for, absorb, recover from and adapt to bad circumstances. This study sheds light on the outcomes of IR4.0 technology adoption, PL, OA and SF in achieving sustainable performance within Malaysian manufacturing SMEs. The cross-sectional analysis of a data set collected from 395 Malaysian manufacturing SMEs provides evidence of AT's importance in improving OA and CSP.

Although PL and SF influence were found to be insignificant in this model and sample population, their importance is undeniable in tackling complexity in the VUCA world. Therefore, internal and external stakeholders, policymakers and industry players' support, collaboration and proactivity can assist manufacturing SMEs to be sustainable.

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Further reading

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Appendix

Construct	Items	Source
Adoption of industry 4.0 technologies	AT1: Computer-aided process planning (CAPP) AT2: Automatic identification/bar code systems/RFID/industrial IoT AT3: "Smart" ICT applications supporting collaboration, connectivity, data processing, information mining, modeling, simulation AT4: Manufacturing resource planning (MRP) and/or enterprise resource planning (ERP) AT5: Advanced manufacturing technologies, additive manufacturing, 3D printing, high precision technologies (micro/nano-processing)	Gastaldi *et al.* (2022)
Paradoxical leadership	PL1: Leaders uses a fair approach to treat all subordinates uniformly but also treat them as individual PL2: Leader shoes a desire to lead but allows others to share the leadership role PL3: Leader controls important work issues but allows subordinates to handle details PL4: Leader success conformity in task performance but allows for exceptions	Zhang *et al.* (2015)
Strategic flexibility	SF1: There is a larger range of alternative uses to which a resource can be applied SF2: The costs and difficulty of switching from one use of a resource to an alternative use SF3: The time required to switch to alternative resource use is low SF4: Identify environmental changes and reconfiguring chains of resources the firm can use in developing, manufacturing and delivering its intended products to targeted markets SF5: Deploy resources through organizational structures that support the firm's product strategies	Meng *et al.* (2020)
Organizational ambidexterity	*Exploitation-exploration innovation* OA1: We innovate with new products and services in our local market OA2: We frequently refine the provision of existing operations OA3: We frequently use new opportunities in new markets OA4: We innovate in improved but existing products for our local market OA5: We innovate to improve the efficiency of existing operations	Sahi *et al.* (2020)
	Agility OA6: We change (expand or reduce) the variety of products available for sale OA7: We react quickly to new product or service launches by a competitor	Wamba *et al.* (2020)

(*continued*)

Table A1. Measurement of the constructs

Construct	Items	Source
	OA8: We respond quickly to changes in aggregate consumer Demand OA9: We shift quickly to contingency plans and crisis management Teams	
	Configurability	Wamba *et al.* (2020)
	OA10: We systematically dispatch resources according to market change OA11: We systematically create flexible product and process configurations OA12: We generally have a less formal structure OA13: We do not usually focus on traditions and legacy	
Corporate sustainable performance	*Economic performance*	Kamble *et al.* (2020)
	SP1: Reduced costs of production SP2: Improved revenue growth SP3: Improved quality of products SP4: Reduced lead time	
	Environmental performance	Belhadi *et al.* (2022)
	SP5: Reduced greenhouse gas emissions SP6: Reduced water usage SP7: Reduced energy use SP8: Reduced consumption of hazardous/harmful/toxic materials	
	Social performance	Kamble *et al.* (2020)
	SP9: Improved working conditions SP10: Improved safety and well-being SP11: Community support/involvement	

Table A1.

Source: By authors

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