Journal of Economy and Technology 2 (2024) 79–94

Contents lists available at ScienceDirect

Journal of Economy and Technology

journal homepage: www.keaipublishing.com/JET

Review article

Review of enablers and barriers of sustainable business practices in SMEs

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ARTICLE INFO

Keywords:
Artificial intelligence
Digital transformation
Industry 4.0
Sustainability
Big data

ABSTRACT

There are many factors that persuade or discourage business owners or managers of small and medium-sized firms to adopt sustainable policies. It is important to understand how different factors are interlinked to influence the business owners'/managers' decisions for sustainability. Therefore, the gap between policies and their implementation in the workplace causes the failure of the adoption of sustainable policies in business practices. To provide a clear picture, the present study intends to investigate the factors that might foster/hinder the adoption of sustainable policies in business practices. The study provides a systematic literature review on sustainable business policies from 2015 to 2023. We consider what are the key factors supporting or obstructing the successful implementation of a sustainability framework in the business practices in SMEs. Our findings reveal that data-centered solutions, sensor aided cyber physical systems, green consumption, vendor support, technological roadmap, gain legitimacy on the use of data analytics, and acceleration of digital transformation are the most significant enablers for sustainable business practices in SMEs. In addition, cloud enterprise resource planning is found to be the most significant enabler for developing countries. The barriers are mainly related to the implantation of the enablers. Among those major barriers are security of the data storage, lack of trust, lack of top management support, resistance to change to the new technology, lack of skilled workforce, data breaches, and poor network security. Our findings have key policy implications for practitioners and policy makers.

1. Introduction

Since 1990, the sustainability field has evolved in the mainstem of public awareness and gained interest from scholars and political considerations. The concern about sustainable development changed the business landscape (Martins et al., 2022) and became a driving force for the success of the corporate sector. Sustainable businesses are especially leading in terms of environmental issues and in long-term economic benefits (Melkonyan and Gottschalk, 2017). A huge interest is developed in sustainability research,

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https://doi.org/10.1016/j.ject.2024.03.005
Received 15 February 2024; Received in revised form 28 March 2024; Accepted 28 March 2024
Available online 31 March 2024
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but this research is mainly focused on the adoption of sustainable measures for large companies. For obtaining long-term benefits large enterprises implement sustainable activities as part of their business strategies. For the ongoing debate about sustainability developments small and medium-sized enterprises (SMEs) have received less attention from scholars (Jansson et al., 2017).

Large enterprises are under pressure from their stakeholders and are responsible to take part in the sustainability agendas (Singh and Misra, 2021). The scholars mainly focused their attention on the sustainability activities of large companies and multinational corporation firms (Westman et al., 2019). Although SMEs play a significant role in the economies, however, academic research on sustainability particularly in SMEs is limited (Kraus et al., 2020; Afshar Jahanshahi, et al., 2020).

Small and medium-sized enterprises (SMEs) are considered dissimilar from large companies due to their specific features (such as liability of smallness), and as such SMEs cannot be viewed as "little big businesses" (Westman et al., 2019). Indeed, due to increased competition and technological evolution, SMEs need to constantly improve their performance if they want to survive in the market alongside large companies. Nonetheless, the adoption of a sustainable framework implies barriers for SMEs in business practices. The adoption of sustainability policies is widely discussed among researchers as well as in the United Nations (UN). In 2015, the UN set an agenda to transform the world by adopting the 2030 Agenda for Sustainable Development. Therefore, it would be interesting to study how SMEs adopt sustainable practices in their business and the factors that support SMEs. Studying the supporting factors and the hinderances for SMEs is important because these enterprises have inherent characteristics and various geographical locations and contextual barriers that might require particular solutions for their issues.

Despite their key role in economic activities, research on the topic of sustainability in SMEs is not extensively explored (Jansson et al., 2017; Kraus et al., 2020; Afshar Jahanshahi, et al., 2020). Previous research has underscored the importance of sustainability in the diverse aspects of SME businesses. For instance, existing studies provide a review of barriers and key drivers for environmental sustainability in SMEs (Bakos et al., 2020), factors influencing sustainability performance, and sustainability relations towards SMEs financial performance (Bartolacci et al., 2020). Moreover, previous studies highlight the barriers and enablers faced by SMEs; barriers in terms of innovation in SMEs barriers to SMEs performance and barriers to environmental sustainability and enablers for sustainable manufacturing in SMEs (Bhanot et al., 2017) among others. However, the field is still under- researched and lacks a comprehensive overview of the state of the art. Some of the key research questions in this regard would be what are the useful enablers of sustainable business practice which are adopted by SMEs? What type of enablers could be used to overcome the barriers? What are barriers/hindrances against using digital technologies for sustainability in SMEs? More specifically, the enablers and barriers will be categorized as "internal" and "external".

Thus, in our study, we address these research questions and contribute to the existing literature by providing a more encompassing analysis that will allow identifying the individual barriers and enablers for SMEs sustainability. More specifically, we conduct a systematic literature review (SLR) to analyze the key factors supporting or obstructing the successful implementation of a sustainability framework in business practices in SMEs. Further, instead of generalization, we categorize the enablers and barriers as "internal" and "external" to identify some key patterns. Furthermore, unlike some previous research (e.g., Bhanot et al., 2017), we consider both the manufacturing and service sectors in SMEs to broaden the scope of our study.

The results of our study make important contributions to the ongoing research by identifying the existing barriers and supporting factors in the SMEs sustainability literature as well as highlighting the future avenue for academic research. The major enablers are found to be digitalization, Industry 4.0, smart factory, AI, and digital transformation of processes in SMEs. The hinderances of such enablers in SMEs are found to be lack of technical skills, technological capabilities, organizational culture, employee training, leadership support, as well as security & privacy concerns. However, one can focus on specific digital arenas, e.g., AI (data science, machine learning, etc.) and the connections between Industry 4.0 and sustainability to overcome the barriers. Based on the main research results, one can identify which enabler factors are more useful according to the nature of the business in SMEs to overcome the existing barriers to adopting sustainable policies. In addition, it provides awareness among academics and SMEs about sustainable adoption and the current barriers faced by SMEs due to technological change. Finally, it may guide policymakers and practitioners, and top managers to help SMEs engage with sustainability business policies and can assist in which type of enabler is more useful, supportive, or successful for business performance in SMEs.

2. Theoretical framework

Digitalization and digital transformation become the focal point of development for SMEs across the globe as it helps promoting activities related to sustainable business practices as well as contributing to sustainable development. Melo et al. (2023) analyzed the performance evaluations (environmental, social, economic, and digital maturity) of digital transformations in SMEs towards sustainability. Melo et al.'s result of 74 literature review from various sources shows that applying big data, cross-temporal investigations, and sectorial and regional prioritization are the essential elements in achieving digital transformation in SMEs.

Sustainability has been focused on many businesses because of government regulations, customers' expectations, and competitive advantage. Sustainability comprises a group of actions taken to fulfill the needs of the present aspect without compromising the future capability (Clancy et al., 2013). Sustainability includes three dimensions. The first organization needs to be socially liable, and the second organization needs to be environment-friendly, and the third organization should create wealth opportunities for the shareholders. In this aspect, such sustainability practices might enhance profit gains for the stakeholders in an environmentally driven business situation and might create benefits for society (Am, 2016). Sustainable practices at the business improve relationships with the stakeholders and improve reputation and trustworthiness (Moktadir et al., 2018).

The challenges to business sustainability are continuous and require exploring diverse sustainability approaches to address the various sustainability challenges (Alexander, 2020). The barriers and challenges mostly hider organizations to achieve their

sustainability objectives for organizational change management in the business (Uyarra et al., 2014). The barriers to sustainable business practice can only be overcome through various enablers which might support sustainable business performance (Orji, 2019). Therefore, it requires a comprehensive review of sustainability research to recognize those factors that impact the role between formulated policies and their execution. In this context, it may provide practical solutions to handle the intermittent factor that might hinder sustainability policies (Fischer et al., 2020; Jang, 2020). A detailed summary and overview of the existing literature on the barriers and enablers for business sustainability is provided in Table 2.

Previous studies highlight the importance of the internal or external nature of drivers and barriers for sustainability (Govindan and Bouzon, 2018). Further scholars have acknowledged barriers and enablers for sustainable manufacturing and industrial barriers to sustainable manufacturing (Alayón et al., 2016); and enablers for environmental manufacturing practices (del Mar Miras-Rodriguez et al., 2018). Moreover, some scholars provide evidence that the influencing factors could be either external or internal to companies (Fernández-Viñé et al., 2013; Alayón et al., 2016). For instance, barriers to sustainable manufacturing could be a lack of knowledge of how to adopt sustainable manufacturing practices (Cagno et al., 2017). Further, for sustainable manufacturing enablers could be government promotion and regulations and managerial leadership toward sustainability (Cagno et al., 2015).

3. Methodology

In general, the idea of a systemic literature review is to inform policymakers and practitioners and to provide insights into the relevant field development and current challenges. This study follows the systematic literature review approach which is followed by the previous studies (Johnson and Schaltegger, 2016; Martins et al., 2022). Therefore, this study provides a brief overview of internal and external barriers and enablers for sustainable business practices in SMEs in the manufacturing and service sector. Based on the proposed guidelines by Moher et al. (2010) and Fisch and Block (2018), the following steps are followed for conducting the systematic literature review.

Stage 1: For search protocol, a set of keywords were identified in the Thomson Reuters Web of Science core collection database (WoS) and Scopus such as “small businesses”, “small and medium-sized enterprises, “small companies”, “SME”, “sustainability, “enablers”, and “barriers”.

Stage 2: Recognized important aspects related to the research question and identified the most relevant literature.

Stage 3: For the literature search, the search criteria was selected from the year 2015 onwards. The key title for the search used such as barriers and sustainability and SME or SMEs.

Stage 4: Based on the search criteria, a total of 160 publications were eligible to be reviewed. After gathering the relevant papers, we revised their abstracts and did not consider those papers that were not related to the research topic. Consequently, 99 papers were selected based on our research objectives for this systematic literature review analysis.

The selection of inclusion and exclusion criteria for the papers is based on the research objectives, quality of the publication, relevant content, and methods that are applied (Kuckertz and Block, 2021). The final selection criteria (the inclusion and exclusion of the articles for the review) is described below. Fig. 1 depicts the method used for the systematic literature review.

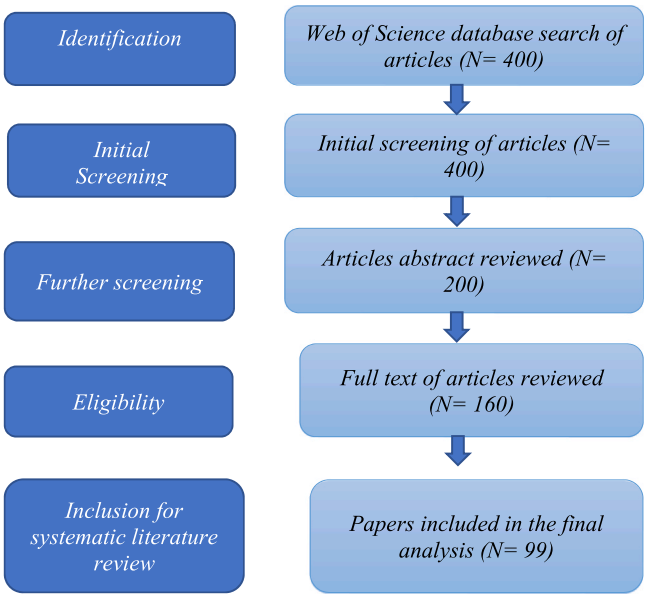


Fig. 1. Method applied in systematic literature review. Source: Authors’ own elaboration.

3.1. Inclusion criteria

Only peer-reviewed academic papers are considered that are published in English from 2015 onwards. In addition, only research articles published in journals that listed in WoS and Scopus are included in our review, and finally, articles that used quantitative, theoretical, empirical, and qualitative methods were included.

3.2. Exclusion criteria

Articles that are published before 2015, Conference papers, working papers, research papers published in journals that are not indexed with WoS and Scopus, and articles that are not relevant to the research topic are excluded from our review. Fig. 1 depicts the method applied in our systematic literature review.

4. Results

The final sample for systematic literature review is based on 99 papers which include both theoretical and empirical research which highlight the barriers and enablers for sustainable business practices in SMEs. The research about sustainable business practices received more attention from scholars since the UN set an agenda in 2015 to transform the world by adopting the 2030 agenda for Sustainable Development. Therefore, this study considers those papers which are published in 2015 and onwards. The following discussion in Section (4.1) will mostly cover the recent developments in new technologies and sustainability concerns and their role in SMEs' sustainable business practices. This is due to the fact that most of the recent studies have highlighted similar concerns with regards to the SMEs sustainability.

4.1. New technologies

After reviewing the previous literature, this study identified the barriers and enablers that include a variety of factors including digital transformation, digital technologies, and artificial intelligence among others for sustainability in SMEs. This study also highlights the enablers which could be useful to overcome the identified barriers.

Scholars stressed the importance of highlighting the internal and external nature of barriers and useful drivers to overcome the barriers (Govindan and Bouzon, 2018). The previous studies have mostly focused on barriers as compared to the enablers (Alayón et al., 2022; Henriques and Catarino, 2016). The systematic literature review has been carried out in this paper and revealed the most identified barriers and enablers in SMEs (See Table 2). Our study has identified 80 barriers and 100 enablers for SMEs' sustainable business practices. Table 1 shows the number of articles cited in this paper with the relevant publishers while Fig. 2 depicts the frequencies.

4.1.1. Artificial intelligence

As artificial intelligence (AI) plays a significant role in all aspects of business and society, its role in affecting business practices in SMEs towards sustainability must be acknowledged. Luckily, the association between AI and business practices have been quoted in the literature. For instance, Basri (2020) used AI assisted social media marketing (AISMM) to examine the role of AI on the performance of start-ups in Saudi Arabia. The results of the study revealed that improvements in workplace connectedness, creative

Table 1
Number of articles and name of the publishers.

Publisher	Number of articles
Atlantis Press	1
Australasian Chapter of the Association for Information Systems	1
CellPress	1
Elsevier	33
Emerald	16
ExcelingTech Pub, UK	2
IADITI	1
IGI Global	1
Inderscience	2
MDPI	9
Sage journals	1
Springer	9
Taylor & Francis	8
University of Bahrain	1
University of Tehran	1
UUM PRESS	1
Wiley	11
Total	**99**

Source: Authors findings

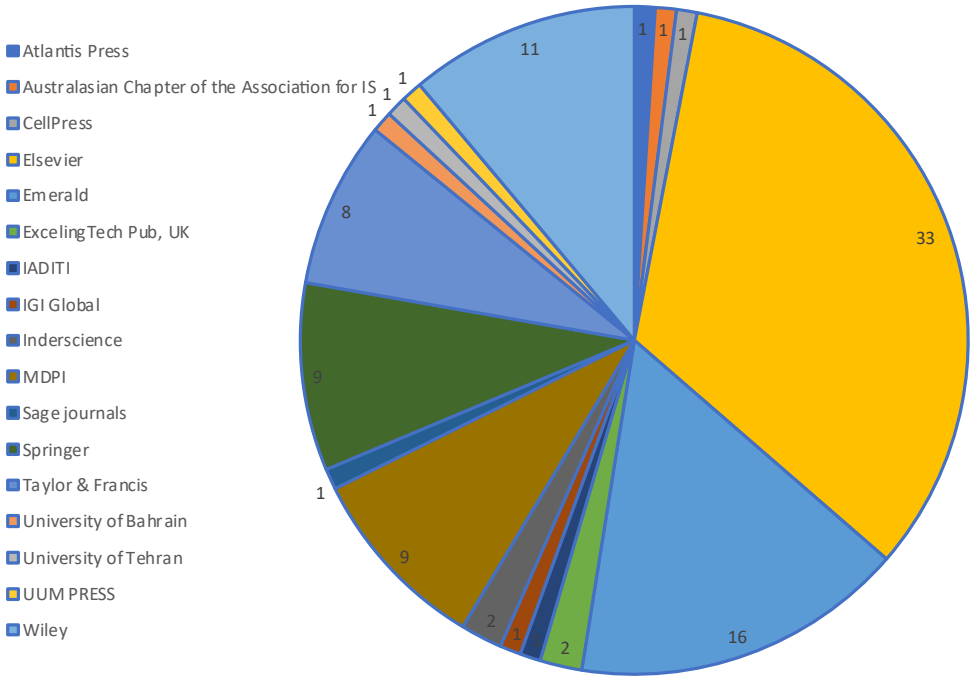


Fig. 2. Frequency of the published papers. Source: author findings.

thinking, and reduction in employee turnover rate were the major benefits of AISMM. In addition, the adoption of AISMM led to increase in the number of customers and profit for the organization which are the measures of SMEs performance.

Baabdullah et al. (2021) claimed that successful adoption of technology is crucial for SMEs' development. One of the new generations of technologies is Artificial Intelligence (AI) that can facilitate competitive strategy but there is a little evidence in the literature especially for the Middle East region. Baabdullah et al. (2021) hence examined the antecedents and consequences of implementation of AI in SMEs in Saudi Arabia. They used the "technology-organization-environment framework" to see the impact of AI enablers on the acceptance of AI practices. Eventually, this would have an impact on the governance, and performance of SMEs which use AI-based business customer interactions. Using structural equation modeling and a survey data of 392 SMEs, the results of the enablers show that "acceptance of AI practices" is significantly influenced by technology road-mapping. The results of the AI readiness variables, "acceptance of AI practices" is significantly influenced by infrastructure and awareness. The "acceptance of AI practices" hence affects AI-enabled relational governance, performance, and customer AI-based interaction.

4.1.2. Industry 4.0

Global warming and resource efficiency have a significant impact on the small and medium sized enterprises in the developed and developing countries. The review of the literature in this regard shows that sustainability and Industry 4.0 are intertwined (Jamwal et al., 2023). The interaction between these two phenomena has been examined to see if Industry 4.0 has at all any impact on sustainability in terms of process, and product levels especially for the SMEs. In addition, manufacturing SMEs are facing challenges from stakeholders and customers for environmentally friendly products to remain competitive.

Industry 4.0 is a relatively new concept for SMEs to help them achieve sustainable development in their business practices. In an empirical study, Jamwal et al. (2023) investigated 233 manufacturing SMEs using a Fuzzy Hierarchy Process model. Their empirical findings show that "data security and privacy issues" and "lack of research and development (R&D) teams" as significant challenges for SMEs in emerging economies.

Haseeb et al. (2019) argued that technology challenges adversely impact sustainable business performance of SMEs. But the incorporation of industry 4.0 would help to overcome some of those issues via operational effectiveness, productivity, and higher level of atomization. Haseeb et al. conducted a survey in Thailand to identify the role of Industry 4.0 in promoting sustainable business performance in a sample of 280 SMEs. Using structural equation modeling, the results show that Industry 4.0 is the key for SME's growth and the elements of Industry 4.0 such as Internet of Things (IoT), big data, and smart factory play a positive role in advancing IT implementation which contributes to the sustainable business performance (Chandrayan et al., 2023).

Hung and Chen (2023) investigated the adoption of Industry 4.0 to meet the United Nations sustainable development goals (SDGs) in Taiwan using Technology, Organization, and Environment (TOE) model via structural equation modeling. The results show a significant gap for SMEs to achieve SDGs via Industry 4.0. The reasons are reported to be the organizational resource availability that impacts Industry 4.0 adoption, investment costs that impact sustainability, and external support that pushes the adoption of Industry 4.0.

Kumar and Sharma (2024) investigated the relationship between sustainable development and Industry 4.0 using systematic literature review and interpretive structural modeling. The results identified 14 solution dimensions for implementing I4.0 in SMEs

Table 2
Classification of barriers and enablers of the adoption of sustainable business practices in SMEs.

Category	Internal/ External	Barriers	Country	Enablers	Internal/ External	Country
General ICT (information and communications technology)	Internal	Unskilled workforce, challenges in data management and lack of ICT infrastructure (Kumar et al., 2021).	India	SMEs need to recognize and seize digitally enabled growth opportunities and access the competencies linked to each level to promote digital enabled growth in competitive environments (North et al., 2019).	Internal	Not mentioned
	External	SMEs face several issues for ICT adoption such as lack of expertise, financial resources, and appropriate solutions in ICT utilization (Kazakov et al., 2020; Babajide et al., 2023).	Turkey, Nigeria	Information technology (IT) impacts the economic development of SMEs in conducting sale activities (Mukhtar et al., 2020).	External	Indonesia
	External	The technology acceptance is barrier for SMEs due to the available ICT compatibility with specific SMEs tasks and procedures (AlBar and Hoque, 2019; AlZayani et al., 2023)	Saudi Arabia, Bahrain	The adoption of supply chain technology could enhance the organizational performance of SMEs (Mekhum, 2020).	Internal	Thailand
				The eco-sourcing tool grounded in Model View Control (MVC) architecture through using internet enabled platform empowers customers to choose and order any automobile product online and its time saving (Anthony, 2019).	External	Malaysia
				The digital innovation process and outcomes in SMEs is impacted by configuration of technological, organizational, and environmental antecedents (Ramdani et al., 2022)	External	Review Paper
				Information Communication Technology (ICT) provides modern platform for the improvement of business performance in SMEs and speed-up managerial processes execution (Karakara and Osabuohien, 2020; Ab Wahab et al., 2020).	Internal	Malaysia, Ghana, Nigeria
IoT and IIoT	Internal	Technology challenges could adversely impact sustainable business performance of SMEs and Big data, IoT, and smart factory are found to be the barriers for SMEs in Thailand (Haseeb et al., 2019).	Thailand	System integration, IoT infrastructure, organizational resources, technological capabilities, organizational culture, and human capital are highlighted as enablers of IoT in SMEs (Samaranayake, et al., 2023).	Internal	Thailand
Smart technology	Internal	The challenges identified: Technology, strategic, investment, supply chain, operation process, skills learning, and market challenges (Martinsuo and Luomaranta, 2018).	Finland	Digital technology, digital innovation, strategic and operative actions are suggested as enablers of smart technologies (Martinsuo and Luomaranta, 2018).	Internal	Finland
Cloud computing technology	Internal	Reluctance in adoption of cloud computing and securities and privacy concerns are the main challenges for embracing new technologies (Asiaei and Rahim, 2019).	Malaysia	The most key factors that support the adoption of cloud computing are the top management support, data security, technology readiness, competitive pressure, and innovativeness in SMEs (Asiaei, and Rahim, 2019).	Internal	Malaysia
	External	Potential risks concerning the use of cloud services and concerns about privacy and security of the data storage with the third-party server hinder the adoption of cloud computing in SMEs (Khayer et al., 2020a).	Bangladesh	Perceived ease of use, trust, cost, and perceived usefulness significantly affect user's behavioral intention for cloud computing adoption (Asadi et al., 2017).	Internal/ External	Malaysia
	External	Considerable firms still reluctant to adopt the cloud computing technology because of the lack of trust and its absence of physical presence (Hassan et al., 2022)	Pakistan	In SMEs, the most significant determinants of cloud computing adoption are data security and privacy, perceived trust, effort expectation, performance expectation and absorptive capacity (Khayer et al., 2020a).	Internal	Malaysia
	Internal	Privacy, security, and trust are the main challenging issues for cloud computing adoption in enterprises (Chang et al., 2016).	China, England	The quality of service and trust towards cloud providers enable the adoption of cloud computing in organizations (Alkhater et al., 2018).	Internal	Bangladesh

(*continued on next page*)

Table 2 (*continued*)

Category	Internal/ External	Barriers	Country	Enablers	Internal/ External	Country
	Internal	Security and privacy worries and absence of physical location for data storage and culture hinder the decision to adopt cloud computing (Alkhater et al., 2018).	Saudi Arabia	IT resources and external pressure support the SMEs intention to adopt cloud computing (Hassan et al., 2017).	External	Malaysia
	Internal	The main challenges towards cloud computing adoption include lack of sharing and collaboration, lack of top management support, and lack of confidentiality in SMEs (Raut et al., 2018).	India	Technological readiness, security, prior IT experience, competitive pressure and top management support are the principal factors for employing cloud computing technology in SMEs (Rababah and Al-nassar, 2020).	Internal	Jordan
	Internal/ External	The potential barriers for the implementation of cloud computing in Saudi Arabian SMEs include lack of cloud knowledge and training, data control, lack of government support, security concerns, privacy issues, service cost, and lack of top management support (Alsafi and Fan, 2020).	Saudi Arabia	Quality of service, hardware scalability and standardization, cost, installation and up gradation and innovation are the key factors for the adoption of cloud computing in SMEs (Raut et al., 2019a, 2019b).	Internal	India
	Internal	Perceived risks and resistance to change to the new technology are the hindering factors of cloud computing adoption in SMEs (Khayer et al., 2020b).	Bangladesh	Computer self-efficacy of decision-makers, server location, service quality, facilitating conditions, cloud providers support (i.e. technological, and skilled human resources to maintain their infrastructure) and top management supports are the encouraging factors to adopt cloud services (Khayer et al., 2020b).	Internal	Bangladesh
	Internal	Privacy issues, securities concerns, and culture privacy are the main challenges for cloud computing adoption in SMEs (Albelaihi and Khan, 2020).	Saudi Arabia	Organizational competitiveness and the institutional pressure (mimetic, coercive and normative) are the supporting factors for the adoption of cloud computing (Adjei et al., 2021).	External	Ghana
				SMEs size play a significant role during the developmental stage of digital transitional period. Also, workforce educational factor is important during the transformational period (Trstenjak et al., 2020).	Internal	Croatia
				Resultant cost benefits for the SMEs support toward the adoption of cloud technology (Doherty et al., 2015).	Internal	Ireland
				The awareness of technology, cloud relative advantage, quality of service and firm size significantly contributes to the cloud computing adoption in SMEs (Senarathna et al., 2018).	Internal	Australia
				Technology readiness, competitive pressure, top management support, and enterprise size have significant impact on the implementation of cloud enterprise resource planning in developing countries (Moh'd Anwer, 2018).	Internal	Jordan, Lebanon, Saudi Arabia, Bahrain, Qatar, Emirates, Egypt, Oman, Kuwait and Turkey
AI (Artificial Intelligence)	Internal / External	CPS is considered as the backbone of Industry 4.0, and its implementation in SMEs will make significant changes pertaining to manufacturing automation. "Lack of skilled manpower" and "lack of robustness with respect to environmental conditions in automotive environments" are the most significant barriers hindering CPS adoption in SMEs (Wankhede and Vinodh, 2022).	India	Data acquisition and processing are the enabler of cyber physical systems (Wagner et al., 2017)	Internal	Germany

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Table 2 (*continued*)

Category	Internal/ External	Barriers	Country	Enablers	Internal/ External	Country
	Internal	The personal data breaches and incidents linked with AI applications and poor network security cloud lead to loss of trust from users and limit organizations intentions to implement AI at their workplace. Due to these aforementioned factors organizations hesitate to adopt AI (Yu et al., 2022; Chi et al., 2020).	Review	The increasing trends, improvements in workplace connectedness, reduced rates of employee turnover and creative thinking are the beneficial effects of the artificial intelligence-assisted social media marketing (AISMM). Overall, the rise in business sales, increase in the number of clients, and growth in profit generation are the positive attributes that arise from AISMM adoption (Basri, 2020).	Internal	Saudi Arabia
				Organizational characteristic of readiness towards use of AI, employees training, leadership support and technological support have the enormous potential to impact AI deployment to ensure the sustainability at the firms (Chaudhuri et al., 2022).	Internal	India
				The environmental factors, technical subsystem, organizational structure subsystem and personnel subsystem are the AI adoption related antecedents (Yu et al., 2022).	Internal / External	Review No country
CPS (Cyber Physical Systems)	Internal and external	The barriers and challenges of big data implantation were additionally identified to be financial barriers, data security, technical barriers, data security, and awareness in SMEs in Malaysia (Falahat et al., 2022).	Malaysia	Improvement of financial management, improvement of financial and industrial prediction models, increased efficiency of organizational processes, optimization of financial and marketing performance, better understanding of business challenges, improvement of strategic decision-making, and improvement of the industrial or business strategy (Justy et al., 2023).	Internal	France
Big Data	Internal	Unsuitable IT infrastructure, lack of managerial support, inability to identify strategic use cases for data analytics, misalignment between business strategy and information systems, lack of organizational culture or leadership supporting data analytics use, lack of data analytics-skilled employees and professional training, high cost of adopting data analytics and maintaining IS infrastructure, and lack of legal knowledge to comply with GDPR legislation (Justy et al., 2023).	France	Improvement of customer knowledge, better identification of customer needs, improvement of segmentation, targeting and positioning, improvement of digital marketing operations, create innovative digital services, increased adoption of data analytics in rival SMEs, aversion to missing a technological opportunity, gain legitimacy on the use of data analytics, and acceleration of digital transformation due to Covid-19 crisis (Justy et al., 2023).	Internal	France
	External	Lack of software editors specialized in SME, shortage in skilled employees on the job market and high cost of salaries, increased competition due to high demand in service providers, poor quality of the data, and inability to measure the return on investment of data analytics adoption (Justy et al., 2023).	France	The enablers were identified to be top management vision, data driven culture, skillful talent employees, quality control in data collection, technological roadmap, and software (Falahat et al., 2022).	Internal	Malaysia
	Internal / External	Big data, IoT, and smart factory are found to be the barriers for sustainable business practices in SMEs in Thailand (Haseeb et al., 2019).	Thailand	In a recent study, vendor support is listed as the most crucial enabler when considering the implementation of additive manufacturing (Krishnan and Mathiyazhagan, 2022)	External	India
	Internal	Technological barriers such as limited multi-material printing capabilities, slow printing speed, and lack of technological readiness; organizational barriers such as lack of skilled workforce, lack of commitment from low-level employees, and late	India			

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Table 2 (*continued*)

Category	Internal/ External	Barriers	Country	Enablers	Internal/ External	Country
		design changes; environmental barriers such as unawareness of benefits for sustainability, lack of government support, and lack of stakeholder pressure toward environmental sustainability; risk barriers such as social sustainability, creation of a parallel industry of 3D scanning, and risk of counterfeit products available in the market; value barriers such as high operational cost of additive manufacturing machines, high investment cost of printing materials, high investment for R&D and training, and Short window of return due to fast changing technology (Priyadarshini et al., 2022).				
Additive manufacturing	Internal	leadership style, central government policy, customer integration, and internal business process have a significant impact on big data analytics and sustainable practices (Raut et al., 2019a, 2019b).	India	Digital technologies, green consumption, local sourcing, circular supply chain, eco-efficiency, circular business model, government support, circular entrepreneurship (Santolin et al., 2023)	External	Australia, Brazil, Italy
Economic sustainability	Internal and external	Lack of resources, lack of employee engagement, managerial barriers due to their negative attitudes and lack of knowledge, and less tech orientation are the internal barriers. Industrial barriers, lack of government support, and high cost of certification are the external barriers (Dasanayaka et al., 2022).	Sri Lanka	Accessible information such as online tools and databases, government incentives such as tax breaks, and changing consumer preferences towards ethical and environmentally responsible products are also highlighted as enablers (Raut et al., 2019a, 2019b).	External	India
Environmental sustainability	External	Community misperception of high price and low quality of the product, lack of institutional and government support in capacity building, and lack of necessary space throughout a value chain for reuse activities (Awan and Sroufe, 2022).	USA	Lean thinking, and green thinking are quoted as enablers of Sustainable business practices in SMEs (Caldera et al., 2019).	Internal	Australia
Social sustainability	Internal	lack of employee's competence, lack of resources, lack of awareness, lack of cultural feasibility, low cost of the virgin product, lack of implementation plan and policy for sustainability, lack of intention to sustainability, and high investment cost, lack of infrastructure, lack of trust, lack of business model, and lack of government and organizational support (Kumar et al., 2023).	India	Automation systems, sensor aided cyber physical systems, radio frequency identification, information management, IT infrastructure, employee training and development, Internet of Things (IoT), regulations and policies, financial support, and stakeholder(s) involvement are listed as enablers of Industry 4.0 in India (Chandrayan et al., 2023).	Internal	India
Industry 4.0	Internal	"Data security and privacy issues" and "lack of research and development (R&D) teams" are the major barriers for SMEs (Jamwal et al., 2023).	Emerging economies	In the study of Machado et al. (2021) the enablers were identified to be strategic alignment, data-centered solutions, employees' empowerment, knowledge sharing, and valuing R&D.	Internal	Brazil
	Internal	In the study of Machado et al. (2021); the barriers were identified to be lack of technical expertise, cybersecurity issues, resistance to change, lack of investment in R&D, cost of improvement, poor legislation, and lack of management commitment.	Brazil			
	Internal	For the transformation of Industry 4.0 companies mostly face challenges about the required technical skills and expertise (Yüksel, 2020).	Turkey			

for sustainable development. The most important dimensions were human resource training program, strategic collaborations, top management commitment, and coordination among key stakeholders. The said dimensions have an impact on sustainable development through defining a substantial correlation between the sustainability dimensions and Industry 4.0 implementation in SMEs.

Kumar et al. (2023) investigated several challenges that affect the adoption of Industry 4.0 and sustainability in SMEs in India. In addition, the barriers of adopting sustainability and I4.0, and the relationship between the barriers are examined. The results of literature search and interview with three SMEs identified 12 barriers to adoption based on the "Interpretive Structural Modeling". Lack of employee's competence, and lack of resources are the major barriers.

Khan et al. (2023) claimed that Industry 4.0 has gained attention from every aspect of sustainability especially from policymakers and practitioners, the sustainable development becomes crucial to sustainable business competitive advantage. Using a systematic literature review, authors tried to address the nexus between a combination of Industry 4.0 technologies and innovations could contribute to the sustainability implications. The analysis of 58 articles shows that Industry 4.0 results in different innovation types including process, business model, organizational, supply chain, and marketing innovations that help advancing sustainable business models, and sustainable development goals.

In another study by Machado et al. (2021) the enablers and barriers of integration of Industry 4.0 into the supply chain of SMEs were investigated. The barriers were identified to be lack of technical expertise, cybersecurity issues, resistance to change, lack of investment in R&D, cost of improvement, poor legislation, and lack of management commitment. The enablers were identified to be strategic alignment, data-centered solutions, employees' empowerment, knowledge sharing, and valuing R&D.

4.1.3. Smart Technologies

SMEs can enhance their sustainable business practices by integrating new and smart technologies into their operations. A variety of technologies have been quoted as enablers of sustainable business practices in SMEs such as IoT devices that provide real-time monitoring of operations, e.g., resource usage, and minimizing waste, etc. Further, cloud computing is another smart technology that facilitates remote work, minimizing commuting and hence contributing to lowering CO_2 emissions. Blockchain and AI ensure transparency and empowers SMEs to make informed decisions. For instance, AlZayani et al. (2023) investigated the impact of smart technologies on SMEs sustainable performance in 403 SMEs in Bahrain. The sustainability concept in this study were social sustainability, environmental sustainability, and profitability. The results depict that smart technology only affects profitability performance.

Digital developments such as cyber-physical systems (CPS) are the key elements for agile production and manufacturing in SMEs, but a collective understanding of the enabling of such systems still needs more investigation. Wagner et al. (2017) investigated the enablers of CPS to be data acquisition and data processing.

Yang et al. (2023) argued that digital innovation has a great relationship with firms' sustainability and these two variables are the two essential parts of the circular economy. The authors examined the adoption of digital technologies for sustainable smart manufacturing in SMEs.

Martinsuo and Luomaranta (2018) argued that adopting additive manufacturing could be challenging for SMEs supply chain. The interview-based research design (from 17 respondents) was employed to identify the challenges and solutions. Strategic and operative actions were suggested as solutions to the challenges. Here are the challenges identified: technology, strategic, investment, supply chain, operation process, skills learning, and market challenges.

Using a qualitative method, Falahat et al. (2022) claimed that advanced technologies drastically changed the business environment and dictates firms to be more agile and innovative to respond to the customers' needs. One of those technologies is Big Data analytics as one of the frontiers for productivity, competition, and innovation. With the help of a qualitative technique via a focus group, 14 SMEs, and industrial experts in Malaysia have been interviewed. The barriers and challenges of big data implantation were identified to be financial barriers, data security, technical barriers, data security, and awareness. The enablers were identified to be top management vision, data driven culture, skillful talent employees, quality control in data collection, technological roadmap, and software.

In another study by Raut et al. (2019a, 2019b), big data was highlighted to be one of the popular concepts in ensuring sustainable operations for businesses in their supply chains. To investigate this issue, data were collected from 316 Indian experts in manufacturing sector that adopted sustainable practices. The results show that the enablers of big data analytics were highlighted to be leadership style, central government policy, customer integration, and internal business process have a significant impact on big data analytics and sustainable practices.

4.2. Economic, environmental, and social sustainability

Even though the new technologies have an eminent impact on sustainability in SMEs, the fact that the economic and social environments will influence such practices should not be ignored. Therefore, these items are also discussed. Each element within these domains has an important impact on such practices. As it can be seen in Table 2, lack of awareness, lack of cultural feasibility, lack of implementation plan, lack of intention to sustainability, lack of infrastructure, and lack of government and organizational support are quoted as major barriers for sustainability practices in SMEs (Kumar et al., 2023). While accessible information such as online databases, government incentives, changing consumer preferences towards ethical and environmentally responsible products are highlighted as enablers of SMEs sustainability practices (Raut et al., 2019a, 2019b). Employee training, Internet of Things (IoT), financial support, and stakeholder(s) involvement are listed as additional enablers of social sustainability of SMEs (Chandrayan et al., 2023).

SMEs are embracing economic, environmental, and social sustainability for the long-term viability of their businesses. From the economic perspective, cost saving measures and waste management are highlighted in the literature. From an environmental perspective, preserving natural resources, and minimizing CO_2 emissions are emphasized. From social perspective, diversity, positive relationships with employees, customer relationships, and stakeholders' engagement would ensure social sustainability.

Caldera et al. (2019) argued that "sustainable business practice" could enable SMEs with more profit, resilience, and enhance their social and environmental impacts. Lean thinking, and green thinking are quoted as enablers of sustainable business practices in SMEs. The result of an in-depth interview reveals that lack of knowledge and skills, lack of financial resources, and organizational culture are the major barriers for "sustainable business practices" in SMEs. Integrated strategy, continuous improvement, stakeholder involvement, and streamlined process are listed as the enablers.

5. Discussion and policy implications

Through our study, we contribute to the literature about sustainable business practices in SMEs by proposing a typology of enablers and barriers of smart technology adoption in SMEs. Our analysis of the systematic literature review revealed several barriers and enablers for the implementation of sustainable policies implementation in SMEs.

From Table 2, we can see that most of the barriers could be mitigated through enablers of sustainable business policies especially in the domains of smart technologies, big tata, and cyber-physical systems (CPS). When we categorize the barriers into various domains, we can see that major barriers lie within the domains of technical, managerial, strategic, cultural, skills, financial, legal, supply and demand, and technological advancements. While the domain of enablers lies within operational, strategic, market-related, competition-related, and adaptation related enablers.

To be more specific about barriers, they are mainly related to the implantation of the enablers. Among those of major barriers are security concerns (such as data storage), lack of trust, lack of top management support, resistance to change to the new technology, lack of skilled manpower, data breaches, and poor network security issues.

We further identified the internal and external drivers and barriers. In general, the major internal barriers among SMEs are related to improving business strategy, and operational management. The external barriers are mostly related to competition, government support, environmental regulations, potential risks concerning to the use of cloud service, privacy and security of the data storage, lack of trust, absence of physical presence of technology, shortage in skilled employees on the job market, increased competition due to high demand, poor quality of the data, inability to measure the return on investment of data analytics adoption, and high cost of certification.

Moreover, the literature we examined in this paper focuses on the impact of artificial intelligence, data analytics, Industry 4.0, and smart technologies. With regards to the industry 4.0, data security and privacy issues and lack of research and development (R&D) teams were the major barriers for SMEs (Jamwal et al., 2023). Technical expertise, resistance to change, cost of improvement, and poor legislation were further identified by Machado et al., (2021). In addition, lack of employee's competence, lack of resources, lack of awareness, lack of cultural feasibility, low cost of the virgin product (LCVP), lack of implementation plan and policy for sustainability, lack of intention to sustainability, high investment cost, lack of infrastructure, and lack of business model were emphasized by Kumar et al. (2023).

For the cyber physical systems, lack of skilled manpower and lack of robustness with respect to environmental conditions are the most significant barriers hindering CPS adoption in SMEs (Wankhede and Vinodh, 2022). While artificial intelligence, personal data breaches, poor network security, and limit organizations intentions to implement AI are the factors that organizations hesitate to adopt AI (Yu et al., 2022; Chi et al., 2020).

The literature has revealed several barriers to enabling additive manufacturing (AM) for sustainable business practices in SMEs. Among those are limited multi-material printing capabilities, slow printing speed, and lack of technological readiness are mainly listed as technical AM barriers. The organizational barriers of AM are lack of skilled workforce, lack of commitment from low-level employees, and late design changes. The AM environmental barriers are unawareness of benefits for sustainability, lack of government support, and lack of stakeholder pressure toward environmental sustainability. The AM risk barriers are social sustainability, creation of a parallel industry of 3D scanning, and risk of counterfeit products available in the market. The AM value barriers are high operational cost of additive manufacturing machines, high investment cost of printing materials, high investment for R&D and training, and short window of return due to fast changing technology (Priyadarshini et al., 2022).

Another type of smart technology is the use of IoT. With this regard, big data, and smart factory are found to be the barriers for SMEs to adopt IoT (Haseeb et al., 2019).

Apart from all the barriers highlighted above, we identified several enablers too. Our findings suggest that data-centered solutions, sensor aided cyber physical systems, green consumption, vendor support, technological roadmap, gain legitimacy on the use of data analytics, acceleration of digital transformation, and cloud enterprise resource planning are the most significant enablers for sustainable business practices in SMEs.

With a closer look into the enablers identified in Table 2, we were able to identify the most important internal enablers. Those are employee training and development, green thinking, top management vision, data driven culture, skillful talent employees, quality control in data collection, increased efficiency of organizational processes, optimization of financial and marketing performance, better understanding of business challenges, and digital innovation. While the external enablers are government support, circular entrepreneurship, government incentives such as tax breaks, changing consumer preferences towards ethical and environmentally responsible products, vendor support, and institutional pressure.

For AI, Organizational characteristic of readiness towards use of AI, employees training, leadership and technological support are listed by Chaudhuri et al., (2022). While environmental factors, technical subsystems, and organizational structure are the AI enablers listed by Yu et al., (2022).

For the case of IoT, system integration, IoT infrastructure, organizational resources, technological capabilities, organizational culture, and human capital are highlighted as enablers of IoT in SMEs by Samaranayake et al., (2023). While digital technology, digital innovation, and strategic and operative actions are the suggested enablers of smart technologies in SMEs (Martinsuo and Luomaranta, 2018).

For the CPS enablers Wagner et al. (2017) identified data acquisition, and data processing to be the major enablers of cyber physical systems. However, for the big data, improvement of customer knowledge, better identification of customer needs, improvement of segmentation, targeting and positioning, improvement of digital marketing operations, innovative digital services, adoption of data analytics in rival SMEs, aversion to missing a technological opportunity, and digital transformation are the enablers justified by Justy et al., (2023).

Vendor support is listed as the most crucial enabler of AM when considering the implementation of additive manufacturing (Krishnan and Mathiyazhagan, 2022). While automation systems, sensor aided cyber physical systems, radio frequency identification, robust supply chain management, information management, IT infrastructure, employee training and development, IoT, regulations and policies, employees' empowerment, knowledge sharing, and valuing R&D, and financial support are listed as enablers of Industry 4.0 (Chandrayan et al., 2023; Machado et al., 2021).

6. Emerging topics

A few areas of emerging topics can be observed in the recent literature, i.e., AI, I4.0, digitalization, and automatization. These four emerging concepts have an impact on both SMEs as well as MNCs since these two types of production facilities contribute to the manufacturing and service industry relatively significantly.

The present research is based on a systematic literature review that identified several dimensions of sustainable business practices in SMEs. The future research direction might focus on the areas that highlight the impact of artificial intelligence and more specifically automatization of the manufacturing sector as this sector contributes to the sustainable development agenda of the UN. To be precise, the following dimensions must be considered in the future research:

6.1. AI related technological development

The introduction of ChatGPT and open AI are significant milestones achieved with the use of artificial intelligence systems. By using AI, SMEs can enhance their operational efficiency and hence contribute to environmental conservation (the latter is of significant relevance as it has been quoted as a pressing issue for all sectors). In this regard four new dimensions might be beneficial to be explored: machine learning mechanisms, predictive analytics, AI-driven technologies, and data-driven decision mechanisms.

6.2. Sustainable development goals

SMEs contribute to sustainable development through various channels which should be explored further. Among those channels are innovation, environmental responsibility, and economic growth. These can be further studied to see the true impact of SMEs. In addition, the role of SMEs can be examined in achieving SDG 1 (reducing poverty), SDG 8 (economic growth), SDG 9 (innovation), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

7. Conclusion

This study is based on literature review to identify the barriers to sustainable business practices and drivers which support sustainable business performance in SMEs. In this article, we have considered the relevant literature from 2015 onwards to provide a comprehensive overview of sustainable performance in SMEs. Through this literature review, we uncovered that there are some internal and external factors that play a significant role in SMEs taking sustainability initiatives and working towards to use of new technology such as Industry 4.0 for their sustainable practices in SMEs. Our findings suggest that research focusing on SMEs using industry 4.0 technology for their sustainable goal received less attention in academia.

The main barriers that we have identified in most studies are lack of ICT infrastructure, unskilled workforce, lack of technical skills and expertise, lack of financial resources, securities and privacy concerns of the data storage, lack of trust and its absence of physical presence, lack of sharing and collaboration, lack of top management support, lack of confidentiality in SMEs, culture's privacy, data breaches and poor network security, lack of skilled manpower, technical barriers, data security, lack of employees competencies, lack of employees engagement, lack of institutional and government support in capacity building, cyber security issues, lack of cultural feasibility, lack of implementation plan and policy for sustainability, lack of intention to sustainability, lack of infrastructure, lack of trust, lack of government and organizational support. These barriers highlight that they are associated with other obstacles and are potential hindrances to sustainable business practices, the removal of these barriers would enable SMEs to enhance their sustainable business practices more effectively with the use of new technology.

Several enablers are identified in our study which will facilitate SMEs to mitigate the barriers and obstacles for sustainable practices. The most influential drivers that support sustainable performance by utilizing Industry 4.0 in SMEs are information communication technology, adoption of supply chain technology, IoT infrastructure, top management support, data security, technology readiness, perceived ease of use of cloud computing, trust, prior IT experience, competitive pressure, upgradation and innovation, skilled human resources, cost benefits, awareness of technology, employees training, and financial support. Based on our

findings, we note that the increasing trend of smart technologies, Industry 4.0, big data, and IoT are bringing challenges for SMEs to adopt new technology and perform sustainable business practices. As we have highlighted the most influential drivers above, SMEs can use those as a gateway to enter sustainable business practices and can overcome the key barriers to business sustainability. These supporting influential drivers will not only enhance sustainable business practices but also help SMEs to adopt new technology and boost their performance. In addition, the organizational structure and process need to be updated to adopt or practice these drivers to overcome their existing barriers. We can conclude that cutting-edge technologies, like robotics, Industry 4.0, and AI perform better than general ICT facilities indicating that innovative technical skills and top management support are the key driving factors alongside technological sophistication.

Sustainable business practices in SMEs and large corporations differ in terms of their approach to such practices and the adoption of new technologies. Large corporations often have more resources to adopt sustainability initiatives. They may have dedicated departments and significant R&D budget to implement cutting edge technologies for their sustainability practices. In contrast, such resources for SMEs are constraint but they are more agile in adopting to new changes due to simpler processes. SMEs may struggle in accessing capital for investing in large-scale technologies. However, both SMEs and large corporations play a significant role in promoting sustainable business practices. Large corporations lead innovation practices and SMEs driving sustainability efforts within their communities.

7.1. Limitations

This study is not free from limitations. It is important to consider that some papers were not accessible for downloading due to lack of subscription. Therefore, it is possible that some insights on sustainability might be overlooked because of the unavailability of the papers. Another limitation refers to the fact that we selected WoS, and Scopus listed papers and it could exclude the contributions on sustainability in SMEs offered in papers in other journals indexed in other databases as well as papers that are published in conference proceedings. Further, we have considered only papers that were published in the English language. We notice that some articles published in other languages such as German, and French were also available in academic journals which might be also an important addition to the current literature on sustainability. Forthcoming studies might consider the literature on that subject in other languages as well.

Declaration of competing interest

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

Acknowledgement

This research received no funding.

Appendix

Table A
List of articles by journal and publishers

International Journal of Computational Intelligence Systems	1	Atlantis Press
Australasian Journal of Information Systems	1	Australasian Chapter of the Association for Information Systems
Heliyon	1	CellPress
Decision Analytics Journal	1	Elsevier
Energy Conversion and Management	1	Elsevier
Future Generation Computer Systems	1	Elsevier
Industrial Marketing Management	1	Elsevier
International journal of surgery	1	Elsevier
Journal of Cleaner Production	10	Elsevier
Journal of Operations Management	1	Elsevier
Procedia CIRP	3	Elsevier
Renewable and Sustainable Energy Reviews	1	Elsevier
Resources, Conservation & Recycling	3	Elsevier
Technological Forecasting and Social Change	1	Elsevier
Technology in Society	3	Elsevier
Technovation	2	Elsevier
Telematics and Informatics	1	Elsevier
Computers & Industrial Engineering	1	Elsevier
European Research on Management and Business Economics	1	Elsevier
Sustainable Production and Consumption	1	Elsevier
Benchmarking: An International Journal.	2	Emerald
Business Process Management Journal	1	Emerald

(*continued on next page*)

Table A (*continued*)

International Journal of Computational Intelligence Systems	1	Atlantis Press
Competitiveness Review: An International Business Journal	1	Emerald
European Journal of Management and Business Economics	1	Emerald
Industrial Management & Data Systems	1	Emerald
Information Technology & People	1	Emerald
Journal of Business Strategy	1	Emerald
Journal of Enterprise Information Management	1	Emerald
Journal of Enterprising Communities: People and Places in the Global Economy	1	Emerald
Journal of Science and Technology Policy Management	1	Emerald
Journal of Small Business and enterprise development	1	Emerald
Kybernetes	1	Emerald
Management Research Review	1	Emerald
Supply Chain Management	1	Emerald
VINE Journal of Information and Knowledge Management Systems	1	Emerald
International Journal of Supply Chain Management,	2	ExcelingTech Pub, UK
Journal of Information Systems Engineering and Management	1	IADITI
International Journal of Cloud Applications and Computing	1	IGI Global
International Journal of Environment and Health	1	Inderscience
International Journal of Intelligent Enterprise,	1	Inderscience
Applied Sciences	1	MDPI
Social Sciences	1	MDPI
Sustainability	7	MDPI
Journal of Hospitality & Tourism Research	1	Sage journals
Energy efficiency	1	Springer
Information Technology and Management	1	Springer
Journal of Business Ethics	3	Springer
Management Review Quarterly	2	Springer
Flexibility, Innovation, and Sustainable Business	1	Springer
Operations Management Research	1	Springer
Information Technology for Development	2	Taylor & Francis
International Journal of Computer Integrated Manufacturing	1	Taylor & Francis
Journal of Hospitality Marketing & Management	1	Taylor & Francis
Journal of Small Business Management	1	Taylor & Francis
Entrepreneurship & Regional Development	1	Taylor & Francis
International Journal of Computer Integrated Manufacturing	1	Taylor & Francis
International Journal of Quality & Reliability Management	1	Taylor & Francis
International Journal of Computing and Digital Systems	1	University of Bahrain
Journal of Information Technology Management	1	University of Tehran
Journal of Information and Communication Technology,	1	UUM PRESS
Business and Society	1	Wiley
Business Strategy and Environment	1	Wiley
Journal of Management Studies	1	Wiley
Journal of Small Business Management	1	Wiley
Strategic management journal	1	Wiley
Sustainable Development	1	Wiley
Business Strategy and the Environment	4	Wiley
Corporate Social Responsibility and Environmental Management	1	Wiley

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