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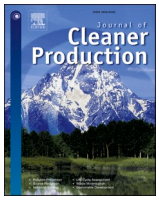

Strategic orientations, organizational ambidexterity, and sustainable competitive advantage: Mediating role of industry 4.0 readiness in emerging markets

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ABSTRACT

We explore the relationship between strategic orientations (market orientation and entrepreneurial orientation), organizational ambidexterity, and sustained competitive advantage under the mediation of Industry 4.0 readiness. Based on data from a sample of 144 SMEs belonging to different economic sectors, we employed partial least squares–structural equation modeling to test our hypotheses. Empirical research suggests that market orientation and entrepreneurial orientation have a favorable relationship with Industry 4.0 readiness and sustainable competitive advantage. Moreover, our findings reveal that entrepreneurial orientation has a greater effect on SCA than market orientation in emerging markets. Furthermore, Industry 4.0 readiness acts as a full intermediary between strategic orientations and sustainable competitive advantage. This study contributes to the existing literature by exploring the relationship between strategic orientation and sustainable competitive advantage through Industry 4.0 as the mediator. SMEs' managers can use these findings to rethink their technology adoption strategies and exploitative and explorative approaches.

1. Introduction

In today's turbulent and competitive market, the success of any organization significantly depends on the ability to develop a sustainable competitive advantage (SCA) and superior firm performance. Consequently, it has received much more attention than ever before among post-modern organization theorists, corporate strategists, and policy-makers (Bag et al., 2021a; Pratono et al., 2019). Firms compete with innovative activities that generate SCA and sustainable growth (Lu et al., 2021; Maury, 2018). From the strategic management perspective, key firm resources are deployed to create SCA (Hooley et al., 2001). Some other factors that enhance SCA are strategic orientations (Kiyabo and Isaga, 2020; Pratono et al., 2019), intellectual capital and innovation (Chahal and Bakshi, 2015), innovation culture (Wolf et al., 2012), knowledge management (Arsawan et al., 2020; Mohiuddin et al., 2022; Al-Azad et al., 2022), organizational ambidexterity (Clauss et al., 2020), strategic flexibility (Hossain et al., 2021), managerial ability (Mishra, 2019), sustainable/ethical consumption behaviors (Geng and Maimaituerxun, 2022), carbon neutrality (Geng et al., 2022), and of course, entrepreneurship (Weerawardena and O'Cass, 2004).

According to the resource-based approach (RBV), firms generate SCA using both tangible and intangible resources (Barney, 1997). The question of whether tangible or intangible resources are more beneficial to a company's success remains unanswered (Lu et al., 2021). Guided by the RBV, we adopted strategic orientations (SO) as intangible resources in the form of a process to determine the firms' competitive advantage. More recently, the entrepreneurship literature has drawn on RBV to investigate the role of SO in achieving SCA and argued that entrepreneurial orientation (EO) is among the most valuable resource that leads to the SCA (Kiyabo and Isaga, 2020; Pratono et al., 2019). Similarly,

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Pratono et al. (2019) explored market orientation (MO) as another valued resource for the improvement of SCA. The recent literature has also stated that Industry 4.0 can be a game changing force for the SCA in the global arena (Bal and Erkan, 2019; Longo et al., 2017). However, there remains gaps in analyzing the determinants of SCA from RBV perspective by focusing on fresh empirical evidence related to SO and ambidextrous (exploitative and explorative) innovation capabilities. Our study thus aims at contributing to the theoretical gap on organizational ambidexterity's (OA) impact on competitive advantage that remains largely unaddressed (Clauss et al., 2020).

Despite the fact that research provides some preliminary insight into how I4.0 affects advanced manufacturing capabilities and SCA (Belhadi et al., 2021; Tortorella et al., 2020), there is scant literature on how I4.0 technologies can be best used in achieving SCA through strategic planning and vision. To date, the majority of studies have been undertaken in the context of developed countries (e.g., Hassen and Singh, 2020; Kiyabo and Isaga, 2020), despite the obvious importance to developing country contexts where firms' strategy and technology adoption perceptions are mixed (Kiyabo and Isaga, 2020). Therefore, our study focuses on the developing country context to have a more comprehensive understanding of the relationship between SO and SCA. As learning-based operational ambidexterity is a better choice for SMEs (Sahi et al., 2020), firms in emerging countries need to engage both in exploitation and exploration simultaneously to ensure their survival and growth.

We contribute to the literature in several ways. First, our findings add to a better understanding of the role of EO and MO in enhancing SCA in the I4.0 era. Second, to the best of our knowledge, this is the rare study to examine the mediating role of I4.0 readiness on the relationship between SO and SCA. Specifically, we reveal that I4.0 is a primary source of SCA. Third, this empirical view could open the "black box" by taking us into fields where comparative advantage needs to be sustained—inside the firm. Overall, the framework may help firms to revise their strategies and ambidextrous capability to better comprehend the benefits and challenges related to the I4.0 technologies.

The rest of the paper is structured as follows. Section 2 presents a literature review and precedes the development of the hypothesis development presented in section 3. Section 4 describes the methodology used. Section 5 presents and analyses our main findings. Finally, we present the discussion and conclusion in section 6.

2. Literature review

2.1. Sustainable competitive advantage

SCA is essential for any kind of firm because it determines success and long-term survival (Arsawan et al., 2020). SCA can be defined as "a capability (or set of capabilities) or resource (or set of resources) that gives a firm an advantage over its competitors which ceteris paribus leads to higher relative performance" (Wiggins and Ruefli, 2002, p. 84). Research demonstrates that the attainment of SCA can be enhanced by deploying the resources a firm possesses, which cannot be easily imitated or substituted by its rivals (Barney, 1997; Baker and Sinkula, 2009). Similarly, the RBV posits resources as fundamental for SCA and the resources should have "*valuable, rare, inimitability and non--substitutability*" attributes to create SCA of a newly developed capability. Firms should also have the ability to effectively and efficiently exploit the full potential of the resources for developing and maintaining the potential SCA. However, SCA does not mean that it will last forever, rather indicates that it will not be competed or copied easily by the competitors (Busenitz et al., 1997). Any unanticipated changes in the market may challenge this competitive advantage. The rapid changes in technology, competitive market forces, and customers' expectations make it difficult for firms to develop and sustain long-term competitive advantage. Therefore, firms with specific strategic focus, innovative technology, and exploration and exploitation innovation capabilities are in a better position to cope with the rapidly changing environment and maintain SCA (Bag et al., 2021b, Sahi et al., 2020).

2.2. Strategic orientation

SO is a critical pillar of strategic management (Covin and Wales, 2019). SO refers to the firm's philosophy of how to conduct business through a deeply rooted set of values and beliefs that guides the firm's attempt to achieve superior performance (Gatignon and Xuereb, 1997). For instance, the managerial ability is influenced by the firm's choice of SO (Mishra, 2022). From the RBV perspective, the "*market orientation*" of the firm complements "*entrepreneurial orientation*" and both combined as SO most likely positively affect SCA and firm performance (Baker and Sinkula, 2009; Pratono et al., 2019; Sahi et al., 2020; Wales et al., 2021; Zhou et al., 2005). Previous research also supports the assumption that such orientations have even stronger synergistic effects (Sahi et al., 2020).

2.2.1. Entrepreneurial orientation

EO is considered as the entrepreneurial strategy-making process that managers use to rectify their organizational purposes, sustain their vision, and create competitive advantage (Rauch et al., 2009). It involves not only the intentions but also the actions of key decision-makers regarding the entrepreneurial process aimed at new entry including the method, practices, and decision-making styles. A previous study viewed it as the "driving force behind the organizational pursuit of entrepreneurial activities" (Covin and Wales, 2012). The firms that act independently, encourage innovation, promote corporate risk-taking, show aggressive movements toward competitors, and pursue market opportunities proactively are more likely to have a higher level of EO compared with those lacking some of these (Anderson et al., 2015; Zhang and Bruning, 2011). Thus, EO describes how organizations coordinate, configure, and use their capabilities and resources to create new value that generates competitive advantage. From RBV's perspective, EO is one of the most important variables affecting SCA and sustainable growth because of its rooted foundation and synergistic alignment with organizational elements that create new value for the firm (Jayashree et al., 2021; Kiyabo and Isaga, 2020; Lu et al., 2021; Maury, 2018; Pratono et al., 2019).

2.2.2. Market orientation

MO refers to the organization-wide efforts that reflect the degree to which an organization focuses on current and future customer needs, demands, and satisfaction as well as the ability to react to market changes depending on the situations of customers and competitors (Narver and Slater, 1990). Jaworski and Kohli (1993, p.6) defined MO as "the organization-wide generation of market intelligence, dissemination of this intelligence across departments and organization-wide responsiveness to it." Thus, the central principle of MO is that firms should focus on understanding the market and must continuously contribute skills and knowledge to deliver higher value to the customer. By innovating and improving new products and services, a firm can satisfy its existing and potential customer needs and can respond to any changes brought by the major competitors in the market (Song and Jing, 2017). Therefore, market-oriented firms must have an organizational culture that facilitates the exploration and exploitation practices to comply with customer and competitor responses in the target market (Zhang and Bruning, 2011).

2.3. Industry 4.0

The fourth industrial revolution or Industry 4.0 refers to the transformation of production processes through increased connectivity and integration of technologies. such as cyber-physical systems (CPS), the Internet of Things (IoT), and cloud computing (Tortorella et al., 2020). This integration facilitates efficient manufacturing processes by automating business processes and reducing human efforts while creating

higher values for customers as well as businesses (Belhadi et al., 2021). I4.0 technologies also enable companies to monitor and control their equipment, products, and services in such a way that decision-makers are well informed about the real-time situation and can take improved decisions (Bag et al., 2021a). However, the key influence of I.40 is its ability to identify any changes in the chain and inform responsible bodies providing accurate forecasting, a greater degree of visibility, thoughtful resource efficiency, and asset utilization (Stentoft et al., 2020a,b).

The concept of "technology readiness" is defined as the propensity to embrace and use new technologies for accomplishing goals (Parasuraman and Colby, 2015). According to Stentoft, Wickstrøm, Haug, and Philipsen (2020b), I4.0 readiness refers to the state of being completely prepared to use I4.0-related technologies. The concept of I4.0 technology readiness is based on two main factors: the availability of the I4.0 technologies and the ability of individuals or firms to use these for improved performance (Jafari-Sadeghi et al., 2021).

Because firms are increasingly depending on modern technologies, their ability to combine necessary IT resources and skills is required for achieving competitive advantage and firm performance (Kamble et al., 2019). The firms must have also a clear strategic vision of how to deploy the I4.0 technologies for creating an environment in which all entities are connected to become more proficient, responsive, and robust in their decision-making processes (Hoyer et al., 2020).

2.4. Organizational ambidexterity

OA refers to the firms' capability of exploiting existing market competencies while simultaneously exploring new opportunities and radical innovations (Raisch et al., 2009). Patel et al. (2012) defined it similarly as the simultaneous pursuit of exploration and exploitation of operational business units, thus assisting in the management of fast environmental change (Jurksiene and Pundziene, 2016). March (1991) suggested that exploitation involves a different set of activities such as choice, refinement, production, selection, execution efficiency, and implementation. On the other hand, exploration covers the generation of knowledge as well as the examination of future opportunities. There is a trade-off between firm efforts to exploit existing competencies and exploring new ones (Tortorella et al., 2021). Although both of the capabilities are essential, firms make explicit and implicit choices between these two because of strategic directions and scarce resources (March, 1991). These choices are found inherited within the organizational customs, norms, routines, assumptions, and decisions. Many researchers have argued that firms need to focus on both exploitative and explorative innovations simultaneously to achieve and sustain competitive advantage in current and future markets (Tortorella et al., 2021). Exploitative innovations are incremental as firms change their products, services, and business processes over time based on the current requirements of customers (Ghantous and Alnawas, 2020).

Therefore, exploitative innovations comparatively focus on increasing the efficiency of existing services and a low degree of novelty that require fewer resources, business risk, and investment (Gibson and Birkinshaw, 2004). Conversely, exploratory innovations are revolutionary (referred to as adaptive) in nature, requiring extensive market research and sensing capability of new opportunities for producing new ideas, services, and business processes. They aim for significant transformation of existing business processes and offerings through the development of innovations to service emerging customers' demands (Alpkan et al., 2012). It is obvious from the above explanations that OA incorporates two different fundamental attributes, alignment, and adaptability, where both aim to bring some changes within the business process to meet current and future customer needs, demands, and preferences (Belhadi et al., 2021). To surpass competitors, both types of innovations must be embraced by businesses since they are complementary rather than mutually exclusive. (Ghantous and Alnawas, 2020).

3. Hypothesis development

3.1. Strategic orientations and sustained competitive advantage

Evidence shows that lack of SO makes firms often avoid long-term planning, which eventually results in unsustainable competitive advantage (Wales et al., 2021). Here, SO guides firms to create proper behaviors for market entry and practices, as well as how to meet existing customers' needs and appeal to future customers in the market (Zhou et al., 2005). Thus, SO becomes an integral part of any organization and is considered a powerful predictor of business efficiency (Sahi et al., 2020). The RBV similarly views SO as an intangible resource that gives a company a competitive advantage and, as a result, improves its performance (Barney, 1997). Very often, intangible resources differentiate firms more in terms of competitive advantage compared with physical resources, as intangible resources are not vulnerable to imitation (Kiyabo and Isaga, 2020). Previous research has equally argued that superior performance depends on the quality of different SOs like EO and MO (Kiyabo and Isaga, 2020; Khedhaouria et al., 2020).

The dimensions of EO are innovative, risk-taking, and proactive action, illustrate the firms' behavior that allows them to gain valuable knowledge and recognize potential business opportunities (Covin and Miller, 2014). Innovativeness allows firms to discover ways to operate more efficiently as well as compete in the market by introducing new products and services. Risk-taking encourages businesses to take risks by devoting large amounts of resources to opportunities (venturing into new markets), and proactive actions permit firms to seize valuable resources sensibly from the environments that can be used in innovative projects to explore new opportunities. Zhang and Bruning (2011) state that a firm with these orientations encourages taking risks, and thus pioneering innovative products and being productive, which ultimately facilitate competitive advantage. Firms with a high degree of EO can quickly detect changes in the external environment and adjust their strategy accordingly to capture new opportunities out of the current strategy. Consequently, EO is considered a possible remedy to the problem that entrepreneurial firms are facing while conducting business in unpredictable markets (Anderson et al., 2015).

MO facilitates the building of marketing capabilities that permits firms to realize customer needs and the prospects of new and existing markets. This also enables firms to deliver superior customer value and react to competitor responses in the market (Khedhaouria et al., 2020). A higher-level understanding of customer needs, competitive actions, and market trends places market-oriented firms in a better position to distinguish and create capabilities that are fundamental for long-term competitive advantage and firm performance (Narver and Slater, 1990). This implies that creating and strengthening strategic focus on MO over time make firms' marketing capabilities more distinctive, which results in SCA. The literature has found that MO as market intelligence is a source of SCA (Ge and Ding, 2005; Pratono et al., 2019), as a significant antecedent of firm performance (Hassen and Singh, 2020; Morgan et al., 2009), firm profitability (Baker and Sinkula, 2009), new product performance (Langerak et al., 2004) and radical innovation launch success (Cake et al., 2020). Thus, we propose:

H1. Strategic orientation has a positive effect on sustainable competitive advantage

H1a. Entrepreneurial orientation has a significant and positive effect on sustained competitive advantage.

H1b. Market orientation has a significant and positive effect on sustained competitive advantage.

3.2. Strategic orientations and industry 4.0 readiness

Since SO specifies how a firm conducts business based on a set of core values and beliefs, modern firms always focus on new technology to

become innovative and deliver superior value to customers (Pan et al., 2021). Firms' uses of innovative technology can easily bring fundamental changes to the business process that facilitates technological capabilities and competitiveness. However, the readiness for technology adoption mostly depends on firms' strategic plans and orientations (Zhou et al., 2014). Strategic vision along with strong management commitment toward new technology enables firms to create innovative product and services that eventually results in competitive advantage. In other words, firms without deliberate strategy are not ready yet to embrace and exploit new technology creating market-based breakthrough innovation (Hoyer et al., 2020).

EO highlights the spirit of creating innovative products and services out of ongoing practices, which is often accomplished through the adaptation and utilization of modern technology (Industry 4.0) (ZZhou et al., 2014).

EO also inspires entrepreneurial firms to take unknown risks in the interest of obtaining high returns, that is, the application of technological resources in the unexplored market. This proactive behavior of firms toward new opportunities promotes capabilities that enable them to develop superior products and services over competitors (Pan et al., 2021). Zhou et al. (2014) noted that substantial managerial commitments and strategic foresight are essential for ensuring firms' promises toward new technology. Mills and Pawson (2012) identified decision--makers' attitudes as a key component in technology readiness and pointed out that entrepreneurial alertness and strategic foresight can predict the opportunities and business value in information technology. A lack of devoted strategies and positive perceptions of technological value make firms struggle to identify the strategic field of action toward I4.0 adoption (Tortorella et al., 2020). Thus, the dimensions of EO innovation, risk-taking, and proactiveness behaviors of firms determine the propensity to embrace and use I4.0 technologies.

MO emphasizes the essence of identifying customers' needs and satisfying them by producing the product and services utilizing advanced technologies. By prioritizing customers, market-oriented firms use advanced technologies to articulate the understanding of customers' needs, choices, and feedback, and provide superior customer value; therefore, it is logical to expect that MO has a direct influence on the use of technologies of I4.0 (Herrero et al., 2018). MO also focuses on the use of technology in understanding competitors' strengths and weaknesses and preparing responses to their actions (Song and Jing, 2017). Firms use advanced I4.0 technology to scan surrounding market environments and acquire competitors' information, and then allocate necessary knowledge and resources to compete with them. A strong management commitment toward technology use is highly imperative to develop tech-based innovation and fulfill customers' hidden needs (Zhou et al., 2014). The study similarly indicated MO as a key antecedent of firms' innovative behavior as it suggests doing something new using available new technology in response to market conditions (Herrero et al., 2018). Nguyen and Barrett (2006) also pointed out that the degree of MO has a significant effect on the use of new technology. Thus, we propose:

H2. Strategic orientation has a positive effect on Industry 4.0 readiness.

H2a. Entrepreneurial orientation promotes higher Industry 4.0 readiness.

H2b. Market orientation promotes higher Industry 4.0 readiness.

3.3. Strategic orientation and organizational ambidexterity

A set of entrepreneurial and market-oriented strategies instigate firms' specific behaviors that enable them to exploit current business capabilities and seek new opportunities and radical innovation simultaneously (Clauss et al., 2020; Sahi et al., 2020). In an open marketplace, SO provide firms guidance and recommend strategic actions while facing high levels of uncertainty and ambiguity in the innovation process. A lack of SO may cause firms to lose sight of their strategic goals and engage in unfavorable behavior, which could ultimately delay or obstruct identifying new market opportunities (Posch and Garaus, 2020).

As a strategic approach, EO drives firms' proactive, innovative, and risk-taking behavior toward improving existing or creating new ideas, products, services, and market opportunities, which reflect firms' focus on exploitation and exploration strategies (Tuan, 2016). EO captures decision-making styles, processes, and practices that specify how entrepreneurial firms adjust strategies to improve products and services for satisfying customer preferences (Sahi et al., 2020). To do so, product innovation knowledge, skills, and procedures are refined and extended by entrepreneurial enterprises using resources (Zhou et al., 2014). EO also inspires entrepreneurial firms to pursue new market opportunities outside their current sphere of operation; therefore, they need to be more proactive and anticipate in order to avoid any unwanted results serving current markets (Ghantous and Alnawas, 2020). Entrepreneurial firms are thus motivated by addressing latent and emerging customers' needs, new ideas and business practices, and new-market investigation. Such qualities of EO support entrepreneurial firms' engagement with exploitative and exploratory innovation through the development of improved or new products and services (Sahi et al., 2020). Researchers have claimed that a higher degree of EO leads to more innovation and performance through intensifying information utilization efforts (Posch and Garaus, 2020).

MO reflects firms' responsive and market-driven approach that emphasizes the understanding of customer needs and monitoring competitors' actions, and this results in firms' attributes of enhancing existing capabilities and exploring new opportunities to respond to customer needs (Joshi et al., 2016). In this regard, market-oriented firms emphasize knowledge acquisition to meet existing needs through well-established competencies and products with a view of exploitation (Sahi et al., 2020). Firms with this orientation often emphasize exploitative innovations that require adaptations to the changes in market trends through adapting learning capability. MO also forces firms to keep an eye on the outside world, examine the competitive landscape in their industry, and compare their offerings to those of key competitors (Ghantous and Alnawas, 2020). Such activities increase firms' awareness of new changes and market opportunities that causes firms to switch from an existing product, service, and market to completely new ones, resulting in a customer-centric culture (Alpkan et al., 2012). This market-oriented information also forces firms to make constant refinements and improvements to their services and allows them to offer superior products over major competitors (Gotteland et al., 2020). MO admits firms to sensing new market opportunities through carefully analyzing customers' various kinds of needs, demands, preferences, and feedback (Joshi et al., 2016). Thus, we propose:

H3. Strategic orientation has a positive effect on organizational ambidexterity.

H3a. Entrepreneurial orientation promotes organizational ambidexterity.

H3b. Market orientation promotes organizational ambidexterity.

3.4. Industry 4.0 readiness and organizational ambidexterity

I4.0 readiness prepares firms to embrace and use innovative technology that retains firms' competitiveness in the current and future markets. Integration of I4.0 technologies accelerates digital transformation in all aspects of businesses including business models, processes, and operational routines (Tortorella et al., 2021). These make businesses more flexible and provide real-time data to key decision-makers that help them to make improved strategic decisions. Tortorella et al. (2020) stated that I4.0 also enables firms' inter-connectivity in the value-chain and collaboration among

stakeholders that facilitate information exchange and business process monitoring. When decision-makers are well-informed about the updated business conditions, they are in a better place to accurately reconfigure their resources to enhance their organizational exploitative and explorative capabilities (Belhadi et al., 2021). Moreover, Dezi et al. (2018) explained clearly that modern technologies are in sync with business intelligence tools that provide ambidextrous organizations greater flexibility, agility, and the capacity to integrate technical and business opportunities into innovative business processes design and successful optimization.

The managerial capabilities assist decision-makers to adapt and implement I4.0 technologies to achieve SCA in the values chain. More recently, Bag, Yadav, Dhamija, and Kataria (2021b) found that sustainable manufacturing is linked to critical resources for I4.0 adoption. They also found that the most required resources to achieve a competitive edge for the manufacturing firm when integrating I4.0 are: Big Data analytics, cloud computing, green design, collaborative relationships, and production systems. In the same vein, recent evidence suggests that I4.0 can be a driving force of SCA in the global arena (Bal and Erkan, 2019; Longo et al., 2017). For instance, it is argued that I4.0 technological applications could contribute to the development of several organizational and structural aspects of organizational systems, such as achieving sustainable production and sustainable development goals (Bag, Gupta, & Kumar, 2021a; Bag et al., 2021b; Kamble et al., 2019), achieving sustainable supply chain performance (Sharma et al., 2021), enhancing advanced manufacturing capabilities (Bag et al., 2021a), enabling business model innovation (Tortorella et al., 2020), achieving higher operational performance levels (Tortorella et al., 2020), and achieving sustained competitive advantage (Wamba et al., 2017). Thus, we can propose:

H4. Industry 4.0 readiness has a significant and positive effect on organizational ambidexterity.

H5. Industry 4.0 readiness has a significant and positive effect on sustained competitive advantage.

3.5. Organizational ambidexterity and sustainable competitive advantage

Exploitative and explorative natures of OA grant firms SCA and firm performance (Raisch et al., 2009). Exploitative innovations often use existing domains of knowledge and experiences that align with the understanding of existing customers' needs and demands, and thus, emphasize organizational learning within traditional boundaries. Based on that learning, firms refine existing products and services that are well accepted and valued by customers (March, 1991). Compared with exploitation, exploration focuses on adaptability to change and an in-depth understanding of customer latent needs by using new knowledge, resources, and market research skills. Thus, exploratory innovation results in new technologies, products, and services that have greater customer value and market appeal (Tortorella et al., 2021). Balancing between two practices reduces costs and enables firms to better manage and use limited resources to achieve SCA (Jafari-Sadeghi et al., 2021; Sahi et al., 2020). Kristal et al. (2020) revealed that an ambidextrous supply chain strategy improved combinative competitiveness, which leads to higher profits and market share in the US manufacturing industry.

Gibson and Birkinshaw (2004) likewise argued that when an organization engages in both exploitation (geared toward alignment) and exploration (geared toward adaptability) innovations, these practices result in SCA and improved performance. They also claimed, alignment activities mostly focus on the improvement of short-term performance, whereas adaptability gear toward long-term performance. Thus, we can propose-

H6. Organizational Ambidexterity has a significant and positive effect on sustained competitive advantage.

3.6. Mediating effects of industry 4.0 readiness

Additionally, we also hypothesize a mediating role of I4.0 readiness, such that the EO and MO generate SCA through their I4.0 readiness. Thus, I4.0 serves as an important intermediate mechanism that connects EO and their MO to their SCA. I4.0 readiness is the independent variable that sheds light on why EO generates SCA. Previous research has emphasized that EO contributes to firm performance through innovation ambidexterity (Ghantous and Alnawas, 2020; Kollmann and Stöckmann, 2014; Zhang, Edgar, Geare and O'Kane, 2016). Accordingly, we hypothesize that

H7a. Industry 4.0 readiness mediates the relationship between Entrepreneurial Orientation and sustained competitive advantage.

H7b. Industry 4.0 readiness mediates the relationship between market orientation and sustained competitive advantage.

4. Research methodology

4.1. Sample and data collection

To investigate the relationship between SO and SCA under the mediation of I4.0 readiness, we employed a survey methodology to test the model (See Annex Fig. 1). The scales used to measure the constructs came from previously validated scales. For this purpose, a questionnaire was devised that included measures of I4.0 readiness, EO, MO, OA, and SCA (see 4.2). The instrument was written in English first, then translated into French. The French-language questionnaire was reviewed by one of the authors of this study and then submitted to a group of managers to ensure that each term used was understood and to verify the accuracy before its implementation. Data were collected using a questionnaire survey. The survey was conducted between January 2022 and March 2022. The questionnaire was given or sent via mail to the top management team, such as CEOs, those who were in charge of the decision-making at the firm, or the person in charge of overall technology business development. The minimum required sample size should be at least ten times the largest number of paths directed at one latent construct in the model (Hair et al., 2011). These sample size considerations are respected in our study because the sample size needed to be at least 80. The 10-times rule method is the most widely used in partial least squares–structural equation modeling (PLS–SEM) (Kock and Hadaya, 2018) in the field of information systems as well as other fields. Finally, Reinartz et al. (2009) identified a minimum threshold of 100 samples for the PLS-SEM. The descriptive statistics of our sample are summarized in Table 1.

4.2. Measurement of the variables

The item indicators were measured by a five-point Likert-type scale. The **OA** is measured as the extent to which an operational unit simultaneously pursues exploration and exploitation (Patel et al., 2012). Therefore, Sahi et al. (2020) proposed that **learning-based operational ambidexterity** was a better choice for SMEs in a developing economy because such firms can, at best, undertake incremental innovations. Consequently, firms with contextual ambidexterity engage in both exploitation (alignment) and exploration (adaptability) (Gibson and Birkinshaw, 2004). Based on De Clercq, Thongpapanl, and Dimov (2013), Gibson and Birkinshaw (2004), and Jurksiene and Pundziene (2016), the OA indicators are grouped into two sub-categories: alignment and adaptability. **I4.0 Readiness** is developed based on Stentoft et al., (2020a). I4.0 readiness and I4.0 adoption are two sides of the same medal (Hoyer et al., 2020). **EO** is a formative construct that we assessed using three reflective subdimensions associated with innovation (e.g., the introduction of new products), risk-taking (e.g., tolerance for high-risk projects), and proactive actions (e.g., initiating actions that competitors respond to) (Anderson et al., 2015). **MO** measures were

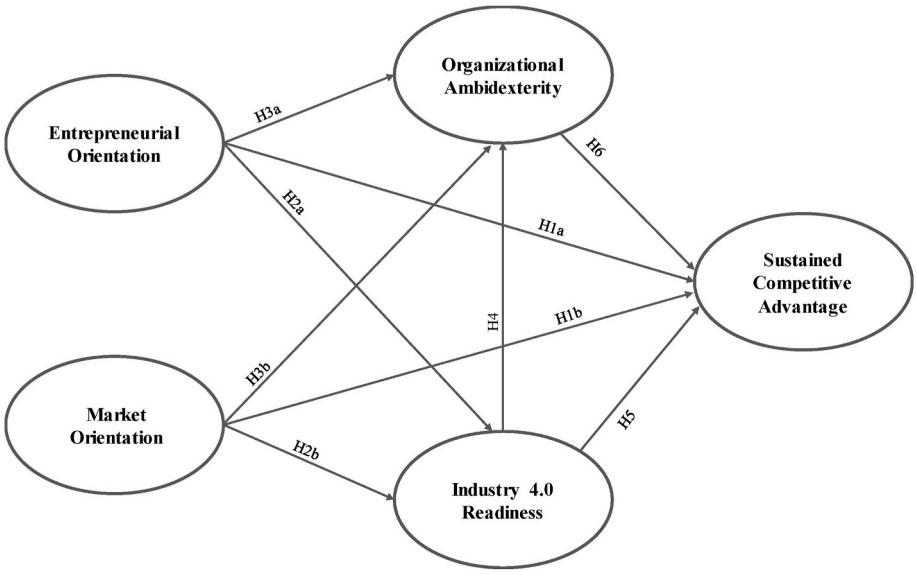

Fig. 1. Theoretical model.
Source: Source: Authors' construct, 2022

Table 1
Sample characteristics.

Characteristics	Numbers	Percentage
Position of respondents		
Managing director	65	45%
Leading manager	50	35%
Other staff with managing responsibilities	29	20%
Number of employees		
[0–50[	63	44%
≥50	81	56%
Sectors		
Industry sector	68	47%
Other sectors	76	53%

assessed on customer orientation and competitor orientation (Narver and Slater, 1990). To these two dimensions, we added items regarding technological orientation based on Gatignon and Xuereb (1997). Items for the measurement of **SCA** were adapted from Clauss et al. (2020), Durand (2003), Hooley et al. (2001), and Venkatraman and Ramanujam (1986). Respondents were asked to indicate in a Likert scale from 1 (no advantage) to 5 (very high advantage) the relative strength in comparison to their competitors, regarding the following indicators: innovative offerings, quality, technological capacity, reputation, service, financial successes, and market share. We also controlled for several variables that can influence a firm's competitive advantage: firm size, industry, and competitive intensity, measured on a five-point scale using six items adopted from Jaworski and Kohli (1993).

4.3. Data analysis

Data were analyzed using the SPSS® (v.21) software. SmartPLS 3.0 was used for data analysis because it allowed us to test all hypotheses at the same time and measure mediating effects. The PLS–SEM is the preferable approach to focus on prediction and theory development (Reinartz et al., 2009), and it is appropriate for estimating (complex) path models (Sarstedt et al., 2017). In light of its current more widespread application, the PLS–SEM path modeling is assumed as a flexible approach in theory and practice (Hair et al., 2019).

5. Results

5.1. Measurement model

5.1.1. Factor analysis and reliability

Two exploratory factor analyses that used the principal component extraction method and varimax rotation were conducted on the sample of 144 firms as follows: 19 items from the group of dependent variables related to OA, I4.0 readiness, and SCA and 22 items of the group of independent variables related to the EO and MO. Before running the analysis with the SPSS (21), the data was screened by looking at descriptive statistics for each item, inter-item correlations, and possible violations of univariate and multivariate assumptions.

The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was greater than 0.841 for the dependent variables and 0.905 for the independent variables (the value must be 0.60 or greater to be significant), indicating that the current data were suitable for principal components analysis (PCA). To this end, we have eliminated items that showed significant cross-loadings. Considering these results, no items showed significant cross-loadings in the final list (see Table 4). Similarly, Bartlett's sphericity test was significant (p.001), indicating that there was enough correlation between the variables to proceed with the analysis (see Table 5).

The factor analysis procedure was used twice in this study: once for the group of dependent variables, which included three variables, and once for the group of independent variables, which included two constructs. The three factors accounted for more than 58% variance of each dependent variable and the Cronbach's coefficients ranged from 0.8789 to 0.9135 among the factors, indicating good subscale reliability. Furthermore, for the 15-item group of independent variables, a two-factor solution was used. All four factors were considered acceptable and were retained for further analysis. Cronbach's coefficients for the two factors ranged from 0.930 to 0.938, indicating good subscale

Table 2
Summary of reliability coefficients for dependent variables.

	Given names	Number of items	Alpha
Factor 1	I4.0 R	6	0.9135
Factor 2	OA	6	0.9103
Factor 3	SCA	7	0.8789

Source: authors' own compilation

Table 3
Summary of reliability coefficients for independent variables.

	Given names	Number of items	Alpha
Factor 1	EO	9	0.9269
Factor 2	MO	13	0.9481

Source: authors' own compilation

Table 4
Psychometric analyses.

Constructs	Items	Loadings	KMO	T-value	% of variance
EO CogAb (0.9269)	INN1	0.8267	0.905	0.000	63.196
AVE (0.6318)	INN2	0.8351		0.000	
	INN3	0.7683		0.000	
	PRO1	0.8441		0.000	
	PRO2	0.7958		0.000	
	PRO3	0.782		0.000	
	RISK1	0.7648		0.000	
	RISK2	0.7614		0.000	
	RISK3	0.77		0.000	
I4.0 R	I4.0R2	0.7979	0.841	0.000	62.931
CogAb (0.9135)	I4.0R3	0.8478		0.000	
AVE (0.6991)	I4.0R4	0.904		0.000	
	I4.0R5	0.8534		0.000	
	I4.0R6	0.7989		0.000	
	I4.0R7	0.8095		0.000	
MO	CM2	0.6432	0.923	0.000	74.592
CogAb (0.9481)	CM3	0.8053		0.000	
AVE (0.6187)	CM4	0.7519		0.000	
	CS1	0.7362		0.000	
	CS2.	0.8289		0.000	
	CS3	0.8641		0.000	
	CS4	0.8085		0.000	
	CS5	0.7436		0.000	
	CS6	0.8324		0.000	
	TO1	0.8116		0.000	
	TO2	0.7614		0.000	
	TO3	0.7874		0.000	
	TO4	0.8257		0.000	
OA	AD1	0.8124	0.890	0.000	69.232
CogAb (0.9103)	AD2	0.8501		0.000	
AVE (0.6922)	AD3	0.8424		0.000	
	AL1	0.8789		0.000	
	AL2	0.8682		0.000	
	AL3	0.7312		0.000	
SCA	CA1	0.7783	0.863	0.000	58.266
CogAb (0.8789)	CA2	0.832		0.000	
AVE (0.5799)	CA3	0.8226		0.000	
	CA4	0.857		0.000	
	CA5	0.7274		0.000	
	CA6	0.6211		0.000	
	CA7	0.6599		0.000	

EO = Entrepreneurial orientation, MO = Market Orientation, I4.0 R = Industry 4.0 Readiness, OA= Organizational ambidexterity, SCA= Sustained competitive advantage.
Source: authors' own compilation

Table 5
Discriminant validity.

	EO	I4.0 R	MO	OA	SCA
EO	0,7949				
I4.0 R	0.6482	**0,8361**			
MO	0.7799	0.664	**0,7866**		
OA	0.6586	0.7725	0.7047	**0,8320**	
SCA	0.5926	0.5792	0.5941	0.5263	**0,7615**

Note. EO = Entrepreneurial orientation, MO = Market Orientation, I4.0 R = Industry 4.0 Readiness, OA= Organizational ambidexterity, SCA= Sustained competitive advantage. Diagonal bold values show the square root of AVE while other values are the correlation between the respective constructs.

reliability.

5.1.2. Convergent validity

Table 2 summarizes the psychometric analyses of the scales and confirms the convergent validity of the constructs for our sample. Cronbach's alpha (α) is a measure of each construct's internal reliability; all of the values in our model are higher than the recommended. 7 threshold, indicating that each construct is consistent with its corresponding measures, as suggested by Nunnally and Bernstein (1994). The average variance extracted (AVE), which should be equal to or higher than 0.5, explains the variance captured by items in each construct (Fornell and Larcker, 1981), as is the case in our model. Overall, the constructs that we suggest demonstrated good measurement properties.

5.1.3. Discriminant validity

The results attained comparing the square root of the AVE to the constructs' correlations show that the correlation within each construct is higher than its correlation with the other constructs, in support of discriminant validity (Henseler et al., 2009) (See Table 3).

However, exogenous variables in the model explained standard amounts of variance of I4.0 Readiness (R-Square = 0.4843), OA (R-Square = 0.6665), and absorptive SCA (R-Square = 0.4346). Table 6 shows the outcomes of blindfolding. The communality and redundancy indexes in this model were high in all blocks. Furthermore, the 0.5835 value of the overall goodness-of-fit index (GoF) was well accepted, which means a large fit of the model. In sum, the results showed that the model had acceptable predictive relevance, indicating that our model was robust and our results were reliable (Tenenhaus et al., 2005).

5.2. Structural model

The path coefficients resulting from the hypotheses tests (Annex Fig. 2 and Table 7) showed that high EO increases I4.0 readiness (coefficient = 0.3325, T -Statistics = 3.1498), but it did not lead to a significant effect on the OA (coefficient = 0.1053, T -Statistics = 0.9425).

EO had positive effects with very good effect size and predictive relevance on the SCA (coefficient = 0.2392, T -Statistics = 1.8915), but OA had no significant effect (coefficient = coefficient = −0.0063, T -Statistics = 0.0439). However, the MO effect on SCA was weakly positive (coefficient = 0.2273, T -Statistics = 1.4968). As predicted, I4.0 readiness had a positive and significant effect on OA with very good effect size and predictive relevance (coefficient = 0.5203, T -Statistics = 6.0799). Further, I4.0 readiness and OA were related significantly and

Table 6
R-square, R-square adjusted, communality, and redundancy.

	R square	[a]Communality	[b]Redundancy (Q^2)
Entrepreneurial Orientation	–	0,6318	–
Industry 4.0 Readiness	0,4843	0,6991	0.2224
Market Orientation	–	0,6187	–
Organizational Ambidexterity	0,6665	0,6922	0.0883
Sustained Competitive Advantage	0,4346	0,5799	0.1281
Average	52,85%	64,43%	–
GoF[c]	58,35%		

Note.
[a] The communality index measures the quality of the measurement model for each block (Tenenhaus et al., 2005).
[b] Redundancy index measures the quality of the structural model for each endogenous block, taking into account the measurement model (Tenenhaus et al., 2005).
[c] Following Tenenhaus et al. (2005), the GoF index is calculated using following equation $\text{Goodness} - \text{of} - \text{Fit} = \sqrt{Average\ AVE \times R^2}$.
Source: authors' own compilation

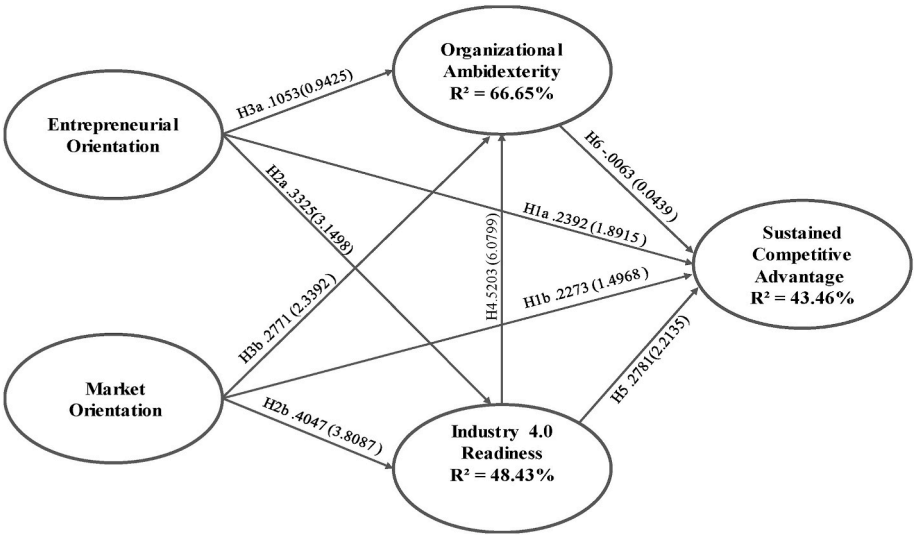

Fig. 2. PLS–SEM results of the Structural Model.
Source: Generated by the authors

Table 7
Structural path analysis results.

No.	Description of main paths	Coefficient (β)	T-statistics	p-Value	Decision
H1a	Entrepreneurial orientation → Sustained competitive advantage	.2392	1.8915	.06058*	Accepted
H1b	Market Orientation → Sustained competitive advantage	.2273	1.4968	.136649	Partially accepted
H2a	Entrepreneurial orientation → Industry 4.0 Readiness	.3325	3.1498	.00199**	Accepted
H2b	Market Orientation → Industry 4.0 Readiness	.4047	3.8087	.000207**	Accepted
H3a	Entrepreneurial orientation → Organizational ambidexterity	.1053	0.9425	.347526	Not Accepted
H3b	Market Orientation → Organizational ambidexterity	.2771	2.3392	.020709**	Accepted
H4	Industry 4.0 Readiness → Organizational ambidexterity	.5203	6.0799	.0000**	Accepted
H5	Industry 4.0 Readiness → Sustained competitive advantage	.2781	2.2135	.028447**	Accepted
H6	Organizational ambidexterity → Sustained competitive advantage	−.0063	0.0439	.965045	Not Accepted

Notes: Critical values. *p < 0.10; **p < 0.05. **Source:** authors' own compilation.

positively to MO (coefficient = 0.4047, T -Statistics = 3.8087; coefficient = 0.0.2771, T -Statistics = 2.3392, respectively).

Next, we tested the mediation hypotheses using the path coefficients approach and through the Sobel test. The results are reported in Annex Table 8. The findings indicate that a full and significant positive mediation role of I4.0 readiness exist between EO and SCA.

Table 8
Indirect and total causal effects.

Variables	Causal effects		Sobel test	T-value (Two-tailed probability)	Decision
	Direct	Indirect			
EO	.290 (2.170)	0,092574	1.811	0.070	Accepted
MO	.263 (1742)	0,11259	1.94	0.055	Accepted

Note. EO = Entrepreneurial orientation, MO = Market Orientation. **Source:** authors' own compilation.

Further, a full and significant positive mediation role of I4.0 readiness exists between MO and SCA (β = . 11259, T-value = . 055) as well as between EO and SCA (β = . 092574, T-value = . 070). Therefore, Hypotheses H7a and H7b were supported.

Concerning the indirect effects, the MO had the strongest indirect effect on the SCA with β = . 11259 (T-value = 0.055), followed by the EO with β = . 092574 (T-value = 0.070). The total indirect effect of the independent variables through the intervening variables (I4.0 Readiness) on the SCA was 0.2051.

The coefficients of the driver construct for I4.0 readiness showed that MO (β = 0.4047) contributed the most to the enhancement of I4.0 readiness compared with EO (β = 0.3325). This indicates that MO was a more important factor that determined the I4.0 readiness than EO. The readiness factors of I4.0 are ranked in descending order by their mean values on each of the readiness items, as shown in Annex Table 9.

Based on the mean values of readiness factors of I4.0, the priority order of readiness factors was I40R6>I40R4 >I40R7 >I40R5 >I40R2 >I40R3. The right motivation of employees to work with technologies received the highest mean value of 3.76, followed by the support required from top management (mean value of 3.68) and the economic freedom to work with the new digital technologies with a mean value of 3.57.

6. Discussion and conclusion

6.1. Discussion

Despite the potential SCA from firms' strategic vision and innovative technology adoption, such approaches have received little scholarly

Table 9
Readiness factors of Industry 4.0

Rank	Items	Mean	SD	Factor loadings
1	**I40R6.** Our employees have the right motivation to judge and work with the new digital technologies.	3.76	1.19	0.7989
2	**I40R4.** We have necessary support from top management to judge and work with the new digital technologies.	3.68	1.22	0.904
5	**I40R7.** We have economic freedom to work with the new digital technologies.	3.57	1.22	0.8095
6	**I40R5.** Our employees have the right competencies to work with the new digital technologies.	3.54	1.26	0.8534
3	**I40R2.** We have the willingness to take risks to experiment with the new digital technologies.	3.52	1.20	0.7979
4	**I40R3.** We have the necessary knowledge about the new digital technologies to judge its importance for our company.	3.49	1.28	0.8478

Source: authors' own compilation

attention, especially from emerging country firms' perspectives. Addressing the issue, we focused on firms' strategic decisions toward the adoption of modern technology in creating SCA.

Pratono et al. (2019) examined the role of inter-organizational learning contribution in transforming the green EO and MO to the improvement of SCA and found that both orientations allow firms to achieve sustainable competitiveness by involving the organizational learning process. The findings demonstrated that, while market-oriented firms were in a better position to deploy their exploitative and exploratory capabilities, entrepreneurial firms did not show a significant effect on OA, which contradicts the literature (Alpkan et al., 2012; Ghantous and Alnawas, 2020). One of the explanation can be related to the type of high-tech firms in developing countries. They are very often subsidiaries of foreign firms and focus more on marketing area than the entrepreneurial approaches. Based on the data from the hotel industry, Ghantous and Alnawas (2020) investigated the differences and synergies of MO and EO on exploitative and explorative innovation practices and hotel performance, and reported that their combination had a significant positive effect of quasi-equal magnitude on both innovations, but EO's effect was significantly stronger than MO. One possible reason for our finding might be that the chosen firms mostly focused on the current market trends, and based on those identified needs, demands, and preferences of customers.

This study found I4.0 readiness as an important predecessor of exploitative and explorative innovation capabilities as well as SCA, and both arguments were validated by the results. These findings are in line with previous studies arguing that firms' ability to adapt to new technology and ambidextrous capabilities help them achieve SCA (Tortorella et al., 2021; Bag et al., 2021a). Contrary to our last hypothesis, OA did not show any significant effect on SCA; however, several previous studies have found evidence for the relationship between the two (Belhadi et al., 2021; Ghantous and Alnawas, 2020; Zhang et al., 2016). Drawing upon a hybrid methodology, Belhadi et al. (2021) examined data from 306 organizations in Europe, Asia, and Africa and found that OA is critical to achieving SCA by recognizing and reconciling divergences and tensions between exploration and exploitation. The possible explanation regarding the antithetic result might be the issue that firms require a significant number of resources and commitments for achieving ambidextrous capability successfully, which developing country firms may not be able to resolve.

Consistent with the extant literature, EO and MO affect SCA through I4.0 readiness (Kiyabo and Isaga, 2020; Pratono et al., 2019); however, OA did not find significance in the relationship between SO and SCA. We, therefore, confirm previous results suggesting that both SO and I4.0 readiness constructs are used by firms to achieve SCA and superior performance (Gruber-Muecke and Hofer, 2015; Pratono et al., 2019). Concerning the effects of SO, the direct effects of EO and MO are considerably superior to the indirect effects in terms of predicting SCA. Moreover, our findings reveal that competitive intensity matters in the relationships between SO with I4.0 Readiness, OA, and SCA.

This research advances our understanding of the relationship between SO and SCA. Thus, our findings support the previous studies by providing an argument that high MO increases the firm competitive advantage (Pratono et al., 2019). The motivation for this research stems from a desire to contribute to the existing body of knowledge on entrepreneurship literature based on the RBV.

6.2. Theoretical contributions

This study has several implications for both theory and practice. We contribute to the scientific literature on the I4.0 readiness–SO–SCA relationship in several ways. First, we add to the existing literature by investigating the role of I4.0 readiness as a moderator in the relationship between SO and SCA. Furthermore, we contribute to the literature on SO (e.g., Hoyer et al., 2020) by demonstrating that SO is a beneficial factor that positively influences the implementation of I4.0. The findings, on the other hand, suggest that SO failed to predict SCA via OA. The results of the study thus extend the frontiers of RBV within the context of entrepreneurship and strategic management in supporting that the valuable resources coupled with ambidexterity and I4.0 capabilities provide superior SCA. Previous studies (e.g., Neumann et al., 2021; Sony and Naik, 2019; Stentoft et al., 2020a) emphasized the importance of motivation and training of employees and top management support as critical success factors for implementing I4.0. Viewed in the context of I4.0, our findings underline the importance of the technological resource in the RBV's "value, rarity, imitability, and organization" model (Barney, 1997). Our findings therefore also respond to calls in the EO literature (Wales et al., 2021) for research on how entrepreneurship is leveraged strategically and how and why EO influences firm performance.

6.3. Practical implications

We contribute to the ambidexterity literature by adopting a dynamic perspective on balancing exploration and exploitation, and studying the contingent nature of the ambidexterity–firm competitive advantage relationship. There is insignificant study that addresses whether the I4.0 implementation mediates the link between SO and SCA. Moreover, assessing and comparing direct and indirect effects in multiple mediator variables has been carried out in developing country context, which can be considered another contribution that enhances managerial and theoretical understanding of SCA of small enterprises through I4.0 implementation. This study thus covers the gap in the EO literature between empirical studies by examining mediating relationships (Wales et al., 2011; Wales et al., 2021). Using data from an understudied North Africa context in strategic entrepreneurship, we extend the current organizational literature by providing a fine-grained view of the mechanisms through which firms can **create, develop, and maintain competitive advantage**. The findings suggest that companies and policymakers should focus on factors that inhibit the sustainable adoption of I4.0. Our findings can help managers deploy the readiness factors in their organizations to implement I4.0.

6.4. Limitations and future research

This study has limitations that need to be addressed in future work to fully explore the potential of I4.0 adoption. Indeed, this research did not take into account other factors that may affect SCA in the I4.0 era (e.g., capital intensity, strategic flexibility, and company strategy). Another limitation is linked to the relatively small sample size. Having more responses would reinforce the analysis and contribute to the conceptual

model generalization. Future studies may focus on the effect of practicing I4.0 technologies at the "industry level." The distinction between I4.0 readiness and I4.0 adoption could also be analyzed. By comparing firms located in emerging and developed countries; in fact, the same I4.0 readiness and practice may not have the same effect on sustained competitive advantage. Thus, future studies could also investigate the impact of entrepreneurial leadership and cultural change on the adoption and success of implementing I4.0 technologies. For instance, top management's capabilities might affect firms' green strategy choices in the context of I4.0. In addition, future studies may consider the four dimensions of strategic orientations (market, entrepreneurial, technology, and learning orientations) to assess how they affect SCA and firm performance through organizational ambidexterity while achieving a successful transformation from I4.0 to Industry 5.0(I5.0). Therefore, further research using samples from developed and emerging economies is needed to investigate the critical success factors of disruptive innovations within SMEs. In future studies, it will be also important for researchers to distinguish different types of ambidexterity and to provide a clear understanding of the nature of advantage by ultimately adopting a longitudinal investigation.

CRediT authorship contribution statement

Slimane Ed-Dafali: Conceptualization, Methodology, Software, Data curation, Formal analysis, Investigation, Resources, Validation, Visualization, Writing – review & editing. **Samim Al Azad:** Data curation, Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft. **Muhammad Mohiuddin:** Visualization, Investigation, Supervision, Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Resources, Validation, Writing – review & editing. **Mohammad Nurul Hassan Reza:** Software, Validation, Conceptualization, Investigation, Methodology, Visualization, Writing – review & editing.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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Appendix A. Questionnaire

I. Market Orientation

(Narver and Slater, 1990; Gatignon and Xuereb, 1997).

CM1. In our organization, our sales people share information about competitor information.

CM2. Firm responds to competitive actions that threaten it.

CM3. Top management regularly discusses competitor's strength and strategies.

CS1. Firm monitors level of commitment and orientation to serve customers' needs.

CS2. Firm's strategy is driven by creating greater value for customers

CS3. Firm's strategy for competitive advantage is based on proper understanding of customers' needs

CS4. Firm's objectives are driven by customer satisfaction.

CS5. We frequently measure customer satisfaction.

CM4. Firm targets customers and customers' groups to develop competitive advantage

CS6. After-sales service.

TO1. The use of sophisticated technologies in new products development.

Technological orientation.

TO2. The rapidity of integration of new technologies.

TO3. A pro-activity in developing new technologies.

TO4. In generating new product ideas.

II. Entrepreneurial orientation

(Anderson et al., 2015).

INN1. In the past three years, our company introduced and encouraged novel ideas, products or services.

INN2. In general, the managers of our firm favor a strong emphasis on R&D, technological leadership, and innovations.

INN3. Changes in product or service lines have usually been quite dramatic.

RISK1. Our company tends to strongly favor high-risk projects (with chances of very high returns).

RISK2. Owing to the nature of the environment, our company favors bold and wide-ranging actions to achieve its fixed objectives.

RISK3. When confronted with decisions involving uncertainty, my company typically adopts a bold posture in order to maximize the probability of exploiting opportunities.

PRO1. In general, the managers of our company have a strong tendency to be ahead of others in introducing novel ideas or products.

PRO2. In dealing with competitors, our company is very often the first business to introduce new products/services, administrative techniques or operating technologies.

PRO3. In dealing with competitors, the managers of our company typically initiate actions that competitors respond to.

III. Readiness of SMES facing Industry 4.0

(Scale adapted from Stentoft et al., 2020a).

I4.0R1. We experience a pressure to work with the new digital technologies (e.g. from customers, suppliers, authorities, etc.)

I4.0R2. We have the willingness to take risks to experiment with the new digital technologies

I4.0R3. We have the necessary knowledge about the new digital technologies to judge its importance for our company.

I4.0R4. We have necessary support from top management to judge and work with the new digital technologies.

I4.0R5. Our employees have the right competencies to work with the new digital technologies.

I4.0R6. Our employees have the right motivation to judge and work with the new digital technologies.

I4.0R7. We have economic freedom to work with the new digital technologies.

IV. Organizational Ambidexterity

Scale inspired by De Clercq, Thongpapanl, and Dimov (2013), Gibson and Birkinshaw (2004), and Jurksiene and Pundziene (2016).

AL1. The management systems in this company work coherently to support the overall objectives of the company.

AL2. People in this company work toward the same goals because our management systems avoid conflicting objectives.

AL3. The management systems in this company prevent us from wasting resources on unproductive activities.

AD1. The management systems in this company encourage people to challenge outmoded traditions/practices

AD2. The management systems in this company are flexible enough to allow us to respond quickly to changes in our market.

AD3. The management systems in this organization evolve rapidly in response to shifts in our business priorities.

V. Sustained Competitive Advantage

Scale inspired by Clauss et al. (2020), Durand (2003), Hooley et al. (2001), and Venkatraman and Ramanujam (1986).

CA1. Innovative offerings.
CA2. Quality.
CA3. Technological capacity
CA4. Reputation.
CA5. Service.
CA6. Financial success.
CA7. Market share.

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