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Dynamic Capabilities of the SMEs for Sustainable Innovation Performance: Role of Environmental Turbulence

Abstract

Purpose – This study aims to investigate how dynamic capabilities, i.e., sensing, learning, integrating, and coordinating trigger sustainable innovation performance. It also examines the direct and moderating role of environmental turbulence towards the sustainable innovation performance of small and medium-sized enterprises (SMEs).

Design/methodology/approach - The data were collected through a cross-sectional survey of 169 SMEs in Oman and analyzed through structural equation modelling using SmartPLS software.

Findings – Our findings reveal that the sustainable innovation performance of SMEs is greatly influenced by the synergy of learning, integrating, and coordinating capabilities. Notably, among these capabilities, coordinating capability emerges as the most important capability for SMEs with a primary emphasis on fostering both human and organizational well-being. However, this research reveals that building dynamic capabilities alone might not be sufficient to address social, ecological, and economic sustainability criteria, and SMEs may need to extend their view beyond internal processes and integrate various environmental contingencies into their approaches while focusing on sustainable innovation performance.

Practical implications - This research is useful for business managers while allocating resources in their business efficiently and effectively to achieve sustainable innovation performance. It also highlights that SMEs need to integrate various environmental contingencies into their approaches while focusing on sustainable innovation performance.

Originality/value - To the best of our knowledge, this study is one of the first to contribute to SME scholarship by mainly investigating the effect of specific four types of dynamic capabilities on sustainable innovation performance in a turbulent environment. This study is likely to contribute to the SMEs addressing sustainability innovation performance and develop capabilities to be sustainable in a turbulent environment.

Keywords: Learning capability, Sensing capability, Integrating capability, Coordinating capability, Sustainable innovation performance, SMEs.

1.Introduction

The dynamic capability theory stands on the notion that firms are required to develop a process of learning to embrace environmental changes (Teece *et al.*, 1997). Thereby, it has enticed a great deal of interest among researchers who are in quest of understanding sustainable innovation (Amui *et al.*, 2017; Dejardin *et al.*, 2022; Hofmann *et al.*, 2012; Mousavi *et al.*, 2018). In fact, the Sustainable Development Goals by the UN have unquestionably prompted the concentration on sustainable issues related to business, and industry. Dynamic capabilities represent the ability of a firm to integrate, build, and reconfigure internal and external capabilities to deal with rapidly changing environments (Miles, 2012; Teece *et al.*, 1997). Dynamic capabilities are based on

distinctive organizational processes and patterns of learned behaviour driven by a firm's specific asset positions to generate and modify its way of doing things more effectively (Macher and Mowery, 2009; Teece *et al.*, 1997). Dynamic capabilities enable firms to renew and utilize resources which have the potential to improve their performances (Eisenhardt and Martin, 2000; Schilke, 2014). Along the same line, Pavlou and El Sawy (2011) argue that understanding the dynamic capabilities and their measurements can help managers make decisions and develop new products even in turbulent environments. Although the contributions of dynamic capability have been explored by scholars (for example, Darawong, 2018; Hernández-Linares *et al.*, 2020; Iles and Martin, 2013; Mandal, 2017; Pavlou and El Sawy, 2011; Tseng and Lee, 2014), the consequences of dynamic capability on SMEs sustainable innovation performance remains equivocal.

SMEs are faced with pressure from multiple stakeholders to integrate sustainability into their business models and practices (World Economic Forum, 2022). For instance, customers are increasingly aware of their responsibility in choosing sustainable products (food, household products, luxury products, clothes etc.) and services (banks, hospitals, hotels, restaurants etc.). Such awareness of the customers, drove the SMEs to adopt a sustainability-focused approach to meet customers' concerns (Green Energy Advice Bureau, 2021). At this juncture, SME owners need to be clear on how to make better use of their capabilities and distinctive processes to develop and maintain sustainable innovation (Green Energy Advice Bureau, 2021). Besides, factors such as better working conditions in terms of safety and hygiene, law-abiding intention, innovative products valued by society, cost savings tendency, unpredictable environment, etc. prompt SMEs to be concerned about sustainability (Lee, 2009; Masurel, 2007).

Hence, sustainable innovation has become a deep-seated function and competitive advantage that businesses and societies are now looking for (Larson, 2000). Due to the rapid technological and digital transformations and the advent of new business models in recent times (Nasiri *et al.*, 2022), firms are compelled to amalgamate ecological and social concerns in their product or service design (Hall and Vredenburg, 2003). Nevertheless, scholars and practitioners have broached with the complexities of incorporating sustainability considerations into their innovation strategies due to resource limitation when cultivating dynamic capabilities (Dyduch *et al.*, 2021; Hockerts and

Wüstenhagen, 2010; Taghizadeh *et al.*, 2020). However, the benefits of being sustainable (e.g., employee engagement, reduction of waste, fulfilling local environmental regulations, or being more energy efficient) are substantial for SMEs to be cost-effective in the long term. On the other hand, scholars have also divulged that due to innovativeness and flexibility, some SMEs can develop the capability for sustainability (Aragón-Correa *et al.*, 2008; Eikelenboom and de Jong, 2019).

In the existing literature, the central premise regarding dynamic capabilities revolves around the moderating role of the environment (Hernández-Linares *et al.*, 2020; Teece, 2007). Rapid technological developments, changes in customer demands, globalization, and intensified competition have formed a turbulent environment characterized by heightened unpredictability, uncertainty and volatility (Boyne and Meier, 2009). Further, the combination of the recent COVID-19 outbreak and the ongoing conflict between Russia and Ukraine has had a profound impact on the global economy (Guan *et al.*, 2023; Ratanavanich and Charoensukmongkol, 2023). These two have acted as catalysts for a worldwide economic recession which in sequence has intensified the prevailing uncertainties faced by businesses. Several studies evidenced that a turbulent environment creates business opportunities and motivates organizations to employ

dynamic capabilities to reconfigure current operational capabilities for innovation (Fainshmidt *et al.*, 2016; Pavlou and El Sawy, 2011; Teece, 2007; Teece *et al.*, 1997). However, there is less understanding to address the moderating role of turbulent environments while SMEs are concerned with incorporating sustainable innovation practices. To address this, we specifically focus on the moderating role of environmental turbulence and expect that this moderation strengthens the effect of dynamic capabilities on SMEs' sustainable innovation performance.

To the best of our knowledge, this study is one of the first to contribute to SME scholarship by mainly investigating the effect of specific four types of dynamic capabilities on sustainable innovation performance in a turbulent environment. In earlier studies, the effect of dynamic capability on firm performance has been supported but dynamic capability was considered as a second-order construct and disregarded the influence of each dimension (Pavlou and El Sawy, 2011). Few studies investigated different types of first-order dimensions of dynamic capabilities with diverse outcomes (Darawong, 2018; Eikelenboom and de Jong, 2019; Hernández-Linares *et*

al., 2020). However, this study contemplates that not all the dimensions of dynamic capability are equally important for SMEs' sustainable innovation performance and hence adopted dimensions of dynamic capability proposed by Pavlou and El Sawy (2011) which are namely: sensing, learning, integrating, and coordinating capability as a measurable model.

This study is likely to contribute to the SMEs addressing sustainability innovation performance and develop capabilities to be sustainable in a turbulent environment. The context of the study is the SMEs in Oman, the country which has lately shifted its economic policy to lessen the oil and gas dependency and is now focused on creating a knowledge-based economy. The roadmap

towards the knowledge-based economy is steered by the Oman Vision 2040 which is the national policy guidebook to achieve a developed, diversified, and sustainable economy through innovative strategies and a new model for sustainable development. However, due to the growing awareness of environmental issues, gaining a sustainable innovation performance could be a critical concern for SMEs in Oman in today's turbulent market. Alike other regions, SMEs in Oman face several challenges regarding sustainable innovation and coping with environmental turbulence (Arslan *et al.*, 2023). They often lack various resources to invest in sustainable innovation and gain a competitive advantage. Therefore, they are facing competition from larger corporations those having more resources and capabilities for sustainable innovation, for example, companies related to the oil and gas industry, and financial institutions. Further, other challenges could be regulatory compliance in keeping up with evolving environmental regulations, technological barriers (i.e., access to the latest sustainable technologies), customer awareness and demand for sustainable

products/services, or cultural factors and traditional practices.

However, we believe that dynamic capabilities may help SMEs in Oman to overcome these challenges. For instance, SMEs can employ dynamic capabilities to understand changes in environmental regulations and adopt those regulations in their business operations and processes. It can benefit them to reallocate resources (e.g., technological, human, and financial) to support sustainable innovation initiatives, accelerate them with a culture of innovation adoption and learning, build a collaborative network with other organizations (e.g., government agencies, large companies, or research centres), response to customer preferences on environmental concerns, or react to environmental challenges by developing new products/services. However, this research believes that dynamic capabilities may empower Omani SMEs to be innovative in the face of

sustainability and environmental issues as well as navigate the complexity of sustainable innovation and environmental turbulence.

This paper starts with presenting the literature review on dynamic capability and sustainable innovation performance. Building on this background, this study formulates hypotheses regarding the effects of dynamic capabilities on SMEs' sustainable innovation performance. After explaining the research methodology, the paper presents the results from the conducted analysis using 169 data collected from SMEs in Oman and renders the empirical findings. Finally, we conclude with a discussion of this study's results, implications, and limitations.

2. Literature Review and Hypotheses Development

To achieve sustainable innovation performance, firms are required to maximize the utilization of their capabilities, with a particular emphasis on employing their dynamic capabilities. However, more investigation is required to answer how SMEs can overcome the potential challenges and build their organizational capabilities to reach this goal. The following section focuses on reviewing the relevant literature, which led us to develop the research hypotheses.

2.1 Dynamic Capabilities

Dynamic capability has been delineated as a firm's set of abilities to strategically integrate, construct, and reconfigure both internal and external resources to respond to changing environments (Teece *et al.*, 1997). The theoretical framework of dynamic capability explains the reason why companies achieve different business outcomes while operating in the same economic condition using similar resources (Eze *et al.*, 2013; Owoseni and Twinomurinzi, 2019). Eisenhardt and Martin (2000) extended the definition of dynamic capability. They explained it as the organizational processes and routines of integration, reconfiguration, gaining and releasing a firm's resources to respond to any changes in the market. The role of such capabilities is to transform the firm's resource base in line with the changes in the environment (Ambrosini *et al.*, 2009). Though such capabilities are rooted in a resource-based view (RBV) (Barney, 1991; Helfat and Peteraf, 2003), RBV emphasizes resource picking, while dynamic capabilities stress resource renewal (Pavlou and El Sawy, 2011).

Four main types of dynamic capabilities have been distinguished by Teece *et al.* (1997) and Pavlou

and El Sawy (2011). A firm uses its (1) sensing capabilities to spot, interpret, and pursue opportunities that it perceives from internal and external stimuli; (2) learning capabilities to determine what organizational capabilities must be revamped, rebuilt, or reconfigured into new knowledge; (3) integrating capabilities to integrate assets and resource for new resource configuration; and (4) coordinating capabilities to implement and use the reconfigured capabilities. It is important to highlight that reconfiguration is all about efficiency (Kogut and Zander, 1996), timeliness (Zott, 2003), and appropriateness (Galunic and Rodan, 1998). The four types of dynamic capabilities have been used in various research contexts (e.g. Darawong, 2018; Hernández-Linares *et al.*, 2020; Pavlou and El Sawy, 2011), and scholars suggest that by applying these dynamic capabilities, firms can recognize the sustainability process. The matter of fact is, that this process is complex and dynamic with unpredictable changes (Arend, 2014; Eikelenboom and de Jong, 2019). Researchers also argued that the process of sustainability is ambiguous, and firms need to be flexible and continuously adapt to learning and overcome the environmental uncertainty around sustainability issues (Arend, 2014; O'Neil and Ucbasaran, 2016).

From the dynamic capability perspective, firms require a distinctive *sensing capability* if they want the reap-off potential benefits of resources to be transformed into realized outcomes in a highly competitive environment (Zhang and Wu, 2013). Sensing capability has been referred to as the ability of firms to spot, interpret, and pursue opportunities in the environment (Pavlou and El Sawy, 2011). It requires searching and exploring technologies and marketing the products or services locally and internationally (Hodgkinson and Healey, 2011; Teece, 2014); learning about its competitors, customers and environment (Day, 1994); maintaining relationships with customers, suppliers, and distributors; and participating in professional networks/associations (Wilden and Gudergan, 2015). *Learning capability* is the ability of a firm to revamp its existing operational capabilities with new knowledge (Pavlou and El Sawy, 2011). Learning capability is all about gaining fresh knowledge (Cohen and Levinthal, 1990), knowledge brokering (Eisenhardt and Martin, 2000), brainstorming (Pisano, 1994), and seizing opportunities with learning (Teece, 2007). Therefore, learning capability can enable a firm to identify new product opportunities and perform tasks much faster and more efficiently (Ambrosini *et al.*, 2009; Lin and Wu, 2014; Teece

et al., 1997). *Integrating capability* refers to the ability of a firm to combine individual knowledge into the unit's new operational capabilities (Pavlou and El Sawy, 2011). Integrating capability facilitates configurations using three groups: contribution, representation, and interrelation.

Contribution refers to individual input dissemination within the organization (Okhuysen and Eisenhardt, 2002). Representation refers to visualizing how people fit in, how others act, and how the unit's activities fit together (Crowston and Kammerer, 1998). Interrelation relates to integrating individual inputs within a unit to hone the reconfigured operational capabilities by executing a collective activity (Helfat and Peteraf, 2003). Pavlou and El Sawy (2011) define *Coordinating capability* as "the ability to orchestrate and deploy tasks, resources, and activities in the new operational capabilities" (p. 246). The functions of such capability have been discoursed in the past literature as allocation of resources to tasks (Helfat and Peteraf, 2003), appropriate appointment of people to tasks (Eisenhardt and Brown, 1999), and identification of complementarities and synergies among tasks and resources (Eisenhardt and Galunic, 2000). Thus, this capability allows firms to access and allocate resources at a lower cost and respond to changes with greater flexibility (Huang *et al.*, 2012).

2.2 Dynamic Capabilities and Sustainable Innovation Performance

Sustainable innovation has been widely proliferated since the last decade among researchers, practitioners, and policymakers. Sustainable innovation has been defined as "the development of new products, processes, services, and technologies that contribute to the development and well-being of human needs and institutions while respecting natural resources and regenerative capacity" (Tello and Yoon, 2008, p.165). Earlier, Carrillo-Hermosilla *et al.* (2010) explained sustainable innovation as "the innovation that improves sustainability performance" and includes social, ecological, and economic criteria.

Munoz-Pascual and Galende (2020) define sustainable innovation performance as the introduction of a new or significantly improved product/service, in terms of its characteristics or in terms of its intended use which can include improvements in materials and components, technical characteristics, ease of use or other environmental, social and economic characteristics. Sustainable innovation performance comprises the integration of innovation practices that are socially beneficial, environmentally responsible, and economically feasible. That allows SMEs to

compete by minimizing negative environmental and social effects while promoting long-term economic sustainability.

According to scholars, sustainable development demands innovation that goes beyond incremental adjustments, as sustainable development in many cases needs modification in the production and consumption system (Boons *et al.*, 2013; Boons and Wagner, 2009). Therefore, it requires consistency in the firm's philosophy, product or process, and value proposition to simultaneously create economic, environmental, and social values (Adams *et al.*, 2016).

Researchers have explained that sustainable innovation performance can be driven by dynamic capabilities (Albort-Morant *et al.*, 2016). The contribution of dynamic capabilities varies in improving a firm's performance, and some of the dynamic capabilities may contribute more than others depending on the specific context of the firms (Ambrosini and Bowman, 2009; Eikelenboom and de Jong, 2019). In the context of large firms, for example, resource building and reconfiguration dynamic capabilities are essential for the firms' market performance (Dangelico *et al.*, 2017). In the context of SMEs, the importance of external integrative dynamic capabilities for all three pillars of sustainability performance in SMEs has been highlighted in a study conducted by Eikelenboom and de Jong (2019). However, we propose that sensing, learning, integrating, and coordinating capabilities are important in the specific context of SMEs and we attempt to investigate which one triggers the sustainable innovation performance of SMEs the most.

Firms can detect and adopt technical capability before the competitors by recurrently exerting the sensing capability (Cohen and Levinthal, 1990). Firms focusing on sensing capability can increase their knowledge about both existing customer needs and underserved market segments (Slater and Narver, 2000; Taghizadeh *et al.*, 2018). Current scholarship affirms that SMEs that regularly exploit sensing capability can develop more innovative products, make a quick entrance to the market (Zhang and Wu, 2013), and effectively improve their marketing and customer retention capability (Wilden and Gudergan, 2015). However, to develop a sustainable product or service, firms can gain a deep understanding of the market and customer and create new knowledge through learning capability in their current operations (Darawong, 2018). The firsthand knowledge through regular employing the learning capability may contribute firms to developing new products and assimilating new technology in line with the firm's sustainability-based objectives. In addition, past studies have documented that learning capability focuses on the firm's ability to make,

understand, use, and develop knowledge to produce new things (Takahashi, 2005). Furthermore, assimilated knowledge of learning capability can help firms' capability in monitoring and reporting the progress of new product development to reduce environmental issues. Most importantly, integrating individual knowledge into the firms' capabilities drives a shared understanding and value for firms and society (Hernández-Linares *et al.*, 2020; Pavlou and El Sawy, 2011; Teece, 2007). Identifying and incorporating resources with current tasks and activities (Darawong, 2018) and orchestrating individual tasks and activities (Pavlou and El Sawy, 2011) enable new product development teams to effectively enhance product quality, market share and project effectiveness for sustainability.

Therefore, based on the above discussion, we formulated the hypotheses below and built a theoretical framework (Figure 1) to address which dynamics capabilities are more effective for sustainable innovation performance.

H1. Sensing capability is positively related to the sustainable innovation performance of SMEs.

H2. Learning capability is positively related to the sustainable innovation performance of SMEs.

H3. Integrating capability is positively related to the sustainable innovation performance of SMEs.

H4. Coordinating capability is positively related to the sustainable innovation performance of SMEs.

2.3 The Role of Environmental Turbulence

Various environmental likelihoods create distinctive challenges for firms. Hence, it is of interest to investigate the environmental turbulence's effects on initiating and implementing sustainable innovation performance among SMEs. Environmental turbulence refers to the change, unpredictability, and instability that occurs in the environment in which a particular industry and firms operate (Rajala and Hautala-Kankaanpää, 2023). It includes market, technology and competitive turbulence (Wang *et al.*, 2021) in which market turbulence is about changes in customers' product and service preferences (Hartono and Sheng, 2016; Qiu *et al.*, 2020; Tsai and Yang, 2013; Wong, 2014; Zhou *et al.*, 2019), technological turbulence refers to the changes in the technology of the industry (Hanvanich *et al.*, 2006; Huang and Tsai, 2014; Zhou *et al.*, 2019), and competitive intensity which refers to

the competitors' activities such as price competition, promotion competition, and new arrivals of products (Cui *et al.*, 2005). According to Sirmon *et al.* (2007), environmental turbulence leads to a high level of uncertainty that "produces deficits in the information needed to identify and understand cause and effect relationships" (p. 275).

Past literature highlights that changes in the environment can influence a firm's innovation behaviours and strategies (Wang *et al.*, 2022). A turbulent environment which is the extent to which a firm's external environment undergoes unpredictability and change is critical to the process of innovation (Chen *et al.*, 2021). Since existing products and services of a firm may rapidly become obsolete in highly dynamic environments, firms need to pursue exploitation activities and develop new products and services as the existing ones become rapidly obsolete (Jansen *et al.*, 2006; Teece, 2007; Yang and Li, 2011). A turbulent technological environment forces firms to constantly keep pace with technological trends and develop new products to maintain their competitiveness (Martin *et al.*, 2020). Companies that face technological changes, new and changing customer preferences related to products and services, growing and strong competition and promotion wars strive to come up with innovative ideas resulting in process/product innovation (Turulja and Bajgoric, 2019). Earlier, Zhou (2006) stated that highly dynamic environments might push a firm to change its products, services, and markets to remain competitive. For example, the recent COVID-19 Pandemic forced the food industry to adopt home delivery ordering through online platforms. In the same vein, Wong (2014) asserted that environmental turbulence would force a firm to leave its comfort zone and adapt to new capabilities and offerings. These may provide "an opportunity for developing new products, mastering new technology, engaging with new customers, and reaching into new markets that help fuel growth and gain competitive advantage." Additionally, Guo *et al.* (2023) asserted that environmental turbulence is always a contingency factor in innovation performance and can motivate people in their workplace to be more innovative. Hence, in this study, we propose that environmental turbulence may push firms to change their products, processes, and services towards sustainability to compete in the market. As such, the following hypothesis is posited:

H5: Environmental turbulences are positively related to the sustainable innovation performance of SMEs.

This study also steps further to examine the moderating role of environmental turbulence on the relationship between each dimension of dynamic capabilities and sustainable innovation performance. It has been instituted in the literature that environmental turbulence positively moderates the relationship between firms' absorptive capacity and green innovation performance (Song *et al.*, 2021). As unpredictable changes mark environmental turbulence, firms should understand current and forthcoming changes in environmental trends and modify their business processes accordingly. For example, firms focus more on the personalized preferences of clients when faced with increased competition (Charoensukmongkol, 2022; Huang, 2023). Teece (2018) argued that the strength of dynamic capabilities influences the degree and speed of a company's business model alignment with environmental changes. The degree and speed of business model alignment are particularly important in a highly turbulent environment (Witschel *et al.*, 2022). In highly environmental turbulent situations, dynamic capabilities will become more valuable due to the emergence of more opportunities. Witschel *et al.* (2022) declared that stronger dynamic capabilities are especially required in turbulent environments for business model innovation. Schoemaker *et al.* (2018) declared that strong sensing capabilities are needed to detect changes before their competitors do and to stay competitive. In the same vein, Witschel *et al.* (2022) mentioned that strong transforming and seizing capabilities help the firm in business model innovation in highly turbulent environments. In a recent empirical study, Mokhtarzadeh *et al.* (2022) found that environmental turbulences (market and technological turbulence) moderate the networking capability, collaborative innovation capability and firm's innovation performance link. Changes in the environment strengthen the link between operational capabilities and a firm's performance (Karna *et al.*, 2016). Such environmental changes allow firms to obtain greater rents from their existing capabilities in the form of higher producer surplus Thus, firms in a highly turbulent environment may use their sensing, learning, integrating, and coordinating all their dynamic capabilities for sustainable innovation performance. Therefore, we propose the following:

H6. Environmental turbulence strengthens the effect of (a) sensing capability, (b) learning capability, (c) integrating capability, and (d) coordinating capability on sustainable innovation performance.

Insert Figure 1 Here

3. Methodology

This study tested the framework of dynamic capability in the context of SMEs in Oman. We collected data from SME owners to examine the objectives of our study using cross-sectional designs. We used cross-sectional designs in our study for several reasons recommended by Spector (2019). Firstly, this study investigates a new variable (Sustainable Innovation Performance of SMEs) in the framework of dynamic capabilities theory. As there is limited existing knowledge

about the variation among variables, a cross-sectional design offers a better method to gain valuable insights into our research topic. Secondly, we conducted exploratory research to understand potential patterns of relationships among the variables. The objectives of our study are to examine whether dimensions of dynamic capability have correlations with the Sustainable Innovation Performance of SMEs with the possible role of moderators (Environmental

Turbulence). Subsequently, the cross-sectional design could allow us to collect efficient variables from the samples with a comprehensive analysis of those relationships. Finally, cross-sectional designs are relatively inexpensive to conduct and can be highly efficient in researcher and participant time. Thus, we can adequately address many questions. This efficiency allows us to effectively address all the research questions.

In this research, we employed self-administered questionnaires for data collection. To confirm the accuracy and clarity of the measurement items, a process of back-to-back translation between English and Arabic was carried out for the initial questionnaires. We conducted a pre-test phase,

based on personal interviews with experts using the debriefing technique to eliminate bugs as per valuable comments given by experts (including three SME owners, and two academicians). To establish both the population and the appropriate sample size, we collaborated with government officials to provide us with the number of registered SMEs focusing on sustainability in their

business. For the final data collection, 500 questionnaires were distributed, and finally, 169 usable data were received for analysis purposes. The majority of the SMEs in our research were established within the period of 2000-2019 (accounting for 90 per cent of the sample). Furthermore, about 63 per cent of the respondents primarily operate in the local market. And a substantial 62 per cent of these SMEs offer various services. Detailed information about the

respondents and their company can be found in Appendix A.

Measurement items of the constructs have been adapted from previous studies. Sensing capability

with 4 items, learning capability with 5 items, integrating capability with 5 items, and coordinating capability with 5 items have been adapted from Pavlou and El Sawy (2011). Sustainable innovation performance with 9 items has been adapted from Eikelenboom and de Jong (2019); Terziovski (2010); and Mousavi *et al.* (2018). Finally, environmental turbulence with 5 items has been adapted from Pavlou and El Sawy (2011). Appendix B shows the descriptive statistics of all the study variables.

While the data was collected from a single source, concerns about potential Common Method Bias (CMB) were addressed. Two statistical remedies - Harman's single factor test and correlation matrix - were used to assess the common method bias (CMB). Initially, Harman's one-factor test was carried out by incorporating all the items of the constructs into a factor analysis suggested by scholars (Podsakoff *et al.*, 2003; Podsakoff and Organ, 1986). Findings reveal that 40.19 per cent of the variance is accumulated by the first factor, which is below the recommended cut-off ceiling value of 50 per cent, whereas the aggregated variance generated by all the seven factors is 68.12 per cent which is greater than the suggested minimum value of 50 per cent.

Secondly, this study conducted correlation analysis among the constructs to test whether they are highly correlated (more than 0.90), as Bagozzi *et al.* (1991) recommended. The results show that the constructs of this study are not highly correlated (the highest significant correlated value is r = 0.757) with each other (see Appendix B). Thus, we ascertain that, as in the case of non-response bias, this study is also free from common method bias.

4. Finding

The structural equation modelling (SEM) technique using SmartPLS software was employed to test the research hypotheses and analyze the study's measurement and structural model.

We tested model fit by using two model fitting parameters namely Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). The SRMR values less than 0.10 or 0.08 are considered a good fit (Ringle *et al.*, 2022). The NFI values between 0 and 1 are considered a good fit and the closer the NFI to 1, the better the fit (Ringle *et al.*, 2022). The results show an SRMR of 0.09 and the NFI value of 0.65 indicating the data fits the model well.

4.1 Measurement model

We examined convergent validity and discriminant validity to assess the measurement model. Convergent validity has been determined through factor loading, average variances extracted (AVE), and composite reliability (CR), as suggested by Hair *et al.* (2017). We considered the cut-off value above 0.5 for factor loading, higher than 0.5 for AVE, and above 0.7 for CR. The results of all other items loading, AVEs and CRs met the equal or above cut-off values. Therefore, the convergent validity for scale measurement is fulfilled (Table 1).

Insert Table 1 Here

Discriminant validity was examined through the heterotrait-monotrait ratio of correlations (HTMT) based on the multitrait-multimethod matrix suggested by Henseler *et al.* (2016). If the HTMT value is greater than the HTMT 0.85 value of 0.85 (Kline, 2015), then discriminant validity is questionable. As shown in Table 2, all the values are below the threshold level of the HTMT 0.85, thus indicating that discriminant validity has been ascertained.

Insert Table 2 Here

4.2 Structural model

In order to assess the structural model (path relationship), the R^2 value, standard beta, t-value via a bootstrapping procedure with a resample of 5000, the predictive relevance (Q^2), and the effect size (f^2) were considered as suggested by Hair *et al.* (2017). Table 3 illustrates the results of path relationships.

H1 predicts the effect of sensing capability on sustainable innovation performance. The results show that there is no relationship between sensing capability and the sustainable innovation performance of SMEs. Therefore, H1 is not supported. H2 predicts the effect of learning capability on sustainable innovation performance. The results show that learning capability significantly affects sustainable innovation performance with $\beta = 0.158$, $p < 0.05$, supporting H2 in this study. H3 predicts the effect of integrating capability on sustainable innovation performance. The results show that integrating capability significantly affects sustainable innovation performance with $\beta = 0.227$, $p < 0.01$, supporting H3 of the study. H4 predicts the effect of coordinating capability on sustainable innovation performance. The results show that coordinating capability has a significant effect on sustainable innovation performance with $\beta = 0.230$, $p < 0.01$ supporting H4.

In addition, H5 predicts the direct effect of environmental turbulence on the sustainable innovation performance of SMEs. The results show that environmental turbulence has a significant effect on sustainable innovation performance with $\beta = 0.155$, $p < 0.01$ supporting H5. Finally, the moderating role of environmental turbulence on the relationship of sensing, learning, integrating, and coordinating capability on sustainable innovation performance has been tested (H6a,b,c,d). The

striking results show that there is no moderating effect of environmental turbulence. The results of can be found in Figure 2.

The R^2 value for sustainable innovation performance is 0.53. The R^2 values are above 0.26, indicating a substantial model as suggested by Cohen (1988). Hair *et al.* (2017) suggested examining the change in R^2 value and determining f^2 (effect size). The effect sizes of 0.02, 0.15 and 0.35, respectively, represent small, medium, and large effects. The results show a small effect on sustainable innovation performance. The Q^2 values are more than 0, suggesting that the model has sufficient predictive relevance (Hair *et al.*, 2017).

Insert Table 3 Here

5. Discussion

If SMEs aspire to contribute to the global sustainable development goal, it is imperative to act upon achieving sustainable innovation performance using the required dynamic capabilities. Crediting this notion, the current study has examined how and which dynamic capabilities, i.e., sensing, learning, integrating, and coordinating, trigger sustainable innovation performance the most. It has also analyzed the role of environmental turbulence towards sustainable innovation performance in the context of SMEs in Oman. The findings show that learning, integrating, and coordinating capabilities contribute to sustainable innovation performance of SMEs where coordinating capability has the highest impact. The results also confirm that scholars need to differentiate between several dimensions of the dynamic capability to study the effectual impacts (Helfat and Winter, 2011; Hernández-Linares *et al.*, 2020). In line with the work by Hernández-Linares *et al.* (2020), the current study revealed the insignificant relationship between sensing capability and sustainable innovation performance of SMEs. The nature of sensing capability is to increase firms' knowledge about the existing customer needs and underserved market segments (Slater and Narver, 2000; Taghizadeh *et al.*, 2018). In the context of Oman's SMEs, sensing from the market does not seem to contribute to gaining knowledge on sustainable innovation

performance. There might be a few explanations which are presumably linked to the contextual factors in which the SMEs are operating. One of the reasons might be that the SMEs in Oman do not have enough resources and/or tools to identify the ideas on sustainability from the customer. Another reason could be that they may not be aware of or may not know how the market can be a place of opportunity to develop products and services in line with social, ecological, and economic criteria. However, it might be also that the lack of development in the human capital among the SMEs' owners in the country holds back the sensing capability of the SME owner. In a study conducted in Oman, Rahman *et al.* (2021) found an insignificant relationship between human capital and entrepreneurial opportunity recognition among SME owners what contributes to the understanding of lack of association between the SMEs' sensing capability and sustainable innovation performance. Moreover, it has also been suggested that firms need to explore the market first, in order to recognize, interpret and pursue opportunities in the environment which they operate (Hodgkinson and Healey, 2011; Pavlou and El Sawy, 2011; Teece, 2014; Wilden and Gudergan, 2015). Therefore, we argue that this is something the Oman Vision 2040 implementors should consider when developing an educational support strategy for their SMEs. Nevertheless, further research is needed to understand the relation between the SME's sensing capabilities and their sustainable innovation performance.

As regards learning capability, the results indicate that learning capability has a significant effect on the sustainable innovation performance of the SMEs. The results corroborate the theoretical perspective indicating that learning enables more efficient performance (Darawong, 2018; Hernández-Linares *et al.*, 2020; Teece *et al.*, 1997). Learning capability may constitute a rare capability to contribute to SMEs in developing sustainable innovative products benefiting human and organizational well-being. Our results regarding the integrating capability confirm a significant relationship with the sustainable innovation performance of SMEs. This result is consistent with earlier studies suggesting that the capability to integrate knowledge-based resources can influence firms' innovation capabilities and be a source of competitive advantage (Taghizadeh *et al.*, 2020; Teece, 2007; Tseng and Lee, 2014). Finally, for the coordinating capability, the results reveal that coordinating capability affects the sustainable innovation performance of SMEs. This significant relationship shows that coordinating capability can contribute to SMEs to identify and incorporate resources in line with the current task and activities

which are aligned with social, ecological, and economic criteria.

Our findings show that environmental turbulence directly affects the sustainable innovation performance of SMEs, while it does not play any moderating role. The positive direct effect of environmental turbulence on sustainable innovation performance is consistent with the previous literature. It highlights that a highly turbulent environment pushes firms to develop new products and services and improve the existing ones (Chang *et al.*, 2011). The matter of fact is, that the products and services of the firm rapidly become obsolete and require firms to pursue exploitation activities and develop new products and services (Jansen *et al.*, 2006; Teece, 2007; Yang and Li, 2011). Thus, our findings suggest that environmental turbulence may compel SMEs to develop sustainable products and services to contribute to the development and well-being of human needs and organizations while recognizing natural resources and renewing capacity.

6. Implication

6. 1 Theoretical Implication

This study attempted to shed light on a few interesting quests of the researchers and investigated the unexplored link between dynamic capabilities, i.e., sensing, learning, integrating, and coordinating, and SMEs' sustainable innovation performance of SMEs in Oman. Theoretically, this study contributes to dynamic capability literature by examining the direct effect of individual dimensions of dynamic capability on SMEs' sustainable innovation performance, whereas Hernández-Linares *et al.* (2020) only focused on firm performance. However, the results of our study can help to understand the extent of each relationship's implication on sustainable innovation which is predominant in the recent era and also would be in future.

The study suggests that the sustainable innovation performance of SMEs in Oman can be driven by learning, integrating and coordinating capabilities. Hence, the findings add knowledge to the literature by specifying the relationships and divergences among the dimensions of dynamic capability and sustainable innovation performance. Further, this study also explored the direct effect of environmental turbulence on the sustainable innovation performance of SMEs in the context of Oman.

6. 1 Practical Implication

In addition, the current study offers several practical implications for SMEs which are inclined to use various capabilities to enhance the sustainable innovation performance of SMEs to keep pace with the environmental dynamism. The finding indicates that the allocation of resources for capability development differs. Hence, business managers might find it useful while allocating resources in their business efficiently and effectively to achieve sustainable innovation performance. SMEs in Oman who seek to align their firm's goals toward social, ecological, and economic criteria may also benefit by understanding the significance of specific dynamic capabilities. Managers or the owners of SMEs may consider this finding useful to provide required training to the employees to develop the required dynamic capabilities. SME managers or owners can also consider developing simulation-based training programs or gaming to enhance the dynamic capabilities of the SMEs' internal stakeholders. This study takes the first step in this direction by demonstrating that learning, integrating, and coordinating capabilities are essential for firms whose focus is on human, organizational, and social well-being. Therefore, SMEs should constantly build and enhance their learning, integrating, and coordinating capabilities to drive sustainable innovation performance.

SME owners can promote a culture of continuous learning within the organization. They can provide employees with opportunities to stay updated on business trends, new technologies, and innovative best practices concerning sustainability. They may also invest in training programs focusing on sustainable innovation that help employees to gain the skills and knowledge for the generation of sustainable innovation ideas. SME owners perhaps can invest in access to the latest sustainable technologies to develop sustainable products/services. It could help everyone get access to analytics tools and collaboration platforms to facilitate integration efforts in adopting a culture of sustainable innovation. In addition, SME owners need to convey the consequence of sustainable innovation to employees and encourage them to develop products/services that are aligned with social and environmental goals.

Furthermore, this study confirmed that SMEs in Oman might need to consider environmental turbulence and extend their view beyond internal processes. Only building dynamic capabilities may not be sufficient to address the social, ecological, and economic criteria of sustainability. Thus, SMEs need to integrate various environmental contingencies into their approaches while

focusing on sustainable innovation performance. SMEs usually face fierce pressure from the environment and must compete with powerful competitors and meet their customers' needs and demands. Therefore, it is critical for SMEs in Oman to focus on investment in resources that promise a substantial return on sustainability criteria. Similar practical implications can be considered in other Gulf Cooperation Countries (GCC) as member countries have almost similar entrepreneurial eco-systems.

7. Limitation and Future Research

Like any other research, our study has some limitations which can be taken into consideration in future research. This research is cross-sectional, and future research could consider a longitudinal study. Because continuous changes in our environment require firms to act differently in various situations, allocating resources and capabilities can be different to be quick in the market and recognize the opportunities. We found that dynamic capability has been emphasized in a different way. Therefore, future studies may test the model in other contexts and find similarities and

dissimilarities. It will also be interesting to explore the role of dynamic capabilities in the context of artificial intelligence in the SME sector. Future studies may also seek to explore the possible antecedents of dynamic capability in terms of resource-based view theory.

Declaration of Interest Statement

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

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Table 1: Results of Convergent Validity

Variables	Items	Factor Loading	CR*	AVE**
Sensing Capability	We frequently scan the environment to identify new business opportunities.	0.765	0.889	0.667
	We periodically review the likely effect of changes in our business environment on customers.	0.851		
	We often review our product development efforts to ensure they are in line with what the customers want.	0.829		
	We devote a lot of time to implementing ideas for new products and improving our existing products.	0.821		
Learning Capability	We have effective routines to identify, value, and import new information and knowledge.	0.818	0.905	0.656
	We have adequate routines to assimilate new information and knowledge.	0.805		
	We are effective in transforming existing information into new knowledge.	0.824		
	We are effective in utilizing knowledge in new products.	0.836		
	We are effective in developing new knowledge that has the potential to influence product development.	0.763		
Integrating Capability	We are forthcoming in contributing our individual input to the group.	0.724	0.901	0.647
	We have a global understanding of each other's tasks and responsibilities.	0.809		
	We are fully aware of who in the group has specialized skills and knowledge relevant to our work.	0.790		
	We carefully interrelate our actions to each other to meet changing conditions.	0.840		
	Group members manage to successfully interconnect their activities.	0.854		
Coordinating Capability	We ensure that the output of our work is synchronized with the work of others.	0.815	0.923	0.706
	We ensure an appropriate allocation of resources (e.g., information, time, reports) within our group.	0.886		
	Group members are assigned to tasks commensurate with their task-relevant knowledge and skills.	0.855		
	We ensure that there is compatibility between group members' expertise and work processes.	0.876		
	Overall, our group is well coordinated.	0.764		
Environmental Turbulence	The technology in this product area is changing rapidly.	0.815	0.904	0.654
	Technological breakthroughs provide big opportunities in this product area.	0.777		
	In our kind of business, customers' product preferences change a lot over time.	0.852		
	Marketing practices in our product area are constantly changing.	0.833		
	New product introductions are very frequent in this market.	0.761		

Sustainable Innovation Performance	Number of product configurations	0.775	0.907	0.526
	Success of sustainable new products launched	0.802		
	Accelerated speed with sustainability to market	0.635		
	Reduction in waste	0.505		
	Increased market opportunities related to sustainability	0.525		
	Increased delivery of sustainable product and services on time	0.723		
	Improved product or service innovations to be reused and recycled	0.835		
	Improved work methods and processes to reduce environmental issues	0.845		
	Increased quality of ecological products or services	0.790		

*CR=Composite Reliability; **AVE=Average Variance Extracted

Table 2: Discriminant Validity (HTMT Ratios)

	1	2	3	4	5	6
Coordinating Capability						
Environmental Turbulence	0.276					
Integrating Capability	0.856	0.375				
Sustainable Innovation Performance	0.639	0.461	0.698			
Learning Capability	0.684	0.365	0.737	0.61		
Sensing Capability	0.729	0.414	0.718	0.618	0.701	

Table 3: Results of the Structural Model

Hs	Path relationships	Beta	SE	t-value	Decision	R2	Q2
H1	Sensing Capability -> Sustainable Innovation Performance	0.142	0.098	1.452	No supported	0.527	0.246
H2	Learning Capability -> Sustainable Innovation Performance	0.158	0.091	1.725*	Supported		
H3	Integrating Capability -> Sustainable Innovation Performance	0.227	0.102	2.217*	Supported		
H4	Coordinating Capability -> Sustainable Innovation Performance	0.230	0.092	2.492**	Supported		
H5	Environmental Turbulence -> Sustainable Innovation Performance	0.155	0.062	2.496**	Supported		
H6a,b,c,d	Moderating Role of Environmental Turbulence	-	-	-	Not supported		

*$p < 0.05$; **$p < 0.01$

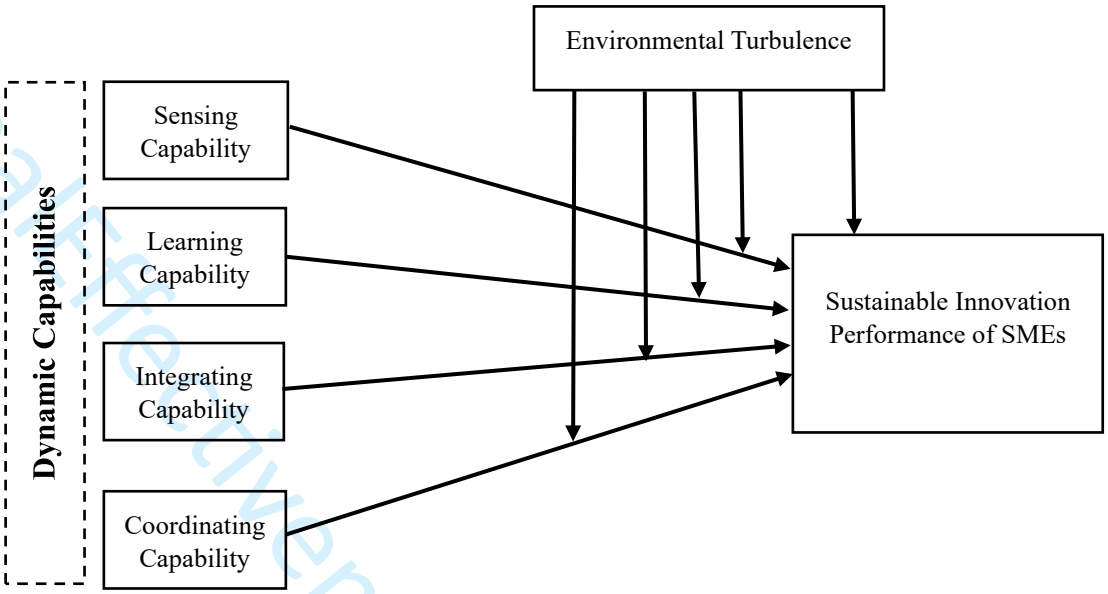

Figure 1: Research Framework

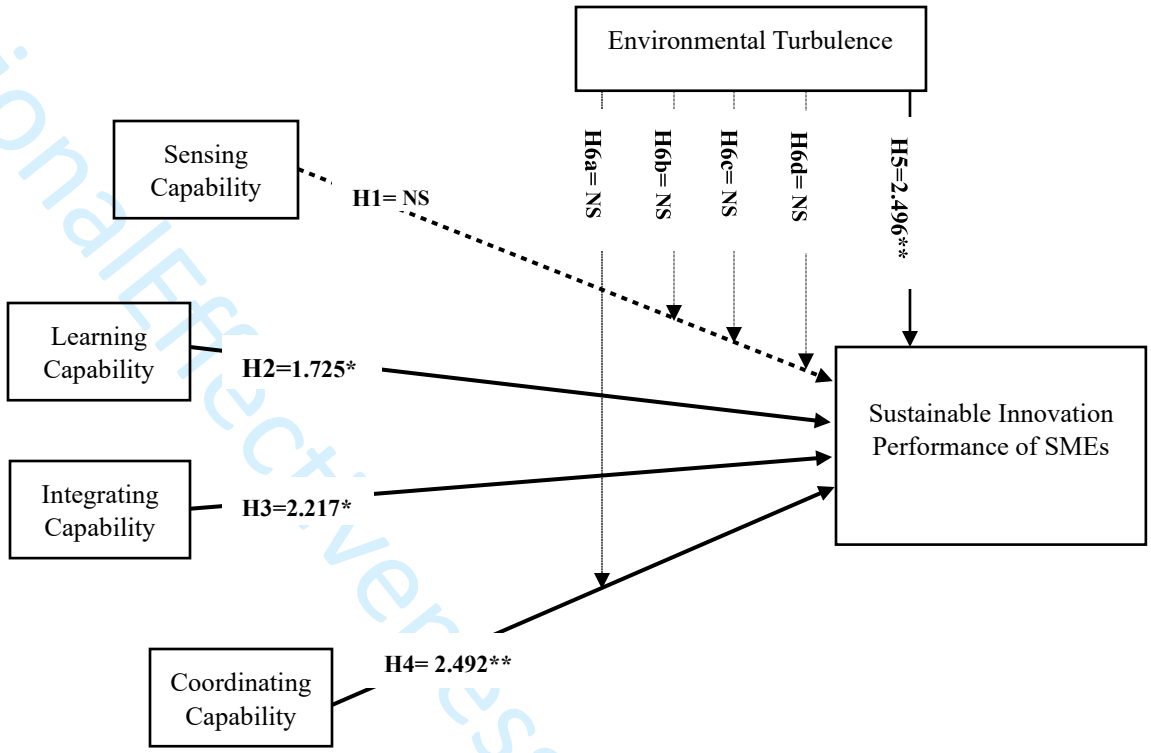

Figure 2: Results of the Structural Model
*$p < 0.05$; **$p < 0.01$
NS= Not significant

Appendix A

Demographic profile of respondents and the studied SMEs

			%
SMEs	Year of Establishment	1900-1999	10
		2000-2009	44
		2010-2019	46
	Type of Business	Manufacturing	27
		Service	65
		Others	8
	Market	Foreign	5
		Local	63
		Mixed	32
	No. of Employee	6-25	82
		26-99	18
	Ownership	Sole proprietor	52
		Partnership	39
		Joint venture	9
Respondents	Position	Business Owner	62
		Business Partner	38
	Number of years running this business	1-5 years	26
		6-10 years	30
		11-15 years	20
		16-20 years	14
		21 and above	10
	Education Level	High school	20
		Certificate	30
		Diploma	18
		Degree	10
		Master and above	22

Appendix B

Descriptive statistics and correlation matrix of all the study variables

		Descriptive Statistics		Correlations					
		Mean	Std. Deviation	1	2	3	4	5	6
1	Sensing Capability	4.074	0.744	1	.597**	.604**	.624**	.347**	.526**
2	Learning Capability	4.225	0.626		1	.642**	.608**	.311**	.472**
3	Integrating Capability	4.057	0.678			1	.757**	.320**	.533**
4	Coordinating Capability	4.164	0.705				1	.232**	.538**
5	Environmental Turbulence	3.601	0.856					1	.579**
6	Sustainable Innovation Performance	3.992	0.747						1

** Correlation is significant at the 0.01 level (2-tailed). Pearson Correlation. Valid N = 169