

# Organizational learning ambidexterity and openness, as determinants of SMEs' innovation performance

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## Abstract

**Purpose** – SMEs could achieve their innovation goals, either through exploitation, exploratory, or ambidextrous learning strategies. This study presents ambidexterity as a more effective and efficient strategy that offers superior innovation advantage to SMEs. We also present the role of openness in this relationship.

**Design/methodology/approach** – Empirical analysis was based on 388 SMEs in Ghana. Various validity and reliability checks were conducted before the presentation of the actual analysis, which was conducted using Ordinary Least Squares approach, run using SPSS (v. 20).

**Findings** – Findings indicate that although exploitative and exploratory learning strategies individually had a positive significant effect on SMEs' innovation performance, organizational learning ambidexterity was found to have a greater positive impact on innovation performance among SMEs. High levels of openness further boosted the effect of organizational learning ambidexterity on SMEs' innovation performance.

**Research limitations/implications** – This study was conducted without recourse to some specific factors that could influence organizational learning ambidexterity among SMEs. Future studies should thus pay particular attention to the determinants of organizational learning ambidexterity among SMEs.

**Practical implications** – Innovation performance is very critical for the sustainability of firms, and SMEs in particular. Management of SMEs must therefore seek to simultaneously adopt both learning strategies, as that gives firms greater advantage, compared to the adoption of only one strategy.

**Originality/value** – The study demonstrates that organizational learning ambidexterity had a superior effect on SMEs' innovation performance. High levels of openness further boosted the effect of organizational learning ambidexterity on SMEs' innovation performance.

**Keywords** Organizational learning, Exploitative learning, Exploratory learning, Ambidexterity, Open innovation, Innovation performance

**Paper type** Research paper

## 1. Introduction

Small and medium-sized enterprises (SMEs) are very crucial for the economic development of nations, whether developed or developing. For emerging economies, SMEs contribute about 45 percent of total jobs, and 33 percent towards GDP (OECD, 2017). When taking informal businesses in both developed and developing economies into consideration, SMEs contribute to over 50 percent job creation and GDP (IFC, 2010). Similarly, in Europe, SMEs constitute 99 percent of all business, and provided 85 percent of new jobs (European Commission, 2019). As such, there is much attention on the macro and microeconomic dominants of SMEs' success. The academia has also been contributing its quota, by conducting research into the various determinants of SMEs' business success. This current study also extends the body of



knowledge, by assessing how the various interplays of organizational learning ambidexterity and openness influence SMEs' innovation performance. We focused on firm-level innovation, that is, SMEs' success in their product and process innovations. Emphasis was placed on SMEs' ability to develop new products or services with speed, launch new products or service on time, quick response to competitors' actions, and ability to alter business process for new learning (Abdallah *et al.*, 2019; Cherrafi *et al.*, 2018).

Innovation has remained the focus of many firms and firms' innovation success have been attributed to organizational learnings, that is, the ability of the organization to learn new competencies (March, 1991). Organizational learning ambidexterity on the other hand represents firms' ability to simultaneously engage in both exploitative and exploratory learning (O'Reilly and Tushman, 2008; Chang *et al.*, 2011). There are two schools of thought regarding the adoption of exploitative and exploratory learning strategies. The first school of thought which was championed by March (1991) suggested that these two learning strategies are contradictory or competitive in nature. This is based on the backdrop that firms have limited resources which are competed for by either exploitation of existing knowledge and competencies, or exploration of new knowledge and competencies, which are based on different organizational routines (Kyriakopoulos and Moorman, 2004; Benner and Tushman, 2003). According to March (1991) the activities involved in both learning strategies are self-reinforcing, creating "success traps" through exploitation, or "failure traps" through exploration of new competencies.

On the other hand, the second school of thought suggests these two learning strategies are complementary, making room for simultaneous adoption by firms (Li and Huang, 2013; Chang *et al.*, 2011; Gilson *et al.*, 2005; Beckman *et al.*, 2004; Gibson and Birkinshaw, 2004). According to this school, exploitation activities provide the needed cash flows for exploratory activities, while exploration also provides the needed capabilities for the long-term survival of firms. The simultaneous adoption of both learning strategies (ambidexterity) therefore provide firms with both short and long-term success.

From the first school of thought, firms have limited or scarce resources, making it difficult to adopt both learning strategies simultaneously. This is even more profound among SMEs, who are more resource challenged when it comes to innovation. Due to this resource limitations, studies on ambidexterity have largely focused on large firms, since they are more resourced for ambidexterity (Jansen *et al.*, 2006; Raisch and Birkinshaw, 2008; Raisch *et al.*, 2009). The few studies on ambidexterity in the context of SMEs have focused on antecedents of SMEs' innovation ambidexterity (Soto-Acosta *et al.*, 2018; Chang *et al.*, 2011; Chang and Hughes, 2012), and product and market ambidexterity (Vos and Vos, 2013). SMEs and large firms however, differ in their response and susceptibility to external environment pressure, and as such, specific focus on organizational learning ambidexterity on SMEs' innovation performance is very critical (Chang *et al.*, 2011). Despite the resource limitation among SMEs, achieving organizational learning ambidexterity is still feasible when they open up. Innovation openness represents firms' external search strategies, in terms of its breadth and depth (Laursen and Salter, 2006). This may include customers, competitors, research institutions, regulatory bodies, higher educational institutions, government institutions, etc. (Stanko and Henard, 2017).

In this dispensing of shortened product life cycle as a result of rapidly changing and knowledge-intensive world, openness helps to increase operational flexibility of SMEs and firms in general (Ham *et al.*, 2017). From the perspective of Resource Dependence Theory (RDT), the essential resources needed for organizational performance resides in external environment (Pfeffer and Salancik, 1978). RDT proposes that firms are unable to internally generate all needed resources for their sustainability (Peng and Beamish, 2014), and therefore depend on outside supplying organizations for their survival (Zhang and Li, 2001). Opening up to external organizations and institutions therefore, helps SMEs to overcome the resource

challenge that hinders the simultaneous adoption of exploratory and exploitative learning strategies (Hernández-Espallardo *et al.*, 2011). SMEs that are open are therefore able to effectively engage in organizational learning ambidexterity, since they have access to external resources that are used to augment their limited internal resources (Chang and Hughes, 2012). We therefore support organizational learning ambidexterity among SMEs, and demonstrate that firm's level of openness makes ambidexterity more effective.

## 2. Theoretical and literature review

Rogers (1995, p. 276) defined innovation as a “an idea, a product, or process, system or device that is perceived to be new to an individual, a group of people or firms, an industrial sector or a society as a whole.” This study focused on both product and process innovation performance. Pan and Li (2016) presented product innovation performance as firm's efforts aimed at making products better, such as improving its quality, while Li and Ni (2016) defined process innovation as efforts aimed at reducing production cost and altering production function, to achieve competitive price. Since the commencement of the industrial revolution, innovation has been acknowledged to give a competitive advantage to firms (Heffner, 2006). Abdallah *et al.* (2019) defined innovation performance as firm's ability to develop innovative products, the speed of the development process, and the ability to introduce the product to the market on time. March (1991) presents two forms of innovation activities; exploitative and exploratory, which means innovation could be realized through the exploitation of existing knowledge and processes, or the exploration of new knowledge and processes. Exploitative or exploratory learning grants firms the intangible resource needed to successfully engage in innovation, and as such, this study draws on the resource-based view (RBV) and knowledge-based view (KBV) in explaining the interrelationship among organizational learning, openness, and innovation performance.

From the RBV perspective, the application of firm's unique capabilities and resources leads to SME's better innovation performance (Barney, 1991). SMEs seeking to have superior innovation performance must therefore possess tangible and intangible assets that are difficult for competitors to imitate. Organizational learning capabilities could provide SMEs with resources that are difficult to imitate by competitors in the industry. KBV also provides SMEs the strategies to leverage their knowledge base for innovation performance. Organizational learning and open innovation present firms with business knowledge which could be capitalized by SMEs for innovation performance (Grant, 1991, 1996).

By focusing on SMEs openness, RDT also become relevant to the study. From the RDT perspective, the essential resources needed for organizational performance reside in the external environment (Pfeffer and Salancik, 1978). For an improved innovation performance, SMEs therefore engage in open innovation to tap into the rich external resources in which the firm is deficient. Business sustainability is very critical, and business survival is dependent on resource availability, which is difficult for SMEs to fully achieve internally (Hillman *et al.*, 2009). The overlapping resource needs across multiple domains, give rise to this “multiplexity” of dependence (Lomi and Pattison, 2006). Firms therefore need to interact with external bodies to tap into the resources they cannot produce internally (Pfeffer, 1987; Yin and Shanley, 2008). Firms do this in the form of joint venture, strategic alliances, and industry network (Xia *et al.*, 2018). RDT has therefore been widely used in the research domain, to explain firms' environmental interdependence (Dong *et al.*, 2018).

### 2.1 Exploitative learning and innovation performance

In exploitative learning, firms focus on utilizing their existing capabilities and knowledge in their innovation and business processes. That is, the elaboration, refinement, and routinization of existing organizational experiences, were once discovered during the

exploration phases (Ojha *et al.*, 2018; Holmqvist, 2003). As presented by March (1991), the competence in exploitative learning is based on firm's investment in extending and refining the current organizational innovation processes, skills, and knowledge. Exploitative learning enables firms to sharpen their existing capabilities to innovate products that favorably compete under short-term market conditions (March, 1991). Exploitative learning emphasizes the synchronization of technological knowledge and market demand in the development of goods and services, based on firm's previous experience (Lane *et al.*, 2006; Lenox and King, 2004; Rothaermel and Deeds, 2004). High levels of knowledge use enhance knowledge absorption for innovation and firm performance (Zahra and George, 2002). Exploitative learning enhances the productivity and efficiency of firm's business operations (Eisenhardt and Martin, 2000; Levinthal and March, 1993), and past studies have shown that exploitative learning leads to unique innovation, since ideas are not exposed to outsiders for imitation (Ham *et al.*, 2017; Choi and Lee, 2012). That is, firm's static optimization of existing knowledge in stable business environment, has a significant effect on firm's innovation success. Exploitative learning is also more efficient when firms have limited time to develop new products, and have to just launch into the bank of their existing knowledge for the product development process.

The success of exploitative learning depends on the availability of exploitable capabilities, assets, or resources, which are under the control of a firm (Ojha *et al.*, 2018). Exploitative learning requires firms to reduce redundancies in the operational processes (Ojha *et al.*, 2018), as managers are expected to develop and improve their dispersion competencies, to reduce cost and enhance operational reliability (Kristal *et al.*, 2010). Exploitation is thus associated with operational efficiency, and enhances the in-depth understanding of existing knowledge, through various combinations of existing knowledge (Tamayo-Torres *et al.*, 2014; Huang *et al.*, 2015). Exploitation enhances decision-making, implementation, and control (Hardy III *et al.*, 2019; Atuahene-Gima and Murray, 2007), which reduces errors, reduces cycle time, has less complex applications due to familiarity, and improves the efficiency of new product development (Huang *et al.*, 2015; Li and Huang, 2013). Exploitative learning helps firms to effectively respond to existing environmental dynamics by adapting existing technology, that is, improving existing technological trajectory (Wang and Hsu, 2014). We therefore hypothesize that;

*H1.* Exploitative learning has a significant positive effect on SMEs' innovation performance.

### *2.2 Exploratory learning and innovation performance*

Exploratory knowledge is defined by March (1991) as knowledge characterized by search, experimentation, risk-taking, variations, and flexibility discovery. Levinthal and March (1993) also stated that exploratory learning is characterized by various experiences, risk-taking, and experimentation. The competence of exploration lies in the investment of resources with the aim of gaining entirely new knowledge, processes and skills, which helps firms to adapt to environmental changes in the long-term (March, 1991). Garud and Nayyar (1994) suggested that exploratory knowledge is very critical for a firm to realign its unique knowledge base. He and Wong (2004) added that exploratory learning leads to radical innovation meant to meet the needs of customers in emerging markets. That is, exploratory learning leads to the creation of new designs, new distribution channels, and new markets, based on knowledge that is new to the existing organizational knowledge (Fang and Chen, 2016; Raisch *et al.*, 2009; Kim *et al.*, 2012). SMEs' exploratory learning demands the development of new knowledge, ideas, and recombination of fresh knowledge (Faems *et al.*, 2012). Since exploratory learning is based on market and technological information, it grants long-term competitive advantage to firms, as well as the performance of new products

(Atuahene-Gima and Murray, 2007; Katila; Ahuja, 2002; Levinthal and March, 1993). Katila and Ahuja (2002) explained that exploratory learning grants new product development team, the access to emergent knowledge that helps to differentiate firm's new product from the competitors' product.

Exploratory learning helps firms to keep up with the pace of the rapidly changing business environment (Mainert *et al.*, 2018). Exploration is considered an antecedent to exploitation, as it focuses on search, experimentation, and discovery of transformational ideas, which are latter internalized by firms (Raisch and Tushman, 2016; Ojha *et al.*, 2018). Exploratory strategy involves constant switching between options, to develop broad range of potential organizational solution (Hardy III *et al.*, 2014). Exploration is thus associated with organizational effectiveness (Li and Huang, 2013). Exploratory learning helps firms to develop technological competencies to achieve competitive advantage in new product development and new niches (Tamayo-Torres *et al.*, 2014), and it is essential for firm's development of unique knowledge base (Wang and Xu, 2018). Firms that adopt exploratory learning strategy are able to expand their ability to accommodate variety of new technology and market knowledge for their product development, which increases their unique problem-solving competency (Tsai and Huang, 2008). Exploration increases the generation of entirely new organizational knowledge and competence, needed for new product development (Katila and Ahuja, 2002). Exploration strategy is positively related to new product development performance (Tsai and Huang, 2008), as it leads to continuous discovery of new market and technological competences for the development of innovative and unique products (Atuahene-Gima *et al.*, 2005; Lennerts *et al.*, 2020). We therefore hypothesize that;

H2. Exploratory learning has a significant positive effect on SMEs' innovation performance.

### *2.3 Organizational learning ambidexterity and innovation performance*

Learning could be at the organizational, group or individual level. This current study however, centers on the organization-level learning, with two main directions. The first direction is whether new learning emerged from the old knowledge path or an entirely new knowledge path (He and Wong, 2004). The second direction also focused on the usage of old or new knowledge itself, and not the path in knowledge generation (Simsek, 2009; Gupta *et al.*, 2006; Vassolo *et al.*, 2004). Since all organizational activities have an element of learning (Gupta *et al.*, 2006), this study adopts the second position, which focuses on the type of organizational learning, rather than the path.

From the conclusions of March's (1991) seminal work on organizational learning, it is apparent that exploitative and exploratory learning strategies are mutually exclusive, that is, incompatible. Studies like those con Greco *et al.* (2019) and Kyriakopoulos and Moorman (2004) have also presented similar argument on the mutually exclusivity of these learning approaches. Other studies however, opposed the logic of incompatibly, and considered exploitative and exploratory learning strategies as complementary (Posch and Garaus, 2019; Li and Huang, 2013; Gilson *et al.*, 2005; Beckman *et al.*, 2004; Gibson and Birkinshaw, 2004). Garcia *et al.* (2003) explained that, knowledge exploitation provides the cash flows needed for investment in exploratory learning or activities, whereas exploratory learning also provides the technological capability or support needed to further exploit existing knowledge. This makes others also see exploitation and exploratory learning as a cycle (Greco *et al.*, 2019). That is, the subsequent use of an explored knowledge leads to knowledge exploitation, and exploitation also provides the basis for exploration. The strategic allocation of firm's limited resources to these learning types however, has been complex and difficult (Sidhu *et al.*, 2007; Tushman and O'Reilly, 1996). The strategic choice between these two learning approaches lead to the concept of ambidexterity, in which firms pursue both

short-term growth through exploitation and long-term survival through exploratory (Lee *et al.*, 2018; He and Wong, 2004).

Turner *et al.* (2013) indicated that the word “ambidexterity” does not reflect managerial “activity,” but rather “capability” (p. 319). We therefore focused on SMEs’ managerial capability of simultaneously adopting exploratory and exploitative learning strategies. Organizational learning ambidexterity may be simultaneous (Simsek, 2009), or punctuated also known as sequential equilibrium (Gupta *et al.*, 2006). From the perspective of punctuated equilibrium, ambidexterity is achieved through the cyclical adoption of exploitative and exploratory learning strategies at different periods. That is, firms have the capability to adopt both exploitative and exploratory learning strategies, but at different time periods. Instead of spatially or periodically alternating between exploitation and exploration, we consider ambidexterity as the simultaneous adoption of both exploitative and exploratory learning strategies. That is, balancing the high levels of both exploitative and exploratory learning strategies within a given time period (Simsek, 2009). Wang and Xu (2018) indicated that, it is impossible to develop all technological and market competences through exploitation. Thus, the simultaneous adoption of the two learning strategies helps firms to acquire external competence to complement its internal competencies for success innovation.

SMEs thus need a balance between exploitation and exploratory learning strategies to achieve ambidexterity, as much focus on exploitation leads to organizational shortsightedness due to success trap, and excessive focus on exploration could also lead to firms getting trapped in the failure cycle (Hill and Birkinshaw, 2014; Ganzaroli *et al.*, 2016; Gupta *et al.*, 2006; Levinthal and March, 1993). Excessive exploratory may lead to underdeveloped innovations, which is a cost to the firm. There is therefore an important implication in balancing exploitation and exploratory activities in the organization, because of the complimentary effect of these two strategies. While exploitation supports static optimization, exploration promotes dynamic optimization. In a short-term stable business environment, firm’s exploitation of consolidated competencies becomes very crucial, while in the long-term dynamic business environment, exploration of new business competencies also becomes very crucial. The combination of these two strategies is therefore very important for firm’s innovation success and competitive advantage (O’Reilly and Tushman, 2013; Eisenhardt and Martin, 2000).

Chang *et al.* (2011) likens exploration to the “research” aspect of R&D process, while exploitative focuses on the “development” aspect. Ambidexterity therefore makes R&D complete. Similarly, Simsek (2009, p. 599) indicated that “upstream units, such as production, are responsible for exploitation, while downstream units, such as marketing and sales, are responsible for exploration.” This, Simsek (2009) referred to as structural ambidexterity. Vos and Vos (2013) also indicated that larger firms have the resources and capabilities required to benefit from a market ambidexterity strategy, however, developing and sustaining market ambidexterity is necessary to drive long-term growth of all firms. Chang *et al.* (2011) however indicated that, in a highly dynamic and competitive environment, SMEs achieve organizational ambidexterity through high centralization and connectedness, which was supported by Andriopoulos and Lewis (2009). Internal organizational structures and leadership styles also shape the adoption of ambidexterity by SMEs (Chang and Hughes, 2012; Jansen *et al.*, 2006). Turner *et al.* (2013) also present organizational capital, social capital, and human capital as the driving force of organizational ambidexterity. Soto-Acosta *et al.* (2018) asserted that achieving innovation ambidexterity among SMEs is possible when suitable organizational contexts are developed to promptly respond to the changes in business environment. Organizational ambidexterity enhances SMEs’ performance by reducing the risk of “success traps” through exploitation, or “failure traps” (Cao *et al.*, 2009). He and Wong (2004) stressed that the interaction between explorative and exploitative innovation strategies leads to performance of firms. We therefore hypothesize that;

H3. Organizational learning ambidexterity has a significant positive effect on SMEs' innovation performance.

2.4 Moderating role of openness

Open innovation as a management practice is concerned with the purposeful knowledge inflow and outflow for an enhanced innovation performance (Chesbrough *et al.*, 2014; Dahlander and Gann, 2010; Chesbrough, 2003). Open innovation grants firms the ability to “tap into shared creativity” (Bessant and Moslein, 2011). In recent times, studies are shifting from open innovation in large corporations to SMEs (Santoro *et al.*, 2018; Usman *et al.*, 2018; Vanhaverbeke, 2017; Brunswicker and Van de Vrande, 2014). Specifically, openness in innovation (or innovation openness) considers firms' external search strategies, in terms of its breadth and depth (Laursen and Salter, 2006). Openness breadth deals with how widely firm searches (number of external sources of search), while openness depth also focuses on how deeply firm searches (frequency of interaction per each search source) (Laursen and Salter, 2014). External search source may include customers, competitors, research institutions, regulatory bodies, higher educational institutions, government institutions, etc. (Stanko and Henard, 2017).

Further, our earlier discussions indicate that organizational learning ambidexterity influences innovation performance. That is, firm's innovation performance through exploitative learning could be further boosted by employing exploration learning as a complementary tool. The interactive effect of exploitation and exploratory learning is thus found to positively affect innovation performance of firms (Posch and Garaus, 2019). Since openness and exploratory learning have a positive relationship (Popa *et al.*, 2017), it is expected that the complementary effect of exploratory learning and exploitative learning on innovation performance, would be further enhanced by firms that are more open. Openness has been established to positively influence innovation performance (Popa *et al.*, 2017; Laursen and Salter, 2006; Roper *et al.*, 2013), however, it is firms that engage in exploratory learning that are able to fully capture the potential of openness (Cheng and Shiu, 2015; Gassmann *et al.*, 2010). Openness helps SMEs to gain access to external knowledge at a minimal cost, and also get to understand the activities of competitors in the market (Tiwana and Bush, 2007). Openness helps SMEs to bridge the innovation gap between them and their competitors, with less time and cost. Openness therefore grants SMEs the flexibility and also increases their knowledge base (Zahra and Nielsen, 2002). We therefore hypothesize that;

H4. Openness positively moderates the positive effect of organizational learning ambidexterity on SMEs' innovation performance.

Figure 1 presents the conceptual framework of the study. The framework depicts exploitative and exploratory learning strategies, to have a direct positive effect on innovation

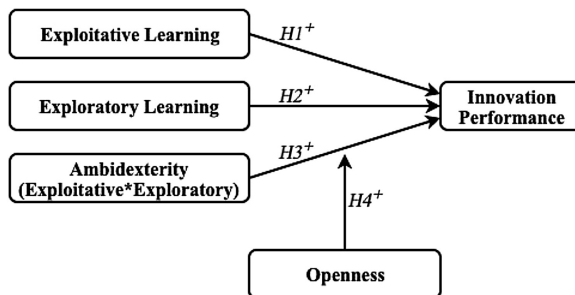


Figure 1.  
Conceptual framework

performance. The interaction of the two learning strategies (which is termed ambidexterity) also had a positive effect on innovation performance. Lastly, firm's innovation openness strategy was also depicted to positively moderate the ambidexterity and innovation performance relationship.

### 3. Methods

The study adopted survey research strategy by collecting large volume of quantitative data through a standardized questionnaire (Saunders *et al.*, 2009). This study was deductive in nature (theory testing), and therefore survey was a suitable strategy, as indicated by past researchers (such as Trochim, 2005). The definition of SME needed to be placed into perspective, and as such, it was defined using the National Board for Small Scale Industries' (NBSSI's) employee criteria. NBSSI (1990) classified firms with 6–29 employees as Small, and 30–99 employees as Medium enterprises. As presented in Table I, firms studied had employees ranging from 6 to 99, but dominated by medium-sized firms. Manufacturing firms dominated the study, constituting about 60 percent of firms. Firms studied had at least 5 years of operations, although the majority had 11–15 years of operating experience. The respondents to the questionnaire were either marketing managers, sales managers, customer relationship managers, new product managers, R&D managers, operations managers, and supply chain managers.

The list of registered SMEs was obtained from NBSSI, which had name of business, year of registration, nature of business, contact, and location. With simple random sampling, 1,000 SMEs who had operated for at least five years with full contact details (email, phone and postal address) were selected. The minimum age was set at 5 years so firms selected will have the necessary operational experience to provide reliable response to the concepts under study. First, a printed version of the questionnaire, cover letter and a postage-paid return envelope were sent to the general managers of these SMEs. Secondly, the web link to the online questionnaire and a cover letter were also emailed to the SMEs. This was to give firms the flexibility of responding to the questionnaire in any preferred format. Phone calls followed after 4 weeks of not getting response from some of the SMEs. After 6 weeks of data collection process, 388 questionnaires were appropriately filled and returned. In Ghana, there are quite a significant number of SMEs operating without duly registering, making it difficult to have a very accurate estimation of SMEs number. This notwithstanding, Kirby *et al.* (2002) showed

Firms and respondents' background	Frequency	Percentages (%)
<i>Industry</i>	388	100%
Manufacturing	236	60.82
Service	152	39.18
<i>Size</i>	388	100%
6–29 employees	156	40.21
30–99 employees	232	59.79
<i>Age of firm</i>	388	100%
5–10 years	97	25.00
11–15 years	136	35.05
16–20 years	93	23.97
Above 20 years	62	15.98
<i>Functional diversity</i>	388	100%
Marketing and Sales	162	41.75
R&D unit	117	30.15
Production	66	17.01
Supply Chain	43	11.08

**Table I.**  
Firms and  
respondents'  
background



that, a population figure of 10,000,000, with 95 percent confidence level and a 5 percent margin of error, a sample size of 384 is enough. Our sample of 388 SMEs was therefore deemed to fairly represent the SMEs population in Ghana.

### 3.1 *Survey questionnaire and measures*

The study used structured questionnaire in the data collection, which was pretested on 20 SMEs. Through the pretest, all ambiguous questions were rephrased for clearer understanding.

**3.1.1 *Main variables.*** The study used three main explanatory variables, which were, exploitative learning, exploratory learning, and openness. Exploitative learning is defined as the elaboration, refinement and routinization of existing organizational competencies (Holmqvist, 2003). This study measured exploitative learning by focusing on SMEs' search for information to refine common methods and ideas in solving problems, to ensure productivity rather than those ideas that could lead to implementation mistakes, and to emphasize the use of knowledge related to existing experience and competencies. It also focused on the use of information acquisition methods that helped to understand and update the firm's current market experiences, and also searching for the usual and generally proven methods and solutions to product development problems. The measurement variables were adopted from Li and Huang (2013), and responded to on a Likert scale of 1: Strongly disagree, to 5: Strongly agree.

Exploratory learning on the hand is defined as the learning strategy that is characterized by experimentation, risk-taking, variations, and flexibility discovery (March, 1991). We measured exploratory learning by asking questions on SMEs' information search that focused on acquiring knowledge of strategies that involve experimentation and high market risks, preference for information with no identifiable strategic market needs to ensure experimentation, acquiring knowledge to develop strategies that lead into new areas of learning such as new markets and technological areas, collecting novel information and ideas that go beyond our current market and technological experiences, and collecting new information that compels firms to learn new things. The measurement variables were adopted from Li and Huang (2013), and responded to on a Likert scale of 1-Strongly disagree, to 5- Strongly agree.

Openness is defined as firms' external search strategies, in terms of its breadth and depth (Laursen and Salter, 2006). From literature, ten possible sources for external knowledge search for SMEs could be identified. These were customers, suppliers, competitors, consultants, contracted R&D or design firms, distributors/retailers, universities or other research institutes, regulatory and standards bodies, industry technical/trade associations, and investors (Laursen and Salter, 2014; Stanko; Henard, 2017). To simultaneously capture both openness breadth and depth, the respondents were asked to indicate the frequency with which their firms sourced knowledge from each of these ten sources, using a Likert scale of 1: Not at all, to 5: Very often. Ticking 1 or 2 (Likert scale) for more external sources listed, indirectly implies that SME sourced external knowledge from limited sources (low openness breadth), and also had less frequent contact with external sources (low openness depth).

The dependent variable for this study was innovation performance. Innovation performance in this study is conceptualized as SMEs' ability develop new products/services with speed, ability to launch new products/services on time, ability to introduced a number of changes in business processes in past one year, and also able to quickly respond to the new processes introduced by competitors within their industry. The study thus focused on firm-level innovation, using Likert scale of 1: Strongly disagree, to 5: Strongly agree. These measurement variables were adapted from Abdallah *et al.* (2019) and Cherrafi *et al.* (2018).

**3.1.2 *Control variables.*** The study controlled for seven potential variables which could potentially influence SMEs' innovation performance. These were, industry, age of the SME,

size, functional diversity, R&D innovativeness, R&D investment, and individual profile. The type of industry was controlled for because each industry has some unique features which could influence its innovation activities (Boso *et al.*, 2013). The type of industry coded as 0: service and 1: manufacturing. Similarly, Boso *et al.* (2013) found that firm size could significantly influence innovation activities in a firm. Wu *et al.* (2016) also indicated that the R&D activities across younger and older firms are different, which results in different innovation performances.

To have a better appreciation of organizational learning ambidexterity among SMEs, the innovativeness of their R&D activities was controlled for. As indicated by Garcia and Calantone (2002) nature of firm's R&D projects is very critical for the firm's innovation success, as also presented by Longo and Narduzzo (2017). In this current study, respondents were asked to rate the level of their firm's R&D project, using a Likert scale of 1: Not innovative at all, to 5: Highly innovative. The level of firm's investment in R&D would likely also have a direct influence on their innovation performance. As such, we controlled for firms' investment in R&D. Here, respondents were asked to compare their investment in R&D with the annual cash inflows of their firm, and respond using a Likert scale of 1: Very low, to 5: Very high.

The individual profile measured by respondent's attitude, skills and job satisfaction was also controlled for, as suggested by Longo and Narduzzo (2017). Prior studies have presented job satisfaction to significantly relate with innovative behaviors (Hage and Aiken, 1970; Longo and Narduzzo, 2017). On a Likert scale of 1: Not satisfied at all, to 5: Very satisfied, respondents were asked to rate their creativity in problem solving and generation of new ideas, ability to communicate and listen to other opinions, reliability, precision and timelines in deliveries, attitude toward working with others, level of autonomy in decision making, responsibility at work (Longo and Narduzzo, 2017). Finally, functional diversity (department of respondents) was controlled for. The respondents for the study came from diverse departments including, production, supply chain, marketing and sales, and R&D unit.

### *3.2 Common method variance (CMV) social desirability bias*

For firm-level analysis, where single senior management member from each firm respond to the questionnaire, it is important to check for potential CMV (MacKenzie and Podsakoff, 2012). Firstly, confidentiality and anonymity were assured the respondents, so as to reduce evaluation anxiety. As indicated earlier, we also pretested the questionnaire to correct any ambiguity in the questionnaire. Fuller *et al.* (2016) recommended Harman's single-factor test through exploratory factor analysis (EFA). From the unrotated factor solution performed using SPSS (v. 20), four items were extracted, in accordance with the studied variables. Each extracted factor had an eigenvalue greater than 1, and the variance explained by the largest factor was 32.6 percent. No single factor therefore accounted for most of the covariance among the study variables.

In accordance with the suggestion of Lindell and Whitney (2001), we also conducted partial correlations, to assess whether there existed any significant difference in the correlations between variables after restricting for a marker variable (theoretically unrelated to at least one of the other constructs). Results showed that the zero-order and partial correlations were similar after restricting for the marker variables, and therefore also conclude that CMV was not a problem.

The data for each key construct were collected via survey questionnaires, which were self-reported. The study also adopted a subjective measurement of each key construct, instead of an objective measurement like secondary data. These represent the tendency of the respondents to provide favorable responses which may not be the true reflection of what actually the situation is (Steenkamp *et al.*, 2010), and could therefore lead to socially desirable responding (SDR). In addressing SDR, past studies like Papadas *et al.* (2019) adopted SDR

scale (Appendix 1) developed by Strahan and Gerbasi (1972). SDR is said to be present when the correlation between SDR scale and other variables in the model are high and significant (Papadas *et al.*, 2019). The test conducted for this study indicates that the correlation between SDR scale and study variables (exploitative learning, exploratory learning; ambidexterity, openness, and innovation performance) were all low and statistically insignificant. The highest coefficient was between SDR scale and innovation performance ( $r = 0.211$ ).

### 3.3 Reliability and validity of the constructs

Confirmatory Factor Analysis (CFA) was run using STATA (v. 15), with results presented in Table II. Prior to the CFA, EFA was conducted, where items with poor factor loadings were deleted from the analysis. Based on Hair *et al.*'s (2010) recommended fit indices criteria, we conclude that our data appropriately fit the construct model.  $\chi^2$  is expected to be statistically insignificant at 5 percent,  $\chi^2/df$  is supposed to be less than 3, TLI and CFI are all expected to be greater than 0.90, while RMSEA and SRMR are also expected to be less than 0.08. The average variance extracted (AVE) for all the constructs were greater than 0.5 (the recommended threshold by Fornell and Larcker, 1981), composite reliability (CR) and Cronbach's Alpha (CA) were also greater than 0.7 as expected (Bamfo *et al.*, 2018; Brown, 2014).

As presented by Bamfo *et al.* (2018), the discriminant validity for the constructs were assessed by comparing the squared-root of the AVEs ( $\sqrt{AVEs}$ ) with the inter-correlation scores. To conclude there was discriminant validity, the  $\sqrt{AVEs}$  are expected to be greater than the respective inter-correlation scores. From Table III, results showed  $\sqrt{AVEs}$  were greater in all cases, and was therefore concluded that there existed discriminant validity among the constructs studied. The highest correlation score was 0.644, indicating there was not high correlation among any two variables studied.

## 4. Results

The conceptual framework for this study (Figure 1) falls under the Model 3 of Hayes' (2017) model and statistical analysis. As such, the various paths estimated were based on the suggestions of Hayes (2017), which was same as the study presented by Dawson and Richter (2006) on three-way interaction effect. From the analysis presented in Table IV (Model 1), R&D innovativeness and R&D investment had a positive effect on SMEs' innovation performance, and age had a negative and significant effect. Functional diversity and individual profile had a positive but insignificant effect on SMEs' innovation performance, whereas industry had a negative but insignificant effect. As the main variables were added to the equation (Models 2–4), R&D innovativeness and R&D investment had a significant effect on SMEs' innovation performance, but all other control variables had no significant effect. In the full model (Model 4), exploitative learning had a positive and significant effect on SMEs' innovation performance. Similarly, exploratory learning and openness had a positive and significant effects, although Ham *et al.* (2017) found a negative relationship between SMEs' openness and innovation performance.

Residual centering approach was used in calculating the interaction terms. From Model 4 (Table IV), the interaction between exploitative and exploratory learning strategies (Exploitat×Explora) had a positive and significant effect on SMEs' innovation performance. This implies organizational learning ambidexterity had a significant effect on SMEs' innovation performance. The interaction between openness and exploratory learning (Openness×Explora) had a positive and significant effect. The interaction between openness and exploitative learning however had a negative and insignificant effect on SMEs' innovation performance. The interaction among openness, exploitative and exploratory learning (Openness×Exploitat×Explora) had a positive and significant effect. This implies that SMEs' openness, positively moderates the positive effect of organizational learning

Observed and latent variables  
 $\chi^2 = 21.45[12]$ ;  $p$ -value = 0.348; RMSEA = 0.041; SRMR = 0.038; TLI = 9.671; CFI = 9.711

Std. Factor  
loading

*Exploitative Learning: CA = 0.861; CR = 0.863; AVE = 0.560*

Source: [Li and Huang \(2013\)](#)

Our aim is to search for information to refine common methods and ideas in solving problems 0.724

Our aim is to search for ideas and information that we can implement well to ensure productivity rather than those ideas that could lead to implementation mistakes 0.641

We search for the usual and generally proven methods and solutions to product development problems 0.870

We use information acquisition methods (e.g., survey of current customers and competitors) that help us understand and update the firm's current market experiences 0.807

We emphasize the use of knowledge related to our existing experience and competencies 0.677

*Exploratory Learning: CA = 0.917; CR = 0.936; AVE = 0.748*

Source: [Li and Huang \(2013\)](#)

In information search, we focus on acquiring knowledge of strategies that involve experimentation and high market risks 0.944

We prefer to collect information with no identifiable strategic market needs to ensure experimentation 0.903

Our aim is to acquire knowledge to develop strategies that lead us into new areas of learning such as new markets and technological areas 0.813

We collect novel information and ideas that go beyond our current market and technological experiences 0.726

Our aim is to collect new information that forces us to learn new things 0.919

*Openness: CA = 0.898; CR = 0.918; AVE = 0.557*

Source: [Stanko and Henard \(2017\)](#); [Laursen and Salter \(2014\)](#)

In your organization, to what extent are new product development ideas drawn from:

Customers 0.659

Suppliers 0.806

Competitors 0.749

Consultants 0.778

Contracted R&D or design firms 0.707

Distributors/retailers 0.602

Universities or other research institutes 0.800

Regulatory and standards bodies 0.802

Industry technical/trade associations 0.788

Investors (i.e., equity investors) ∞

*Innovation Performance: CA = 0.824; CR = 0.873; AVE = 0.633*

Source: [Abdallah et al. \(2019\)](#) and [Cherrafi et al. \(2018\)](#)

We are able to develop new products/services with speed 0.777

We are able to launch new products/services on time 0.834

Introduced a number of changes in our business processes in past one year 0.824

Quick response to the new processes introduced by competitors within our industry 0.743

*Individual Profile: CA = 0.884; CR = 0.906; AVE = 0.620*

Creativity in problem solving and generation of new ideas 0.796

Ability to communicate and listen to other opinions 0.706

Reliability, precision and timeliness in deliveries 0.803

Attitude toward working with others 0.618

Level of autonomy in decision making 0.898

Responsibility at work 0.869

**Note(s):** ∞ ~ Item deleted due to poor factor loading

**Table II.**  
Confirmatory factor  
analysis

**Table III.**  
Discriminant validity  
and descriptive  
analysis

Variables	Min.	Max.	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11
Industry (1)	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Age (2)	2	5	—	—	0.043	—	—	—	—	—	—	—	—	—	—
Size (3)	1	2	—	—	0.055	0.540**	—	—	—	—	—	—	—	—	—
Functional diversity (4)	1	4	—	—	0.220	0.184	0.235*	—	—	—	—	—	—	—	—
R&D innovativeness (5)	2	5	3.669	1.175	0.231	0.322*	0.323*	0.326*	—	—	—	—	—	—	—
R&D investment (6)	1	5	3.466	0.915	0.142	0.162	0.401**	0.187	0.413**	—	—	—	—	—	—
Individual profile (7)	3	5	4.266	1.162	0.212	0.164	0.257*	0.326*	0.221	0.280*	0.787	—	—	—	—
Exploitative (8)	2	5	3.974	1.125	0.152	0.202	0.206*	0.374*	0.435**	0.305*	0.280*	0.748	—	—	—
Exploratory (9)	2	5	4.076	1.099	0.194*	0.126	0.218*	0.193	0.357**	0.401**	0.205	0.504**	0.865	—	—
Openness (10)	1	5	3.743	1.084	0.147	0.109	0.138	0.217	0.492**	0.457**	0.162	-0.369**	0.534**	0.740	—
Innovation Performance (11)	2	5	3.436	0.930	-0.030	-0.136	0.142	0.438	0.542**	0.644*	0.364*	0.451**	0.440**	0.538**	0.796

**Note(s):** \*\* ~ *p*-value significant at 1% (0.01); \* ~ *p*-value significant at 5% (0.05); √ AVE are italicized

Variables	Model 1	Model 2	Model 3	Model 4	VIF
Constant	4.016 (10.052) <sup>***</sup>	2.824 (6.033) <sup>**</sup>	2.289 (4.610) <sup>**</sup>	1.765 (4.966) <sup>***</sup>	1.773
Industry	-0.111 (-1.530)	-0.124 (-1.769)	-0.135 (-1.532)	-0.105 (-1.419)	2.336
Age	-0.280 (-2.175) <sup>*</sup>	-0.143 (-1.707)	-0.195 (-1.841)	-0.117 (-1.214)	1.722
Size	0.201 (1.978) <sup>*</sup>	0.111 (1.209)	0.158 (1.064)	0.103 (1.126)	2.282
Functional diversity	0.133 (1.276)	0.181 (1.747)	0.104 (1.286)	0.131 (1.447)	2.316
R&D innovativeness	0.397 (2.726) <sup>**</sup>	0.277 (2.270) <sup>*</sup>	0.221 (2.106) <sup>*</sup>	0.230 (2.325)	1.501
R&D investment	0.313 (2.660) <sup>**</sup>	0.225 (2.072) <sup>*</sup>	0.217 (1.970) <sup>*</sup>	0.195 (1.981) <sup>*</sup>	2.247
Individual profile	0.171 (1.878)	0.121 (1.287)	0.108 (1.161)	0.089 (1.417)	2.060
Exploitative		0.468 (7.538) <sup>***</sup>	0.478 (2.921) <sup>**</sup>	0.328 (4.417) <sup>**</sup>	1.709
Exploratory		0.428 (5.053) <sup>**</sup>	0.305 (2.861) <sup>**</sup>	0.269 (1.980) <sup>*</sup>	1.423
Openness		0.311 (2.403) <sup>*</sup>	0.330 (3.569) <sup>**</sup>	0.327 (3.923) <sup>**</sup>	2.028
Exploitat×Explora			0.567 (4.277) <sup>**</sup>	0.549 (3.829) <sup>**</sup>	2.165
Openness×Exploitat			-0.262 (1.716)	-0.253 (1.329)	2.053
Openness×Explora			0.370 (2.322)	0.362 (3.016) <sup>**</sup>	1.572
Openness×Exploitat×Explora				0.591 (3.229) <sup>**</sup>	
R <sup>2</sup>	0.201	0.364	0.525	0.596	
F	6.096 <sup>**</sup>	11.569 <sup>**</sup>	8.176 <sup>**</sup>	12.362 <sup>**</sup>	
R <sup>2</sup> Δ	-	0.163	0.161	0.071	
FΔ	-	6.316 <sup>**</sup>	5.619 <sup>**</sup>	3.034 <sup>*</sup>	

Note(s): <sup>\*\*\*</sup> *p*-value significant at 1% (0.01); <sup>\*\*</sup> *p*-value significant at 5% (0.05); <sup>\*</sup> *t*-values are in parentheses

Table IV.  
Moderation analysis

ambidexterity on SMEs' innovation performance. From the analysis presented in [Table IV](#), all the hypotheses (H1–H4) for the study were confirmed.

## 5. Discussions

Firstly, we hypothesized that exploitative learning has a significant effect on SMEs' innovation performance (H1), which was confirmed from the analysis. Firms that emphasize on exploitative learning engage in idea and information search that helps to boost productivity, rather than ideas that has lots of uncertainties. That is, firms search for information that aids in the refinement of existing methods and ideas for solving organizational problems. Exploitative learners emphasize on generally proven problem solving methods in product development, based on knowledge in existing project experience ([Ojha et al., 2018](#)). [Ham et al. \(2017\)](#) indicated that exploitative learning leads to unique innovation, since ideas are not exposed to outsiders for imitation. That is, SMEs that engage in exploitative learning are able to develop new products with speed, launch new products on time, able to introduce new business processes, and also has the ability to effectively match competitors' new business processes ([Abdallah et al., 2019](#); [Cherrafi et al., 2018](#); [Choi and Lee, 2012](#)). [March \(1991\)](#) also stated that exploitative learning enables firms to sharpen their existing capabilities to innovation products that favorably compete under short-term market conditions. By leveraging on past absorbed knowledge through new combinations ([Huang et al., 2015](#)), SMEs will be able to increase their innovation efficiency ([Tamayo-Torres et al., 2014](#)). Exploitation strategy will enable SMEs to develop cost-effective ways of innovation, and also reduces the cycle time for new product development ([Hardy III et al., 2019](#); [Li and Huang, 2013](#)). Exploitation strategy improves SMEs' innovation efficiency through quick decision-making, implementation, and control ([Atuahene-Gima and Murray, 2007](#)).

Secondly, we hypothesized that exploratory learning has a significant effect on SMEs' innovation performance (H2), and results of the study confirmed this. Exploratory learning allows SMEs to focus on acquiring knowledge or business strategies that involve experimentation and high market risks. Exploratory learners emphasize the acquisition of knowledge in new areas of learning such as new markets and technological areas. That is, knowledge acquired falls outside the existing market and technological experiences, with no identifiable strategic market needs. [March \(1991\)](#) indicated that this kind of learning helps firms to adapt to market changes in the long-term. Exploratory learning grants new product development team, the access to emergent knowledge that helps to differentiate firm's new product from the competitors' product ([Katila and Ahuja, 2002](#)), which [Atuahene-Gima and Murray \(2007\)](#) indicate grants firms long-term competitive advantage in new product development. SMEs that engage in exploratory learning are able to acquire knowledge to be more innovative, develop new products with speed, launch new products on time, able to introduce new business processes, and also has the ability to effectively match competitors' new business processes ([Raisch and Tushman, 2016](#); [Ojha et al., 2018](#); [Lennerts et al., 2020](#)). As indicated by [Wang and Xu \(2018\)](#), exploratory learning is essential for firm's development of new unique knowledge base, for innovation advantage. Exploratory learning presents SMEs with varied innovation options in its product development ([Li and Huang, 2013](#); [Tsai and Huang, 2008](#)), based on current trends in the business environment ([Mainert et al., 2018](#)). [Tsai and Huang \(2008\)](#) specifically found exploratory learning strategy to have significant positive effect on new product performance.

Thirdly, we hypothesized that organizational learning ambidexterity has a significant effect on SMEs' innovation performance (H3). The first point of call for SMEs would be to engage in exploitation of their existing knowledge for innovation agenda. Next option will be for firms to also adopt exploratory learning for their business and innovation activities, and the simultaneous use of exploitative and exploratory learning strategies is termed organizational learning ambidexterity. From the work of [March \(1991\)](#), exploitative and exploratory learning

strategies are supposed to be mutually exclusive. Implying that firms could only adopt one strategy at a time, because firms have fixed resources which both strategies compete for. The relationship between these strategies is therefore expected to be negative, as the adoption of one leads to the neglect of the other. Other studies have however opposed that position, and considered both strategies as complementary instead of competing (e.g., Posch and Garaus, 2019; Li and Huang, 2013; Gilson *et al.*, 2005; Beckman *et al.*, 2004). This current study also supports the position that exploitative and exploratory learning strategies are complementary, as the relationship among them was found to be positive (Table III). We therefore support the position of organizational learning ambidexterity among SMEs, as results indicate that the positive effect of exploitative learning on innovation performance is further strengthened by engaging in exploratory learning activities (Table IV). In Model 4 of Table IV, it is realized that organizational learning ambidexterity (Exploitat×Explora) had a higher coefficient ( $\beta = 0.549$ ;  $t = 3.829$ ) than that of exploitative ( $\beta = 0.328$ ;  $t = 4.417$ ) and exploration ( $\beta = 0.269$ ;  $t = 1.980$ ) learning strategies.

Lastly, we hypothesized that firms' openness positively moderates the positive effect of organizational learning ambidexterity on SMEs' innovation performance (H4), which was also supported by the analysis. SMEs that are open, engage in active and deliberate information search from customers, suppliers, distributors, competitors, consultants, external R&D or design firms, higher learning institutions and trade associations. Breadth of openness is measured by the number of external stakeholders that firms share information with, while the depth looks at the frequency with which knowledge is exchanged with a particular stakeholder. SMEs by their nature, have limited financial and human resources for effective innovation (Ham *et al.*, 2017). Developing internal knowledge may be time consuming, as there is abundant knowledge outside the firms, which is easily accessible (Tiwana and Bush, 2007; Haas and Hansen, 2005). Bessant and Moslein (2011) suggested that openness grants firms the ability to "tap into shared creativity." As also indicate by Tiwana and Bush (2007), openness helps firms to gain access to external knowledge at a minimal cost, and also get to understand the activities of competitors in the market. Results as presented in Model 4 of Table IV indicate that the moderating effect of openness in the relationship between organizational learning ambidexterity and SMEs' innovation performance had the largest coefficient ( $\beta = 0.591$ ;  $t = 3.229$ ). That is, the combined effect of exploitative learning, exploratory learning and openness, has greater impact on SMEs innovation performance, compared to the individual effects. Adopting openness therefore helps SMEs to fully capture the potentials in exploratory learning (Cheng and Shiu, 2015; Gassmann *et al.*, 2010). This study thus concludes that, the positive effect of organizational learning ambidexterity on SMEs' innovation performance is further enhanced by firm's level of openness. This is supported by the three-way interaction model presented at Appendix 2, which indicates that at higher levels of exploratory learning and openness, the effect of exploitative learning on SMEs' innovation performance becomes greater.

## 6. Conclusion and contributions

The study concludes that although exploitative and exploratory learning strategies individually had a positive significant effect on SMEs' innovation performance, organizational learning ambidexterity was found to have a greater positive impact on innovation performance among SMEs. High levels of openness further boosted the effect of organizational learning ambidexterity on SMEs' innovation performance.

### 6.1 Theoretical implications and contributions

The concept of ambidexterity has been widely studied in the business domain, and SMEs have also had a fair share of researches on ambidexterity. Prior studies on ambidexterity have however largely focused on innovation ambidexterity. Chang *et al.* (2011) focused on the



internal and external antecedents of SMEs' innovation ambidexterity outcomes. [Soto-Acosta et al. \(2018\)](#) provided insight on the combined role of information technology, knowledge management and environmental dynamism as drivers of SMEs' innovation ambidexterity. [Chang and Hughes \(2012\)](#) also presented the drivers of SMEs' innovation ambidexterity. [Voss and Voss \(2013\)](#) presented strategic ambidexterity in SMEs, where the focus was placed on product and market ambidexterity. Our current study contributes to SMEs' ambidexterity literature by focusing specifically on organizational learning capabilities. While innovation is defined as "an idea, a product, or process, system or device that is perceived to be new to an individual, a group of people or firms, an industrial sector or a society as a whole" ([Rogers, 1995](#), p. 276), organizational learning is defined as the constant and dominant interpretation of business environment by firms, leading to the acceptance of new knowledge to either complement or replace old knowledge ([Michael, 1973](#)). Although the study of [Lubatkin et al. \(2006\)](#) focused on knowledge ambidexterity in SMEs, the study focused on its orientation. That is, the tendencies or willingness of SMEs to either exploit internal knowledge or explore external knowledge. Our current study however, focused on the actual knowledge exploitation and exploration for organizational learning. That is, the capabilities of the SMEs to either exploit or explore knowledge.

Secondly, this study contributes to the ongoing debate about whether exploitative and exploratory learning strategies are competing or complementary strategies. [March \(1991\)](#) first proposed the concept of exploitative and exploratory learning, and suggested they are competing strategies. Since then, there has been debate in academia as to whether these strategies are truly competing, or perhaps rather complementary. Studies like [Greco et al. \(2019\)](#) and [Kyriakopoulos and Moorman \(2004\)](#) have supported the competing ideology of exploitative and exploratory learning strategies. Other studies (e.g., [Posch and Garaus, 2019](#); [Li and Huang, 2013](#); [Gilson et al., 2005](#); [Beckman et al., 2004](#)) have also opposed the competing ideology, and suggested a rather complementarity among the strategies. Findings from our current study supported the complementarity position of these learning strategies, by demonstrating a positive relationship between these strategies. Also, organizational learning ambidexterity positively influenced SMEs' innovation performance.

Furthermore, organizational learning leads to acquisition of knowledge, which is considered as a strategic asset that enhances firms' competitive advantage. As such, this study further contributes to RBV and KBV. From the RBV perspective, the application of firm's unique capabilities and resources leads to SME's better innovation performance ([Barney, 1991](#)). This study presents knowledge as a strategic asset, which makes the difference between SMEs' innovation performance. This strategic asset (knowledge) is achieved through SMEs' organizational learning activities. Organizational learning and open innovation presents firms with business knowledge which could be capitalized on by SMEs for innovation performance ([Grant, 1991, 1996](#)).

The study also contributes to RDT, which indicates that firms' strategic resources needed for performance resides in the external business environment ([Pfeffer and Salancik, 1978](#)). We demonstrated from this study that SME could enhance their internal resources for innovation, by opening up to external knowledge search. Openness therefore makes SMEs dependent on external actors. This study extent the knowledge on RDT by demonstrating that SMEs could maximize the effect of organizational learning ambidexterity on innovation performance, through openness. SMEs therefore engage in exploratory learning and openness to tap into the reach resources which lie outside the business. The study also contributes to the discussions on open innovation, especially among SMEs.

### *6.2 Managerial implications and contributions*

Results presented indicated that firms seeking to protect their operational competence are likely to engage in exploitative learning capabilities. Similarly, firms are also likely to explore

external knowledge, to augment their internal knowledge. This current study showed that either of these learning strategies had a positive significant effect on SMEs' innovation performance. The ambidexterity in organizational learning however, was found to have a superior effect on SMEs' innovation performance. Innovation performance is very critical for the sustainability of firms, and SMEs in particular. Management of SMEs must therefore seek to simultaneously adopt both learning strategies, as that gives firms greater advantage, compared to the adoption of only one strategy.

Openness was found to further enhance the effect of organizational learning ambidexterity. SMEs seeking for a much greater innovation performance should consider adopting open search policy (external search). That is, purposeful knowledge search from customers, suppliers, distributors, competitors, consultants, external R&D or design firms, higher learning institutions, and trade associations. Based on the RDT, the resources needed for better innovation performance lie outside the firm, and SMEs must open up to tap into these rich resources.

### 6.3 Limitations and future research suggestions

The current study focused on the simultaneous adoption (spatial separation) of both exploitative and exploratory learning capabilities by SMEs. Firms may however adopt both learning strategies but in a cyclical manner – temporal separation (Gupta *et al.*, 2006). It is important therefore for futures researches in ambidexterity, to focus on how temporal separation could affect SMEs' innovation performance. And more importantly, to also ascertain if there exist any significant difference in the adoption of spatial and temporal ambidexterity on SMEs' innovation performance.

Although there exists much research on ambidexterity amongst SMEs, the specific focus on organizational learning ambidexterity is very limited. This study was however conducted without recourse to some specific factors that could influence organizational learning ambidexterity. We only assessed the direct effect of organizational learning ambidexterity on SMEs' innovation performance. Future studies should thus pay particular attention to the determinants of organizational learning ambidexterity.

The study was also based on cross-sectional data which may not be very effective for causative analysis. The study was however founded on sound theories, literature, and methodology, and as such results are deemed reliable. However, future studies should consider a longitudinal data.

The study was based on data gathered from senior members in the various SMEs. This may pose CMV challenges. The study presented a number of methodological tests, which showed CMV was not a threat to the results. However, interpretation and application of the results should take into consideration the source of data.

Lastly, the study adopted a subjective measurement of each key construct, instead of an objective measurement, and this could lead to social desirability bias. Although our test indicated that SDR was not a challenge in this study, future studies could as well adopt an objective measurement such as firm output, especially in measuring innovation performance.

### References

- Abdallah, A.B., Dahiyat, S.E. and Matsui, Y. (2019), "Lean management and innovation performance: evidence from international manufacturing companies", *Management Research Review*, Vol. 42 No. 2, pp. 239-262.
- Andriopoulos, C. and Lewis, M.W. (2009), "Exploitation-exploration tensions and organizational ambidexterity: managing paradoxes of innovation", *Organization Science*, Vol. 20 No. 4, pp. 696-717.
- Atuahene-Gima, K. (2005), "Resolving the capability-rigidity paradox in new product innovation", *Journal of Marketing*, Vol. 69 No. 4, pp. 61-83.

- Atuahene-Gima, K. and Murray, J.Y. (2007), "Exploratory and exploitative learning in new product development: a social capital perspective on new technology ventures in China", *Journal of International Marketing*, Vol. 15 No. 2, pp. 1-29.
- Bamfo, B.A., Dogbe, C.S.K. and Mingle, H. (2018), "Abusive customer behaviour and frontline employee turnover intentions in the banking industry: the mediating role of employee satisfaction", *Cogent Business and Management*, Vol. 5 No. 1, pp. 1-15.
- Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.
- Beckman, C.M., Haunschild, P.R. and Phillips, D.J. (2004), "Friends or strangers? Firm-specific uncertainty, market uncertainty and network partner selection", *Organization Science*, Vol. 15 No. 3, pp. 259-275.
- Benner, M.J. and Tushman, M.L. (2003), "Exploitation, exploration, and process management: the productivity dilemma revisited", *Academy of Management Review*, Vol. 28 No. 2, pp. 238-256.
- Bessant, J. and Möslin, K. (2011), *Open Collective Innovation, the Power of the Many over the Few*, Advanced Institute of Management Research, London, [Online] available at: <https://ore.exeter.ac.uk/repository/bitstream/handle/10871/14935/6.pdf?sequence=2&i> (accessed 12 January 19).
- Boso, N., Story, V.M. and Cadogan, J.W. (2013), "Entrepreneurial orientation, market orientation, network ties, and performance: study of entrepreneurial firms in a developing economy", *Journal of Business Venturing*, Vol. 28 No. 6, pp. 708-727.
- Brown, T.A. (2014), *Confirmatory Factor Analysis for Applied Research*, Guilford Publications, New York, NY.
- Brunswick, S. and Van de Vrande, V. (2014), "Exploring open innovation in small and medium-sized enterprises", *New Frontiers in Open Innovation*, Vol. 1, pp. 135-156.
- Cao, Q., Gedajlovic, E. and Zhang, H. (2009), "Unpacking organizational ambidexterity: dimensions, contingencies, and synergistic effects", *Organization Science*, Vol. 20 No. 4, pp. 781-796.
- Chang, Y.Y. and Hughes, M. (2012), "Drivers of innovation ambidexterity in small-to medium-sized firms", *European Management Journal*, Vol. 30 No. 1, pp. 1-17.
- Chang, Y.Y., Hughes, M. and Hotho, S. (2011), "Internal and external antecedents of SMEs' innovation ambidexterity outcomes", *Management Decision*, Vol. 49 No. 10, pp. 1658-1676.
- Cheng, C.C. and Shiu, E.C. (2015), "The inconvenient truth of the relationship between open innovation activities and innovation performance", *Management Decision*, Vol. 53 No. 3, pp. 625-647.
- Cherrafi, A., Garza-Reyes, J.A., Kumar, V., Mishra, N., Ghobadian, A. and Elfezazi, S. (2018), "Lean, green practices and process innovation: a model for green supply chain performance", *International Journal of Production Economics*, Vol. 206, pp. 79-92.
- Chesbrough, H. (2003), "The logic of open innovation: managing intellectual property", *California Management Review*, Vol. 45 No. 3, pp. 33-58.
- Chesbrough, H. and Bogers, M. (2014), "Explicating open innovation: clarifying an emerging paradigm for understanding innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford University Press, Oxford.
- Choi, B. and Lee, J.N. (2012), "Complementarities and substitutabilities among knowledge sourcing strategies and their impact on firm performance", *Journal of the Association for Information Systems*, Vol. 13 No. 7, p. 498.
- Dahlander, L. and Gann, D.M. (2010), "How open is innovation?", *Research Policy*, Vol. 39 No. 6, pp. 699-709.
- Dawson, J.F. and Richter, A.W. (2006), "Probing three-way interactions in moderated multiple regression: development and application of a slope difference test", *Journal of Applied Psychology*, Vol. 91, pp. 917-926.

- Dong, D., Gao, X., Sun, X. and Liu, X. (2018), "Factors affecting the formation of copper international trade community: based on resource dependence and network theory", *Resources Policy*, Vol. 57, pp. 167-185.
- Eisenhardt, K.M. and Martin, J.A. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10-11, pp. 1105-1121.
- European Commission (2019), "Entrepreneurship and small and medium-sized enterprises (SMEs)", available at: [https://ec.europa.eu/growth/smes\\_en](https://ec.europa.eu/growth/smes_en) (accessed 10 June 2019).
- Faems, D., Van Looy, B., Janssens, M. and Vlaar, P.W. (2012), "The process of value realization in asymmetric new venture development alliances: governing the transition from exploration to exploitation", *Journal of Engineering and Technology Management*, Vol. 29 No. 4, pp. 508-527.
- Fang, S.C. and Chen, H.K. (2016), "Strategic intent, organizational environment and organizational learning mechanisms: a multiple-case study in the construction industry in Taiwan", *Personnel Review*, Vol. 45 No. 5, pp. 928-946.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Fuller, C.M., Simmering, M.J., Atinc, G., Atinc, Y. and Babin, B.J. (2016), "Common methods variance detection in business research", *Journal of Business Research*, Vol. 69 No. 8, pp. 3192-3198.
- Ganzaroli, A., De Noni, I., Orsi, L. and Belussi, F. (2016), "The combined effect of technological relatedness and knowledge utilization on explorative and exploitative invention performance post-M and A", *European Journal of Innovation Management*, Vol. 19 No. 2, pp. 167-188.
- Garcia, R. and Calantone, R. (2002), "A critical look at technological innovation typology and innovativeness terminology: a literature review", *Journal of Product Innovation Management: An International Publication of the Product Development and Management Association*, Vol. 19 No. 2, pp. 110-132.
- Garcia, R., Calantone, R. and Levine, R. (2003), "The role of knowledge in resource allocation to exploration versus exploitation in technologically oriented organizations", *Decision Sciences*, Vol. 34 No. 2, pp. 323-349.
- Garud, R. and Nayyar, P.R. (1994), "Transformative capacity: continual structuring by intertemporal technology transfer", *Strategic Management Journal*, Vol. 15 No. 5, pp. 365-385.
- Gassmann, O., Enkel, E. and Chesbrough, H. (2010), "The future of open innovation", *R&D Management*, Vol. 40 No. 3, pp. 213-221.
- Gibson, C.B. and Birkinshaw, J. (2004), "The antecedents, consequences, and mediating role of organizational ambidexterity", *Academy of Management Journal*, Vol. 47 No. 2, pp. 209-226.
- Gilson, L.L., Mathieu, J.E., Shalley, C.E. and Ruddy, T.M. (2005), "Creativity and standardization: complementary or conflicting drivers of team effectiveness?", *Academy of Management Journal*, Vol. 48 No. 3, pp. 521-531.
- Grant, R.M. (1991), "The resource-based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Vol. 33 No. 3, pp. 114-135.
- Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 109-122.
- Greco, L.M., Charlier, S.D. and Brown, K.G. (2019), "Trading off learning and performance: exploration and exploitation at work", *Human Resource Management Review*, Vol. 29 No. 2, pp. 179-195.
- Gupta, A.K., Smith, K.G. and Shalley, C.E. (2006), "The interplay between exploration and exploitation", *Academy of Management Journal*, Vol. 49 No. 4, pp. 693-706.
- Haas, M.R. and Hansen, M.T. (2005), "When using knowledge can hurt performance: the value of organizational capabilities in a management consulting company", *Strategic Management Journal*, Vol. 26 No. 1, pp. 1-24.
- Hage, J. and Aiken, M. (1970), *Social Change in Complex Organizations*, Random House Trade, New York, Vol. 41.

- Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010), *Multivariate Data Analysis: A Global Perspective*, 7th ed., Pearson Education, Upper Saddle River, NJ.
- Ham, J., Choi, B. and Lee, J.N. (2017), "Open and closed knowledge sourcing: their effect on innovation performance in small and medium enterprises", *Industrial Management and Data Systems*, Vol. 117 No. 6, pp. 1166-1184.
- Hardy, J.H. III, Day, E.A. and Arthur, W. Jr (2019), "Exploration-exploitation tradeoffs and information-knowledge gaps in self-regulated learning: implications for learner-controlled training and development", *Human Resource Management Review*, Vol. 29 No. 2, pp. 196-217.
- Hardy, J.H. III, Day, E.A., Hughes, M.G., Wang, X. and Schuelke, M.J. (2014), "Exploratory behavior in active learning: a between-and within-person examination", *Organizational Behavior and Human Decision Processes*, Vol. 125 No. 2, pp. 98-112.
- Hayes, A.F. (2017), *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, Guilford Publications, New York, NY, available at: <http://dm.darden.virginia.edu/ResearchMethods/Templates.pdf> (accessed 12 January 19).
- He, Z.L. and Wong, P.K. (2004), "Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis", *Organization Science*, Vol. 15 No. 4, pp. 481-494.
- Heffner, M.C. (2006), *Knowledge Management for Technological Innovation in Organizations: The Fusion Process for Creating Intellectual Capital*. University of Maryland University College, Maryland.
- Hernández-Espallardo, M., Sánchez-Pérez, M. and Segovia-López, C. (2011), "Exploitation-and exploration-based innovations: the role of knowledge in inter-firm relationships with distributors", *Technovation*, Vol. 31 Nos 5-6, pp. 203-215.
- Hill, S.A. and Birkinshaw, J. (2014), "Ambidexterity and survival in corporate venture units", *Journal of Management*, Vol. 40 No. 7, pp. 1899-1931.
- Hillman, A.J., Withers, M.C. and Collins, B.J. (2009), "Resource dependence theory: a review", *Journal of Management*, Vol. 35 No. 6, pp. 1404-1427.
- Holmqvist, M. (2003), "A dynamic model of intra-and interorganizational learning", *Organization Studies*, Vol. 24 No. 1, pp. 95-123.
- Huang, Y.C., Ma, R. and Lee, K.W. (2015), "Exploitative learning in project teams: do cognitive capability and strategic orientations act as moderator variables?", *International Journal of Project Management*, Vol. 33 No. 4, pp. 760-771.
- International Finance Corporation – IFC (2010), *Scaling-Up SME Access to Financial Services in the Developing World*, International Finance Corporation, World Bank Group, Washington DC, available at: <http://documents.worldbank.org/curated/en/669161468140035907/pdf/948300WP0Box385443B00PUBLIC0ScalingUp.pdf> (accessed 10 June 2019).
- Jansen, J.J., Van Den Bosch, F.A. and Volberda, H.W. (2006), "Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators", *Management Science*, Vol. 52 No. 11, pp. 1661-1674.
- Katila, R. and Ahuja, G. (2002), "Something old, something new: a longitudinal study of search behavior and new product introduction", *Academy of Management Journal*, Vol. 45 No. 6, pp. 1183-1194.
- Kim, C., Song, J. and Nerkar, A. (2012), "Learning and innovation: exploitation and exploration trade-offs", *Journal of Business Research*, Vol. 65 No. 8, pp. 1189-1194.
- Kirby, A., Gebski, V. and Keech, A.C. (2002), "Determining the sample size in a clinical trial", *Medical Journal of Australia*, Vol. 177 No. 5, pp. 256-257.
- Kristal, M.M., Huang, X. and Roth, A.V. (2010), "The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance", *Journal of Operations Management*, Vol. 28 No. 5, pp. 415-429.
- Kyriakopoulos, K. and Moorman, C. (2004), "Tradeoffs in marketing exploitation and exploration strategies: the overlooked role of market orientation", *International Journal of Research in Marketing*, Vol. 21 No. 3, pp. 219-240.

- Lane, P.J., Koka, B.R. and Pathak, S. (2006), "The reification of absorptive capacity: a critical review and rejuvenation of the construct", *Academy of Management Review*, Vol. 31 No. 4, pp. 833-863.
- Laursen, K. and Salter, A. (2006), "Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms", *Strategic Management Journal*, Vol. 27 No. 2, pp. 131-150.
- Laursen, K. and Salter, A.J. (2014), "The paradox of openness: appropriability, external search and collaboration", *Research Policy*, Vol. 43 No. 5, pp. 867-878.
- Lee, S.U., Park, G. and Kang, J. (2018), "The double-edged effects of the corporate venture capital unit's structural autonomy on corporate investors' explorative and exploitative innovation", *Journal of Business Research*, Vol. 88, pp. 141-149.
- Lennerts, S., Schulze, A. and Tomczak, T. (2020), "The asymmetric effects of exploitation and exploration on radical and incremental innovation performance: an uneven affair", *European Management Journal*, Vol. 38 No. 1, pp. 121-134.
- Lenox, M. and King, A. (2004), "Prospects for developing absorptive capacity through internal information provision", *Strategic Management Journal*, Vol. 25 No. 4, pp. 331-345.
- Levinthal, D.A. and March, J.G. (1993), "The myopia of learning", *Strategic Management Journal*, Vol. 14 No. S2, pp. 95-112.
- Li, S. and Ni, J. (2016), "A dynamic analysis of investment in process and product innovation with learning-by-doing", *Economics Letters*, Vol. 145, pp. 104-108.
- Li, Y.H. and Huang, J.W. (2013), "Exploitative and exploratory learning in transactive memory systems and project performance", *Information and Management*, Vol. 50 No. 6, pp. 304-313.
- Lindell, M.K. and Whitney, D.J. (2001), "Accounting for common method variance in cross-sectional research designs", *Journal of Applied Psychology*, Vol. 86 No. 1, p. 114.
- Lomi, A. and Pattison, P. (2006), "Manufacturing relations: an empirical study of the organization of production across multiple networks", *Organization Science*, Vol. 17 No. 3, pp. 313-332.
- Longo, M.C. and Narduzzo, A. (2017), "Transactive knowledge from communities of practice to firms: an empirical investigation of innovative projects performance", *European Journal of Innovation Management*, Vol. 20 No. 2, pp. 291-311.
- Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006), "Ambidexterity and performance in small-to medium-sized firms: the pivotal role of top management team behavioral integration", *Journal of management*, Vol. 32 No. 5, pp. 646-672.
- MacKenzie, S.B. and Podsakoff, P.M. (2012), "Common method bias in marketing: causes, mechanisms, and procedural remedies", *Journal of Retailing*, Vol. 88 No. 4, pp. 542-555.
- Mainert, J., Niepel, C., Lans, T. and Greiff, S. (2018), "How employees perceive organizational learning: construct validation of the 25-item short form of the strategic learning assessment map (SF-SLAM)", *Journal of Knowledge Management*, Vol. 22 No. 1, pp. 57-75.
- March, J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2 No. 1, pp. 71-87.
- Michael, D. (1973), *On Learning to Plan and Planning to Learn: The Social Psychology of Changing toward Future Responsive Societal Learning*, Jossey-Bass, San Francisco.
- National Board for Small Scale Industries – NBSSI (1990), "Supporting micro and small scale enterprises", *A Handbook on Enterprise Development Part 1. NBSSI*, Print Solutions, Accra.
- O'Reilly, C.A. III and Tushman, M.L. (2008), "Ambidexterity as a dynamic capability: resolving the innovator's dilemma", *Research in Organizational Behavior*, Vol. 28, pp. 185-206.
- Ojha, D., Struckell, E., Acharya, C. and Patel, P.C. (2018), "Supply chain organizational learning, exploration, exploitation, and firm performance: a creation-dispersion perspective", *International Journal of Production Economics*, Vol. 204, pp. 70-82.

- O'Reilly, C.A. III and Tushman, M.L. (2013), "Organizational ambidexterity: past, present, and future", *Academy of Management Perspectives*, Vol. 27 No. 4, pp. 324-338.
- Organization for Economic Cooperation and Development – OECD (2017), "Meeting of the OECD council at ministerial level: enhancing the contributions of SMEs in a global and digitalised economy", available at: <https://www.oecd.org/mcm/documents/C-MIN-2017-8-EN.pdf> (accessed 10 June 2019).
- Pan, X. and Li, S. (2016), "Dynamic optimal control of process–product innovation with learning by doing", *European Journal of Operational Research*, Vol. 248 No. 1, pp. 136-145.
- Papadas, K.K., Avlonitis, G.J., Carrigan, M. and Piha, L. (2019), "The interplay of strategic and internal green marketing orientation on competitive advantage", *Journal of Business Research*, Vol. 104, pp. 632-643.
- Peng, G.Z. and Beamish, P.W. (2014), "MNC subsidiary size and expatriate control: resource-dependence and learning perspectives", *Journal of World Business*, Vol. 49 No. 1, pp. 51-62.
- Pfeffer, J. (1987), "A resource dependence perspective on intercorporate relations", *Intercorporate Relations: The Structural Analysis of Business*, Vol. 1 No. 1, pp. 25-55.
- Pfeffer, J. and Salancik, G.R. (1978), *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper and Row.
- Popa, S., Soto-Acosta, P. and Martinez-Conesa, I. (2017), "Antecedents, moderators, and outcomes of innovation climate and open innovation: an empirical study in SMEs", *Technological Forecasting and Social Change*, Vol. 118, pp. 134-142.
- Posch, A. and Garaus, C. (2019), "Boon or curse? A contingent view on the relationship between strategic planning and organizational ambidexterity", *Long Range Planning*, p. 101878.
- Raisch, S. and Birkinshaw, J. (2008), "Organizational ambidexterity: antecedents, outcomes, and moderators", *Journal of Management*, Vol. 34 No. 3, pp. 375-409.
- Raisch, S. and Tushman, M.L. (2016), "Growing new corporate businesses: from initiation to graduation", *Organization Science*, Vol. 27 No. 5, pp. 1237-1257.
- Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M.L. (2009), "Organizational ambidexterity: balancing exploitation and exploration for sustained performance", *Organization Science*, Vol. 20 No. 4, pp. 685-695.
- Rogers, E.M. (1995), "Diffusion of Innovations: modifications of a model for telecommunications", *Die diffusion von innovationen in der telekommunikation*, Springer, Berlin, Heidelberg, pp. 25-38.
- Roper, S., Vahter, P. and Love, J.H. (2013), "Externalities of openness in innovation", *Research Policy*, Vol. 42 No. 9, pp. 1544-1554.
- Rothaermel, F.T. and Deeds, D.L. (2004), "Exploration and exploitation alliances in biotechnology: a system of new product development", *Strategic Management Journal*, Vol. 25 No. 3, pp. 201-221.
- Santoro, G., Ferraris, A., Giacosa, E. and Giovando, G. (2018), "How SMEs engage in open innovation: a survey", *Journal of the Knowledge Economy*, Vol. 9 No. 2, pp. 561-574.
- Saunders, M., Lewis, P. and Thornhill, A. (2009), *Research Methods for Business Students*, 5th ed., Prentice Hall, London.
- Sidhu, J.S., Commandeur, H.R. and Volberda, H.W. (2007), "The multifaceted nature of exploration and exploitation: value of supply, demand, and spatial search for innovation", *Organization Science*, Vol. 18 No. 1, pp. 20-38.
- Simssek, Z. (2009), "Organizational ambidexterity: towards a multilevel understanding", *Journal of Management Studies*, Vol. 46 No. 4, pp. 597-624.
- Soto-Acosta, P., Popa, S. and Martinez-Conesa, I. (2018), "Information technology, knowledge management and environmental dynamism as drivers of innovation ambidexterity: a study in SMEs", *Journal of Knowledge Management*, Vol. 22 No. 4, pp. 824-849.

- Stanko, M.A. and Henard, D.H. (2017), "Toward a better understanding of crowdfunding, openness and the consequences for innovation", *Research Policy*, Vol. 46 No. 4, pp. 784-798.
- Steenkamp, J.B.E., De Jong, M.G. and Baumgartner, H. (2010), "Socially desirable response tendencies in survey research", *Journal of Marketing Research*, Vol. 47 No. 2, pp. 199-214.
- Strahan, R. and Gerbasi, K.C. (1972), "Short, homogeneous versions of the Marlow-Crowne social desirability scale", *Journal of Clinical Psychology*, Vol. 28 No. 2, pp. 191-193.
- Tamayo-Torres, J., Gutierrez-Gutierrez, L. and Ruiz-Moreno, A. (2014), "The relationship between exploration and exploitation strategies, manufacturing flexibility and organizational learning: an empirical comparison between Non-ISO and ISO certified firms", *European Journal of Operational Research*, Vol. 232 No. 1, pp. 72-86.
- Tiwana, A. and Bush, A.A. (2007), "A comparison of transaction cost, agency, and knowledge-based predictors of IT outsourcing decisions: a US-Japan cross-cultural field study", *Journal of Management Information Systems*, Vol. 24 No. 1, pp. 259-300.
- Trochim, W.M. (2005), *Research Methods: The Concise Knowledge Base*. Atomic Dog Publishing, Cincinnati, Ohio.
- Tsai, M.T. and Huang, Y.C. (2008), "Exploratory learning and new product performance: the moderating role of cognitive skills and environmental uncertainty", *The Journal of High Technology Management Research*, Vol. 19 No. 2, pp. 83-93.
- Turner, N., Swart, J. and Maylor, H. (2013), "Mechanisms for managing ambidexterity: a review and research agenda", *International Journal of Management Reviews*, Vol. 15 No. 3, pp. 317-332.
- Tushman, M.L. and O'Reilly, C.A. III (1996), "Ambidextrous organizations: managing evolutionary and revolutionary change", *California Management Review*, Vol. 38 No. 4, pp. 8-29.
- Usman, M., Roijakkers, N., Vanhaverbeke, W. and Frattini, F. (2018), "A systematic review of the literature on open innovation in SMEs. Researching Open Innovation in SMEs", available at: [https://www.researchgate.net/profile/Wim\\_Vanhaverbeke/publication/323128336\\_A\\_Systematic\\_Review\\_of\\_the\\_Literature\\_on\\_Open\\_Innovation\\_in\\_SMEs/links/5a937405a6fdccceff05a313/A-Systematic-Review-of-the-Literature-on-Open-Innovation-in-SMEs.pdf](https://www.researchgate.net/profile/Wim_Vanhaverbeke/publication/323128336_A_Systematic_Review_of_the_Literature_on_Open_Innovation_in_SMEs/links/5a937405a6fdccceff05a313/A-Systematic-Review-of-the-Literature-on-Open-Innovation-in-SMEs.pdf) (accessed 12 January 2019).
- Vanhaverbeke, W. (2017), *Managing Open Innovation in SMEs*, Cambridge University Press, New York.
- Vassolo, R.S., Anand, J. and Folta, T.B. (2004), "Non-additivity in portfolios of exploration activities: a real options-based analysis of equity alliances in biotechnology", *Strategic Management Journal*, Vol. 25 No. 11, pp. 1045-1061.
- Voss, G.B. and Voss, Z.G. (2013), "Strategic ambidexterity in small and medium-sized enterprises: implementing exploration and exploitation in product and market domains", *Organization Science*, Vol. 24 No. 5, pp. 1459-1477.
- Wang, C.H. and Hsu, L.C. (2014), "Building exploration and exploitation in the high-tech industry: the role of relationship learning", *Technological Forecasting and Social Change*, Vol. 81, pp. 331-340.
- Wang, X. and Xu, M. (2018), "Examining the linkage among open innovation, customer knowledge management and radical innovation: the multiple mediating effects of organizational learning ability", *Baltic Journal of Management*, Vol. 13 No. 3, pp. 368-389.
- Wu, J., Wang, C., Hong, J., Piperopoulos, P. and Zhuo, S. (2016), "Internationalization and innovation performance of emerging market enterprises: the role of host-country institutional development", *Journal of World Business*, Vol. 51 No. 2, pp. 251-263.
- Xia, J., Wang, Y., Lin, Y., Yang, H. and Li, S. (2018), "Alliance formation in the midst of market and network: insights from resource dependence and network perspectives", *Journal of Management*, Vol. 44 No. 5, pp. 1899-1925.
- Yin, X. and Shanley, M. (2008), "Industry determinants of the 'merger versus alliance' decision", *Academy of Management Review*, Vol. 33 No. 2, pp. 473-491.



Zahra, S.A. and George, G. (2002), "Absorptive capacity: a review, reconceptualization, and extension", *Academy of Management Review*, Vol. 27 No. 2, pp. 185-203.

Zahra, S.A. and Nielsen, A.P. (2002), "Sources of capabilities, integration and technology commercialization", *Strategic Management Journal*, Vol. 23 No. 5, pp. 377-398.

Zhang, Y. and Li, H. (2001), "The control design and performance in international joint ventures: a dynamic evolution perspective", *International Business Review*, Vol. 10 No. 3, pp. 341-362.

### Appendix 1

Socially Desirable Responding (SDR) scale items

- (1) You like to gossip at times
- (2) There have been occasions when you took advantage of someone
- (3) You are always willing to admit it when you make a mistake
- (4) You sometimes try to get even rather than forgive and forget
- (5) At times you have really insisted on having things your own way
- (6) You have never been annoyed when people expressed ideas very different "from your own"
- (7) You have never deliberately said something that hurt someone's feelings

Source: [Strahan and Gerbasi \(1972\)](#)

### Appendix 2

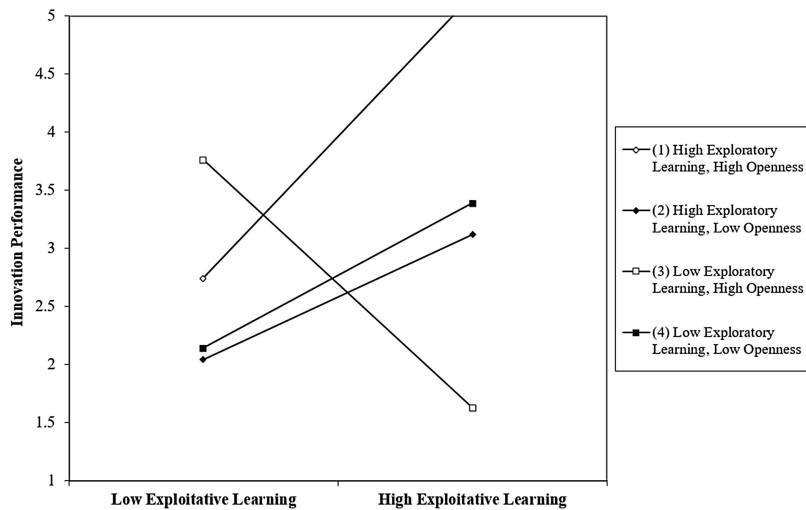


Figure A1.  
Three-Way  
Interactions

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