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Absorptive capacity, marketing capabilities, and innovation commercialisation in Nigeria

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Abstract

Purpose – The purpose of this paper is to investigate how specialised capabilities including absorptive capacity and marketing capabilities influence innovation commercialisation in manufacturing and service firms in Nigeria. The authors hypothesise that absorptive capacity measures including openness and formal training for innovation, and marketing capabilities encompassing new product marketing and marketing innovation are positively associated with innovation performance.

Design/methodology/approach – The authors examine commercialisation of innovation within the profiting from innovation (PFI) and dynamic capabilities (DC) framework and use data from the 2012 Nigeria Innovation Survey to test the hypothesis by means of a Heckman sample selection model.

Findings – The authors find that absorptive capacity measures comprising openness and formal training are positively associated with innovation performance. The authors also find that marketing capabilities as indicated by new product marketing and marketing innovation are positively associated with innovation performance.

Research limitations/implications – The authors acknowledge that firms undergo continuous changes and that there may be the presence of unobserved or unmeasured heterogeneity. Taking into cognisance that Nigeria is a federal state, cultural diversity and economic factors are likely to differ widely between geographical regions. Also, while the proposed conceptual framework offers a deeper understanding of innovation performance, examining how integrating activities of the R&D department, human resource department and marketing department affect innovation commercialisation is likely to provide more meaningful insights.

Practical implications – The role that inter-organisational learning and intra-organisational learning play in driving innovation performance provide managers with a basis for incorporating absorptive capacity building programs that boost employees' ability to recognise and apply valuable external knowledge to commercial ends. Similarly, firms may benefit from offering marketing capabilities development programs. Furthermore, innovation policies in Nigeria are generally designed to focus on fostering innovation activities aimed at developing innovative output. Accordingly, government support explicitly targeting new product marketing and marketing innovation is likely to play a vital role in the successful commercialisation of innovation in Nigeria.

Originality/value – This study fuses the PFI and DC framework to examine why innovating firms may not necessarily succeed. This area of study has received scant attention in sub-Saharan Africa given that extant literature focusses on value creation as opposed to value capture.

Keywords Openness, Absorptive capacity, Marketing capabilities, Product innovation, Commercialization, Formal training

Paper type Research paper

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1. Introduction

Innovation commercialisation – the introduction and market entry of new or significantly improved goods and services – is a defining stage of the innovation process because it is at this stage that the firm begins to earn Schumpeterian profits that enhance competitive advantage (Teece *et al.*, 1997; Urbancova, 2013)[1]. Superior innovation performance involves the commercialisation of new products that create new markets and new revenue streams for firms.

Although commercialisation tends to be the ultimate goal for innovation, it remains a significant challenge for innovative firms (Datta *et al.*, 2015; Markman *et al.*, 2008; Slater *et al.*, 2014; Slater and Mohr, 2006), and especially those in developing countries in Sub-Saharan Africa (SSA). Despite this, extant literature on innovation in SSA generally examines factors accounting for innovation in the context of tangible assets that drive value creation by manufacturing firms (Osoro *et al.*, 2016; van Uden *et al.*, 2017). This has been attributed to a lack of comprehensive data on innovation in Africa (see Ayyagari *et al.*, 2011). In addition, while literature regarding innovation commercialisation has evolved through time, it has typically focussed on developed countries. The fluidity of extant literature in developing countries and particularly those in SSA is lacking (Osoro *et al.*, 2017). Hence, little is understood regarding the factors accounting for successful commercialisation of innovative products in the context of SSA.

Since the 1970s, Africa has embraced the strategic use of Science, Technology, and Innovation (ST&I) policies for achieving socio-economic and development goals. African Union's pro-STI policies include the Monrovia Strategy of 1979, the 1980 Lagos Plan of Action, and Africa's Science and Technology Consolidated Plan of Action of 2006. Thus, efforts geared towards building relevant ST&I capabilities are entrenched in the African Union ST&I strategies.

Against this backdrop, the African Union has recently published a new ten-year strategy: "evaluating public policies in Africa: insights from the Science, Technology, and Innovation Strategy for Africa 2024 (STISA-2024)" that offers essential insights that are critical for enhancing innovative capabilities of the firms in Africa of which Nigeria remains a signatory. For instance, proposed initiatives aimed at improving technical capabilities and open innovation could foster new product development and commercialisation of innovation. This is imperative for sustainable socio-economic development in Africa.

The objectives of STISA-2024 encompass elements that may enhance the ability of the firms to compete in the global market in the creation of new products and the commercialisation (www.au.int). One of the key factors that impede the implementation of innovation in Africa, and Nigeria to be specific, is the development of sufficient technical competencies to facilitate the innovative propensity of the firms. As espoused in literature, new product development and the commercialisation of innovation depend to a large extent on the innovative capabilities of the focal firms. Hence, if managers are aware of the need for dynamic capabilities (DCs) in fostering both the new product development and innovation commercialisation, an effort geared towards improving their DCs could foster the promotion of economic competitiveness, which may result in innovation optimisation, value addition and industrial development (www.au.int).

Considering the case of Nigeria, innovation commercialisation is essential for ensuring that firms remain competitive in a business environment characterised by macroeconomic and institutional instability (Fagbadebo, 2007; Mark and Nwaiwu, 2015). Nigeria also suffers low absorptive capacity and generally underutilises existing capacity, as is the case in SSA (Agri *et al.*, 2018). Nevertheless, in contrast to developed countries, non-technological forms of innovation, such as marketing innovation have typically surpassed those of technological innovation in Nigeria (Egbetokun *et al.*, 2017). These current developments highlight the challenges and opportunities for innovation performance in low-income countries such as

Nigeria, to be specific and Africa at large. In light of this, we posit that intangible assets such as absorptive capacity and marketing capabilities are likely to play a crucial role in fostering innovation commercialisation by mitigating uncertainty in the face of macroeconomic and institutional instability (Garcia Martinez *et al.*, 2019).

We contend that value creation arising from the successful development of new products does not necessarily result in value capture. Hence, it is the case that some firms successfully commercialise innovation when others are unable to do so. The key argument is that firms harnessing absorptive capacity and marketing capabilities for bringing new products to the market have a higher likelihood of succeeding in commercialising innovative products. Conversely, innovation performance can be diminished where firms lack requisite capabilities.

Using recently available data from the 2012 Nigeria Innovation Survey (NIS), we investigate innovation commercialisation in the context of value capture by firms in the manufacturing and service sector[2]. The sample consists of firms from six geographical locations in Nigeria. Some of the firms have their headquarters in Lagos which is one of the most industrialised cities in Africa. Lagos is also one of the most populous cities in the world that displays distinctive urban agglomeration (Adebowale and Oyelaran-Oyeyinka, 2012).

The profiting from innovation (hereafter PFI) and DCs frameworks are applied in examining how fundamental innovation commercialisation capabilities including absorptive capacity and marketing capabilities influence value capture from innovation (Albort-Morant *et al.*, 2018; Helfat and Raubitschek, 2018; Lewandowska, 2015; Teece, 1986, 2006, 2018). The ability to capture value from innovation stems from the idea that a firm's DCs foster access to market information. Hence, the extent to which firms profit from innovation is influenced by DCs that firms possess.

The primary objective of this study is to investigate how absorptive capacity and marketing capabilities are associated with the commercialisation of innovative products in manufacturing and service firms in Nigeria. In so doing, this paper makes several contributions.

First, innovation studies in SSA have generally focussed on value creation arising from manufacturing firms developing new products given the existing resources. In contrast, the question of what factors account for value capture in SSA has remained unanswered (cf. Cooper, 1979; Cooper and Edgett, 2012; Durst *et al.*, 2018). This study addresses this question by investigating factors accounting for innovation commercialisation in Nigeria. We, therefore, attempt to examine the innovation process in its entirety, which provides useful insights into value capture in the context of manufacturing and service firms in developing countries.

Second, this study fuses the PFI and DCs theoretical frameworks with innovation economics by focussing on absorptive capacity and marketing capabilities as fundamental drivers of value capture. In sum, the PFI framework provides insights into why innovating firms may not necessarily succeed in commercialising innovation. This framework underscores the role of specialised complementary capabilities that are considered as antecedents to earning Schumpeterian profits. The DCs framework, on the other hand, focusses on a firm's capabilities encompassing the ability for absorbing, integrating, and transforming both internal and external resources into a sustainable competitive advantage for superior innovation performance (Foss *et al.*, 2011; Teece, 2007; Teece *et al.*, 1997). By drawing on the PFI and DCs theories, this study puts forward a conceptual framework that provides a more comprehensive understanding of innovation commercialisation.

Lastly, the importance of absorptive capacity for promoting learning for enhanced innovation performance cannot be overstated (Osoro *et al.*, 2017). In particular, we examine openness and formal training as fundamental absorptive capacity indicators that stimulate innovation performance. We argue that firm capacities are critical for facilitating external knowledge flows through cooperation with economic actors that fosters inter-organisational learning that is crucial for value capture. In line with this, we

also argue that formal training increases internal knowledge flows within firms, thereby enhancing intra-organisational learning. However, while the importance of absorptive capacity for innovation has been emphasised by numerous studies, this has typically been within the lens of value creation as opposed to value capture (Foss *et al.*, 2011; Ganotakis and Love, 2011; Laursen and Foss, 2003; Michaelis and Markham, 2017). Similarly, the role that marketing capabilities play in enhancing innovation performance in the context of SSA has also received little attention (Gunday *et al.*, 2011; Osoro *et al.*, 2017). While a stream of literature regarding the role of marketing capabilities in facilitating innovation performance in developed countries has grown considerably, such literature is still sparse in SSA. Essentially, Nigeria has a large viable market for innovative output. Its population offers a heterogeneous market, but this might not be a sufficient condition for value capture by innovative firms. Our study, therefore, narrows this knowledge gap by examining how new product marketing initiatives and marketing innovation affect innovation performance in the context of Nigeria.

The remainder of the paper is structured as follows. The subsequent section sets out the contextual background. This is followed by the theoretical framework that incorporates the PFI and DCs theories in explaining innovation performance in the context of specialised complementary capabilities. We also review literature examining the relationship between absorptive capacity, marketing capabilities and innovation performance and develop our hypotheses in this section. Next, we describe the 2012 NIS data and method of analysis. We then provide the results and thereafter conclude with the discussion and implications of our findings.

2. Theoretical framework and hypotheses

In his seminal works, Teece (1986) established a PFI framework that advances fundamental building blocks of the Schumpeterian theory of innovation. The PFI framework explicates how several factors, including managerial choices, protection of IPRs, the nature of knowledge and asset structure of a firm could impact its ability to commercialise innovation. New products consist of technical knowledge about "how to do things better" than the existing products and that the know-how must be sold or utilised on the market to generate profits for sustained competitive advantage (Danneels, 2002; Eisenhardt and Martin, 2000). Additionally, the importance of specialised complementary capabilities such as training and marketing that is specifically tailored to a particular innovation that underlies successful commercialisation of new products. Hence, establishing complementary capabilities is an antecedent for successful innovation commercialisation (Teece, 2000). Thus, specialised complementary capabilities link the PFI framework to the DCs framework, thereby deepening the economic analysis of innovation (Teece, 2006). The DCs framework centres on learning and innovation. This framework also encapsulates changing business realities that require managers to develop DCs for coping with the dynamic business environment (Albort-Morant *et al.*, 2018; Bingham *et al.*, 2007). DCs are therefore pivotal for modifying a firm's resource mix for sustained competitive advantage. Firms, therefore, need to take into consideration a comprehensive view of the business environment in which they operate encompassing how they interact with other economic actors including buyers, suppliers, business rivals, research and educational institutions, financial institutions, legal systems and the domestic political environment (Teece *et al.*, 1997). This framework provides a multidisciplinary approach to the managerial decision-making process that goes beyond focussing on tangible assets only as it emphasises intangible assets including DCs such as absorptive capacity and marketing capabilities (Najafi-Tavani *et al.*, 2016).

The foregoing discussion combines the PFI and DCs frameworks to provide the context of innovation commercialisation by drawing particular attention to the role of absorptive capacity and marketing capabilities in enhancing value capture (Dávila *et al.*, 2018; Katkalo *et al.*, 2010;

Najafi-Tavani *et al.*, 2016; Teece, 1986, 2007; Xia and Roper, 2016). Accordingly, we hypothesise that absorptive capacity, including openness and formal training, reinforce innovation performance. We also hypothesise that marketing capabilities enhance innovation performance. These hypotheses are developed in further detail in the succeeding sections.

2.1 Absorptive capacity and innovation performance

Absorptive capacity is a primary DCs relating to a firm's competence in acquiring, assimilating, transforming and exploiting new external knowledge (Noblet *et al.*, 2011; Teece, 2012; Zahra and George, 2002). Furthermore, the assimilation and use of external knowledge is indispensable for achieving innovation commercialisation (Cohen and Levinthal, 1989, 1990; da Costa *et al.*, 2018; Egbetokun, 2015; Egbetokun and Savin, 2014; Ritala *et al.*, 2015; Xia and Roper, 2016; Abdul Basit and Medase, 2019). Nevertheless, countries in Africa are characterised by a low degree of absorptive capacity relative to developing countries in other regions (Onyeiwu, 2015; Oyelaran-Oyeyinka and Barclay, 2004).

Absorptive capacity relates to learning processes, skills accumulation and transfer of knowledge. These processes strengthen a firm's potential for exploring external knowledge sources, adapting to environmental changes, increasing the degree of innovation and responding to customer needs. Moreover, the innovation process is predominantly contingent on external sources of information (Cohen and Levinthal, 1990). Thus, firms exhibiting a low degree of absorptive capacity are constrained in assimilating and commercialising new knowledge, which inhibits innovation performance (Foss *et al.*, 2011; Onyeiwu, 2015). We, therefore, contend that absorptive capacity arising from openness relating to the sources of external information (Lewandowska, 2015) and formal training (Amara *et al.*, 2008; Cohen and Levinthal, 1989; Thornhill, 2006; Vinding, 2006) constitute key success factors for commercialising innovation.

Further, absorptive capability is an array of firms practices and developments through which firms gain, adapt, transmute and exploit information to create dynamic firms' competencies (Zahra and George, 2002). According to Jansen *et al.* (2005), absorptive competence is a methodical means by which several fragments of the firm work collectively to acquire from supplementary forces functional outside its permissible boundaries. As a result, the learning emerges from the prior knowledge that functions as an antecedent for the efficient absorption of novel knowledge into the firm. Absorptive capability has four sub-elements: knowledge gaining, knowledge adaptation, knowledge renovation, which anchors innovative problem-solving, brainstorming and creative thinking (Teece, 2007; Teece *et al.*, 1997), and knowledge development (Pavlou and El Sawy, 2011; Todorova and Durisin, 2007). Knowledge gaining inducts the stream of supplementary information into the firm. The empirical investigation has shown that by implication, firms need to assimilate attained knowledge for it to be beneficial via assimilation and knowledge transformation. In so doing, the firm can blend novel and previously existing knowledge, hence producing an inimitable knowledge for the firm. The firm can then exploit the exclusive knowledge to advance the innovative new process, products and services.

Gaining and sustaining competitive advantage for superior performance remains paramount for the innovative firms in the contemporary and global milieu (Chen and Huang, 2009). Hence, the growing knowledge-based building of competition, commands the firms to obtain and develop the skills that will give them the advantage quicker over their co-players in the marketplace (Murray and Chao, 2005). It is likely for innovative firms by the utilisation of new product instrument to capture competitive advantage and maintain this advantage (Estrada *et al.*, 2016).

Innovation as a result of a successful new product development that enables this differentiation is the application of creative ideas provided by organisational learning (Sanchez and Mahoney, 1996). Thus, firms are immersed in constant erudition and activity

of inclusive environmental knowledge skimming (Barringer and Bluedorn, 1999). In this context, knowledge is broadly recognised as a premeditated resource and is of infinite value to endure competitive advantage (Kim *et al.*, 2013; Murray and Chao, 2005). New product development is a knowledge-intensive activity that enables the transformation and commercialisation of absorbed external knowledge (Abecassis-Moedas and Mahmoud-Jouini, 2008; Awwad and Akroush, 2016; Cohen and Levinthal, 1990). In that way, absorptive capacity makes outward knowledge valuable (Scaringella and Burtschell, 2017). Knowledge-based organisational capabilities which allow distinguishing, unique and beneficial elements by exploiting ingenuity (Racela, 2014) in the new product commercialisation process are vital for innovative firms (Kim *et al.*, 2013). Product innovation is an outcome arising from collaborating with the external milieu and the integration of novel knowledge (Awwad and Akroush, 2016; Hsieh *et al.*, 2018; Szücs, 2018; Zach, 2016). Firms design their products via attained novel knowledge (Paiva *et al.*, 2012) and organisational learning (Olavarrieta and Friedmann, 2008) owing to their absorptive capacities. For this reason, from a knowledge-based viewpoint, absorptive capacity is an essential capability that offers a sustainable competitive advantage. Novel knowledge is continuously produced by effective learning fixated on clients and competitors (Tu *et al.*, 2006). In this framework, a firm's competitive performance rests on the capability of knowledge formation and knowledge transmission (Rebolledo *et al.*, 2009).

2.1.1 Openness. Openness is the purposive use of knowledge outflows and inflows for accelerating internal innovation and expanding markets for the external use of innovative products. Consequently, openness promotes inter-organisational learning (Tsinopoulos *et al.*, 2018) by pooling a range of internal and external resources. These resources leverage investment in innovation activities for increased absorptive capacity that strengthens innovation performance (Lau and Lo, 2015; Slater *et al.*, 2014; Xia and Roper, 2016). Kim and Mauborgne (2014) document innovation as one of the determinants of the success of high growth firms. The authors consider a brook of premeditated methods that offer direction on how to enhance a firm's competitiveness.

Further, the search and organisation of new ideas for developing new products with commercial potential are central to the innovation process. While internal sources of knowledge underlie innovation (Grant, 1996; Katila and Ahuja, 2002; Zhou and Li, 2012), firms are increasingly turning to external actors and sources of knowledge for achieving and sustaining innovation performance (Laursen and Salter, 2006; Yang and Zhang, 2018). The extent to which firms exploit external knowledge is a significant component of innovation performance (Chesbrough, 2003; Cohen and Levinthal, 1990).

Various empirical studies demonstrate that openness is positively associated with innovation performance (De Beer and Armstrong, 2015; Chen *et al.*, 2011; Chesbrough, 2003; Laursen and Salter, 2006; Leiponen and Helfat, 2010; Parida *et al.*, 2012). Notwithstanding, these studies typically measure openness as the number of information sources for innovation activities thereby disregarding the actuality that the intensity with which these sources are used varies by the firm (Brunswicker and Vanhaverbeke, 2015). We argue that the intensity with which firms draw from different sources of information for innovation reflects the degree of importance that firms attach to information sources. Hence, we posit that openness, as measured by the degree of importance firms attach to sources of information for innovation enhances innovation performance in Nigeria.

Additionally, extant theory demonstrates that there exists an inverted-U shaped relationship between openness and innovation (Drechsler and Natter, 2012; Laursen and Salter, 2006; Leiponen and Helfat, 2010; Vahter *et al.*, 2014). In particular, firms that draw ideas intensively from different external sources are more likely to become innovative. Yet, the money, time, effort and attention devoted to building and maintaining external relationships rises with an increasing number of relationships. These costs may eventually

impede innovation performance. The essence of the inverted U-shaped relation between openness and innovation performance is that the returns to increased openness may become negative as costs outweigh benefits. We, therefore, hypothesise that:

H1. Openness has an inverted U-shaped relationship with innovation performance.

2.1.2 Formal training. Human resource management (HRM) practices described "as the main process by which firms can impact and structure the skills, attitudes and behaviour of individuals" (Chen and Huang, 2009) are imperative for building human resource capacities (Camps and Luna-Arocas, 2010). Furthermore, HRM can build a managerial ethos and framework that promote the possession and transmission of knowledge within the establishment (Runar Edvardsson, 2008). Among the HRM routines, the crucial role of training for firms' learning is emphasised in some studies (Sanz-Valle and Jiménez-Jiménez, 2018; Seeck and Diehl, 2017) its influence on the growth of personal learning abilities, and its role in the formation of a knowledge-related ethos.

The knowledge and dexterity of the workforce attained via training have turned out to be imperative with progressively more swift dynamics in technology, products and systems. Most firms devote resources to workforce training because they trust that improved performance could be attained (Kozlowski *et al.*, 2000). Nevertheless, the theoretical context on the connection between training and firm performance has been extensively debated.

Formal training is inextricably linked to the degree of absorptive capacity in a firm (González *et al.*, 2016; Lewandowska, 2015). SSA is characterised by a largely unskilled labour force (Lall *et al.*, 2016; Tybout, 2000). In such an environment, formal training plays an essential role in imparting knowledge for developing workers skills (Blundell *et al.*, 1999). Empirical studies show that formal training is imperative for assimilating new internal and external knowledge that promotes both intra-organisational learning and inter-organisational learning (Leiponen, 2005; Tsinopoulos *et al.*, 2018) for improved innovation performance (Dostie, 2017; Forés and Camisón, 2016; González *et al.*, 2016; Laursen and Foss, 2003; Pfeffer, 1998; Sheehan, 2014; Vinding, 2006). Also, formal training pertaining to training programmes for the development or introduction of new products is a human resource development activity that has far-reaching effects on innovation performance (Michaelis and Markham, 2017).

Formal training intrinsically underlies the skills dimension of innovation commercialisation and competitiveness (Chen and Huang, 2009). Skilled workers play an essential role in transferring knowledge between firms. Firms, therefore, invest in an absorptive capacity directly when employees receive advanced technical training (Cohen and Levinthal, 1990). Empirical studies examining different dimensions of formal training including managerial training and employee training report a positive association between training and innovation performance (Amara *et al.*, 2008; Bryan, 2006; Dostie, 2017; González *et al.*, 2016; Sheehan, 2014; Thornhill, 2006).

Notwithstanding, Whittaker *et al.* (2016) and Yáñez-Araque *et al.* (2017) find no relationship between training and innovation performance in New Zealand and Spain, respectively. These authors argue that the relationship between training and innovation performance is more complex than suggested by previous studies. Similarly, in the context of West Africa, Robson and Obeng (2008) find that in Ghana, firms conducting formal training had a higher likelihood of encountering business barriers. In line with this, Egbetokun (2015) finds no significant association between formal training and innovation performance in the Nigerian manufacturing industry. In contrast, Oyelaran-Oyeyinka and Lal (2006) demonstrate that training is an essential source of knowledge accumulation that is positively associated with innovation performance in Nigeria.

Overall, empirical studies exploring this relationship provide inconclusive evidence. Nonetheless, we argue that formal training for the development or introduction of new products promotes innovation performance. Thus, we propose the following hypothesis:

H2. Formal training is positively associated with innovation performance.

2.2 Marketing capabilities

Marketing capabilities denote "the integrative processes designed to apply collective knowledge, skills, and resources of the firm to the market-related needs of the business, enabling the business to add value to its goods and services, adapt to market conditions, take advantage of market opportunities and meet competitive threats" (Vorhies *et al.*, 1999, p. 1175). Marketing capabilities determine firms' new product performance (Drucker, 2014; Eisend *et al.*, 2016; Najafi-Tavani *et al.*, 2016).

Marketing capabilities reflect a firm's competency in differentiating its products from those of competitors and in building successful brands. Marketing capabilities also represent how firms connect with consumers to create profitable relationships for enhanced innovation performance (Egbetokun, 2015; Hauser *et al.*, 2006; Ren *et al.*, 2015; Vorhies *et al.*, 2009). Marketing capabilities include architectural and specialised inter-functional processes by which marketing resources are combined for performing marketing tasks in a manner that results in desirable marketing outcomes (Morgan, 2012). Marketing capabilities are usually valuable, inimitable, and non-substitutable in creating sustainable competitive advantage and promoting superior firm performance in both domestic and international markets (Morgan *et al.*, 2018). Previous studies have linked this capability to effectively commercialisation of innovations (Ren *et al.*, 2015; Sok *et al.*, 2013).

We posit that marketing capabilities are driven by two forms of marketing in the context of innovation (see Najafi-Tavani *et al.*, 2016). The first form is the new product marketing entailing activities such as market research and launch advertising. Extant literature highlights the relevance of marketing new products to existing customers and potential customers (da Costa *et al.*, 2018; Hills *et al.*, 2010; Mahmoud *et al.*, 2018; Slater *et al.*, 2014; Wang and Rafiq, 2014). A new product can fail in the market if it remains unknown to consumers. Hence, marketing plays a decisive role in reinforcing innovation performance (Gunday *et al.*, 2011; Kanagal, 2015). The second form pertains to marketing innovation, which encompasses significant changes in product packaging, new techniques for product promotion, product placement, and pricing methods, and new distribution channels. Innovative products are likely to require novel marketing methods (Gunday *et al.*, 2011). Thus, introducing new or significantly improved marketing methods underlies successful commercialisation of new products with an informed organisational strategy.

Furthermore, the organisational strategy explains the market orientation of a firm that defines how a firm is determined in relative to fundamental elements as customers, competitors and department dynamics to produce success (Lockrey, 2015). An effective strategic development necessitates that firms increase their understanding of the potencies influencing the circumstances and the procedures by which such an understanding ensues and, consequently, form marketing strategy (Neill and Rose, 2006). The notion of leveraging a marketing strategy across numerous markets appears to be beneficial. It saves effort and resources and confirms a superior intensity of consistency between all in-market branding and activities. However, to attain this, firms must possess specific marketing competencies. Marketing capabilities, as an enabler in allowing firms to attain market success and financial success, cannot be undermined (Kanibir *et al.*, 2014; Ripolles *et al.*, 2011; Nalcaci and Yagci, 2014; Merrilees and Miller, 2010). Banerjee and Soberman (2013) assert that the firm's product development capability (PDC) impacts the unveiling strategy for an enduring product that is successively developed as time passes.

Also, Ripolles *et al.* (2011) emphasise that marketing capabilities support the global development of universal new ventures as it influences the choices of the firms regarding opting for market access approaches, which includes an advanced resource commitment in external markets.

Additionally, Morgan *et al.* (2009) assess how market recognition, product or variety management, and customer relation management abilities explain firms' revenue and margin growth. Their findings indicate that marketing capabilities have a perceived-direct and paired influence on revenue and margin growth rates. While Krush *et al.* (2013) reveal a direct positive impact of marketing resources on firm performance, the study further shows that sales capabilities and performance supervision support a firm's ability to recognise further market prospects for the new product development. Nonetheless, Mariadoss *et al.* (2011) argue that the direction of argument in the literature on the role of marketing capabilities in supporting the overall performance of the firm remains inconclusive.

Scholars have continued to argue that marketing capabilities can help firms to identify and react to market variations regarding competitors' actions, technological development and modernisation. Also, marketing capabilities could allow the firm to leverage the competencies and resources of cohorts for value creation and value capture by further allowing firms to accelerate and predict customer specific and concealed demands. These marketing competencies are considered to facilitate the ability of the firms to launch either fundamental new products or significantly improved subsisting products for value capture and meeting the needs of their customers.

Marketing capabilities such as market detection, networking, customer capabilities, operational capabilities have been related to different positive firms' successes (Mitrega *et al.*, 2012). Firms can use these know-hows or potentials to create a marketing strategy that would foster outstanding performance hence supporting the firms' value chain. As a matter of relevance, Nath *et al.* (2010) find that marketing capabilities remains substantially more essential in enhancing superior financial performance as compared to functional abilities. Functional or operational capabilities refer to the incorporation of a convoluted array of responsibilities undertaken by a firm to foster its performance outcome through a superior utilisation of its production capabilities, technology, and a stream of physical resources (Dutta *et al.*, 1999). Furthermore, Kanibir *et al.* (2014) show how crucial is the link between SMEs marketing capabilities, their business foresight and global market-oriented knowledge. Marketing capabilities have been considered essential in determining customers heterogeneous valuation of product quality, which further aid firms marketing strategy to PDC (Nalcaci and Yagci, 2014). More significantly, Ren *et al.* (2015) contend that marketing capabilities robustly impact and reinforce the effect of globalisation on firm innovation performance. While standards and market-oriented knowledge are significant dynamics that suit the purview of marketing capabilities, the grasping of firms' standardisation of tactics in marketing and operational capabilities is shown as enablers of global firms' performance (Lahat and Shoham, 2014).

Sok *et al.* (2013) examine how marketing, innovation and learning capabilities influence firms' general performance. The results show that marketing, innovation and learning capabilities are associated with SMEs performance. These inimitable capabilities are found to create a synergetic effect in explaining the overall performance of SMEs. Mu (2015) examines marketing capabilities from an external-internal viewpoint. The findings indicate that marketing capabilities are crucial for the firm to adjust to external variations if the firm adjusts managerial, operational elements with the demand of marketing capabilities for exploitation and exploration in product innovation (Mu, 2015). Marketing capability is also studied from a resource-based standpoint, Yu (2014) reveals that marketing abilities affect firms' operational capabilities, which then positively lead to a firm's efficiency. Operation capability copiously mediates the link between marketing capability and financial

performance (Yu, 2014). Marketing capabilities are also found to affect export performance when employing the resource-based view of the firms (Nalcaci and Yagci, 2014). Marketing capabilities are revealed to help firms outperform their competitors (Nalcaci and Yagci, 2014). It is also shown that although marketing capabilities may help firms to enhance performance, a contributing factor to the synergetic effect of marketing competencies is found more enhanced when firms give priority to networking (Mariadoss *et al.*, 2011). Also, market coordination and organisational capability are considered a sine qua non to enhancing market capabilities which further makes the innovative capacity a superior element of a firm's performance (Merrilees and Miller, 2010).

According to Vorhies and Morgan (2005), marketing capabilities foster firms' performance. Superior marketing capabilities is one of the reliable attributes for firms that outperform their competitors. Therefore, most organisations are investing mainly for the development of marketing abilities that benefit the firms with performance growth and sustainable competitive leverage (Vorhies and Morgan, 2005). Investing in market capability is found to enhance the branding of the firms, and the customer-based relationship, which substantially enhances the success of the focal firms. According to Morgan, marketing capability is confirmed to stimulate firms' performance in the top and bottom line growth. Resources are substantially required when creating the competencies needed for generating market and customer orientation to engender returns on the costs generated in the execution of marketing potentials while increasing business or economic proceeds. Fostering an all-inclusive capability for a firm is more valuable than concentrating on particular marketing competence inventiveness in the quest for superior performance optimisation.

Nonetheless, the development of specific capabilities to deal with external market dynamics has been confirmed to support a superior performance for firms (De Bakker and Nijhof, 2002). In line with the study of Mu (2015) on the link between marketing capability and NPD, the findings submit that marketing capability is positively linked to NPD performance. The author further reveals that firms' adaptation mechanism and search efficiently mediate the positive association between marketing capability and NPD performance. Also, linked to marketing strategy is the customer-based makeup, devolution and inter-functional incorporation, which are found to positively moderate the link between marketing capability and NPD performance. We argue that the primary purpose of new product marketing and marketing innovation is to open up new markets for increased innovation performance. Accordingly, we formulate our two hypotheses as follows:

H3. New product marketing is positively associated with innovation performance.

H4. Marketing innovation is positively associated with innovation performance.

This study draws on the PFI and DCs frameworks to develop the conceptual framework displayed in Figure 1. This framework illustrates our hypotheses by showing how absorptive capacity measures and marketing capabilities relate to innovation performance.

3. Data and methods

3.1 Data

We use the 2012 NIS cross-sectional data collected over the period 2008–2010 to test our hypotheses. The survey was carried out by the National Centre for Technology Management (NACETEM), Ile-Ife, Nigeria, with funding from the Nigerian government and the New Partnership for African Development. Subsequently, the data set was prepared by NACETEM with funding from the Private Enterprise Development in Low-income Programme of the UK's Department for International Development[3].

The NIS sample consists of firms from the manufacturing sector and the services sector. Like in the Community Innovation Survey (CIS), the NIS respondents comprise enterprise

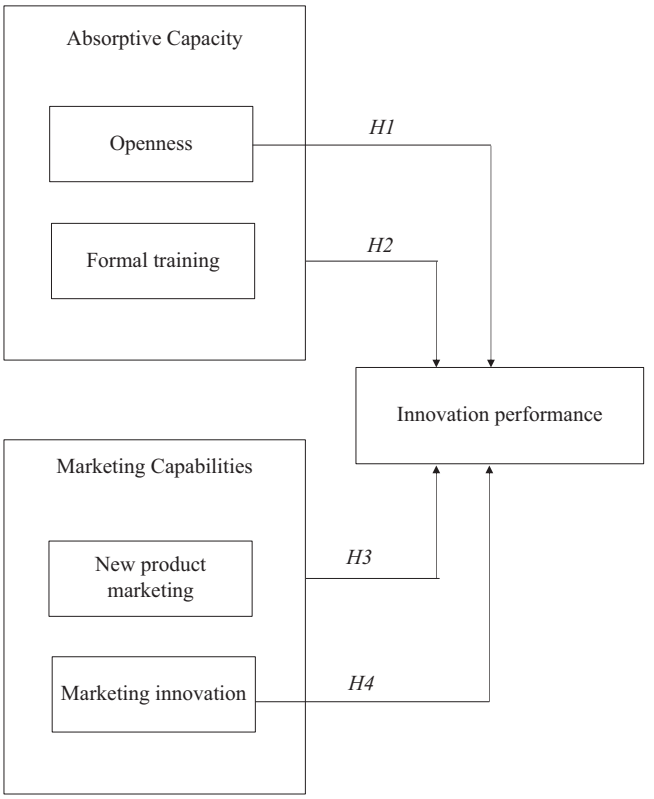

Figure 1.
Conceptual framework

owners and managers. Similarly, while the NIS provides data on firm characteristics, its primary focus is on innovation and innovation activities with the reference period covering three years (i.e. 2008–2010). The NIS also conforms to the Oslo Manual (OECD, 2005) and shares the critical questions with the CIS. The NIS instrument first collects data on general information about the enterprise. This section is followed by several sections covering product innovation, process innovation, marketing innovation and organisational innovation. The survey instrument primarily asks categorical questions relating to whether a firm for instance "introduced a new or significantly improved good or service" as a measure for product innovation, and the origin of the idea for innovation including Nigeria, the rest of Africa, Europe, USA, Asia and other countries.

The NIS sampling frame is based on a list of establishments from the Nigerian Stock Exchange (NSE) and the National Bureau of Statistics (NBS). Whereas the NSE list includes formal firms only, the NBS list includes both formal[4] and informal[5] firms. The NIS cross-referenced the two sources, and the stratified random sampling technique was used to select an initial sample of 1,000 firms. The firms were stratified according to six geographical locations (north-east, north-west, north-central, south-west, south-east, south-south) and sector of activity, resulting in a nationally representative sample. The survey instruments were hand delivered. In some cases, the firms were no longer in business. In such instances, such firms were replaced with similar firms from the same sector and geographical location. This procedure resulted in a final sample of 631 firms representing an overall response rate of 63 per cent. Our analysis is based on 631 firms.

3.2 Dependent variable

Innovation performance refers to the commercialisation of new products over the reference period. The NIS first asks if the establishment introduced any new or significantly improved goods or services over the reference period. The new products are further categorised as either "new to the market" or "new to the firm". The term "new to the firm" describes product innovation that has already been introduced to the market by the firm's competitors but is new to the firm. On the other hand, "new to the market" describes product innovation that the firm introduced on to the market before its competitors regardless of whether the product innovation exists in other markets. The question capturing innovation performance then follows by asking the respondent to estimate the total percentage of the total turnover in 2010 using the defined categories of innovation.

We, therefore, measure innovation performance as the reported percentage of total turnover in 2010 from "new to the firm" or "new to the market" products introduced over the reference period. This measure represents the percentage of turnover from the sale of all innovative goods and services[6].

3.3 Independent variables

3.3.1 Absorptive capacity. Openness. This variable is measured as the percentage of the degree of importance firms attach to the different sources of information for innovation activities or that have led to the successful completion of existing innovation projects within each firm. This measure reflects the intensity with which firms draw on different sources of information. The first step in generating this variable entails constructing openness at the firm level using ten sources of information (see Table I), where a source is coded as "1" when reported to be of a high degree of importance and "0" if reported to be of a "medium" or "low" degree of importance, or when the source of information is not used. The resulting value is then multiplied by 100 to make it a percentage. A high score on this measure indicates a higher degree of openness.

Formal training. The survey instrument asks respondents whether the establishment provided internal or external training to its personnel, specifically for the development or introduction of product or process innovation. This variable takes "1" if the firm conducted formal training for innovation and "0" if otherwise.

3.3.2 Marketing capabilities. New product marketing. This variable relates to whether firms reporting product innovation conducted market introduction activities for the new products. These activities include market research and launch advertising. This variable is measured as a dummy variable taking a value of "1" where the firm conducted marketing for the introduction of new or significantly improved goods and services and "0" if otherwise.

Sources	Description
Internal	Sources within the enterprise or enterprise group
Market	Suppliers of equipment, materials, and components or software
	Clients or customers
	Competitors or other enterprises in the same sector
	Consultants, commercial labs or private R&D institutes
Institutional	Universities or other institutions of higher education
	Government or public research institutes
Other	Conferences, trade fairs and exhibitions
	Scientific journals and trade/technical publications
	Professional and industry associations

Table I.
Sources of information for innovation activities

Marketing innovation. The variable measures whether a firm implemented a new marketing method involving significant changes in product packaging, product placement or sales channels, product promotion or product pricing to increase the competitiveness of its products or to enter into new markets. Marketing innovation is measured as a dummy variable taking a value of "1" if the firm reported at least these forms of marketing innovation and "0" if otherwise.

3.4 Control variables

3.4.1 Firm age. Empirical evidence demonstrates that entrant firms invest more in riskier innovation activities (e.g. R&D) relative to incumbents, particularly when aiming to enter new markets. Hence, younger firms have a higher propensity of product innovation since they rely on innovation for survival and growth (Czarnitzki and Kraft, 2004; Huergo and Jaumandreu, 2004). This suggests that a firm's age is inversely associated with innovation performance (Ayyagari *et al.*, 2011; Coad *et al.*, 2016). This variable is measured as the difference between the year of the survey and the year the firm began operations.

3.4.2 Firm size. Larger firms generally have more complex and diverse resources (e.g. financial slack, skilled workers, marketing skills, product development experience) that are vital for facilitating new product development (Camisón-Zornoza *et al.*, 2004; Damanpour, 1992). Furthermore, a positive relationship between the size of the firm and innovation performance may arise due to increasing economies of scale (Ayyagari *et al.*, 2011; Jiménez-Jiménez and Sanz-Valle, 2011). Size is measured as the natural logarithm of the total number of employees in 2010.

3.4.3 Education level of employees. The importance of formal education for innovative capacity and innovation performance in developing countries has been underscored in various studies (Lall *et al.*, 2016; van Uden *et al.*, 2017). The level of education of workers represents the human capital endowment possessed by a firm (De Winne and Sels, 2010). Additionally, education reflects the stock of prior knowledge of employees that is pivotal in implementing innovation processes (Cohen and Levinthal, 1989; González *et al.*, 2016). This variable is measured as a dummy variable taking a value of "1" if the firm has at least 50 per cent of employees with a Bachelor of Science degree and "0" if otherwise.

3.4.4 Exports destination. Various studies demonstrate a significant link between exporting and innovation performance (Bindroo *et al.*, 2012; Hahn and Park, 2012; Harris and Li, 2009). Firms exporting to international markets have a higher probability of accessing external knowledge flows that build innovative capabilities (Salomon and Shaver, 2005). In this study, exports destination is delineated by the geographical markets where firms sell their goods and services. It takes "1" when the geographic market includes Europe, USA, Asia, and the rest of Africa and "0" if the firm's central geographic market over the reference period includes Nigeria and the Economic Community of West African States member countries.

3.4.5 R&D expenditure. R&D investment underlies the design and development of new or improved goods and services (Huang *et al.*, 2015; Sharma *et al.*, 2016). It is generally agreed that firms investing in R&D expand their scientific and technical knowledge base, which reinforces innovation performance (Cohen and Levinthal, 1990; González *et al.*, 2016; Harris and Li, 2009). The NIS instrument asks for an estimation of the amount firms spent on R&D activity over the reference period. R&D expenditure is measured as the total expenditure in Naira on internal R&D, external R&D, acquisition of machinery, equipment and software and the acquisition of other external knowledge.

3.4.6 Intellectual property rights. The assignment of IPRs allows firms to exercise a monopoly over new products for a specified period. This enables the appropriation of returns from innovation (De Beer and Armstrong, 2015; Teece, 1986). The survey instrument reports

on several forms of IPR, including applying for and securing patents, registering industrial designs, trademarks, claiming copyrights and granting licenses on any IPRs arising from innovation. IPRs is measured as a dummy variable taking a value of "1" if a firm reported engaging in any form of IPRs, and "0" if otherwise.

3.4.7 Origin of innovation. The origin of product innovation has generally been associated with the degree of novelty of new and significantly improved products that ultimately boost innovation performance (Lee *et al.*, 2010). In the context of Africa, innovations originating from international sources are likely to display a high degree of novelty and authenticity relative to those originating from local sources. This is because local firms are more likely to engage in product imitation (Fu *et al.*, 2011). The NIS asks respondents whether innovations originated from abroad or in Nigeria. Origin of innovation is a dummy variable taking a value of "1" if the idea for innovation originated in Nigeria and "0" when innovations are reported to originate from abroad which includes Europe, USA, Asia, Africa and other countries.

3.4.8 Sector dummy. We control for sector-specific effects since innovation performance may be influenced by sectoral heterogeneity (Aboal and Garda, 2016; Kirner *et al.*, 2009). This variable takes a value of "1" when the firm belongs to the manufacturing sector and "0" if the firm belongs to the service sector. The service sector is the reference category.

3.5 Analysis

Innovation performance is a censored variable given that it is measured as a percentage and thus ranges from 0 to 100. Hence, it can only be partially observed. Consequently, we analyse our data by estimating a Heckman's sample selection model (Heckman, 1979). The method of full maximum likelihood under the assumption of normality is applied. The general form of the selection model we adopt assumes that there is an underlying regression relationship:

$$y_j = x_j\beta + u_{1j}, \tag{1}$$

where the dependent variable for observation j is observed when:

$$z_j\gamma + u_{2j} > 0, \tag{2}$$

where $u_1 \sim N(0, \sigma)$, $u_2 \sim N(0, 1)$ and $corr(u_1, u_2) = \rho$. As a rule of thumb, sample selection can be safely ignored when $\rho = 0$.

Equation (1) is the outcome equation consisting of the dependent variable y_j, representing innovation performance, as a function of independent variables x_j including absorptive capacity measures comprising openness and formal training; and marketing capabilities encompassing new product marketing and marketing innovation. Control variables include firm age, firm size, education level of employees, exports destination, R&D expenditure, IPRs, the origin of innovation and sector dummy. Equation (2) represents the selection equation with z_j variables including firm level characteristics that determine whether innovation performance is observed (i.e. openness, formal training, firm age, firm size, education level of employees, exports destination, R&D expenditure, IPRs, sector dummy and group dummy)[7]. Essentially, innovation performance is observed when firms report product innovation. Hence, innovation performance is a function of absorptive capacity and marketing capabilities whereas the propensity of product innovation is a function of firm level characteristics, and implicitly innovation performance through the inclusion of openness, formal training, new product marketing, and marketing innovation. Following Blind *et al.* (2017) and Osoro *et al.* (2017), we

formulate our empirical model as:

$$\text{StageI: Propensity of product innovation} = \beta_0 + \beta_1 \text{Openness} + \beta_2^2 \text{Openness} + \beta_3 \text{Formal training} + \beta_4 \text{Firm age} + \beta_5 \text{Firm size} + \beta_6 \text{Education level of employees} + \beta_7 \text{Exports Destination} + \beta_8 \text{R\&D expenditure} + \beta_9 \text{IPRs} + \beta_{10} \text{Sector dummy} + \beta_{11} \text{Group} + \varepsilon. \quad (3)$$

$$\text{StageII: Innovation performance} = \beta_0 + \beta_1 \text{Openness} + \beta_2^2 \text{Openness} + \beta_3 \text{Formal training} + \beta_4 \text{New product marketing} + \beta_5 \text{Marketing innovation} + \beta_6 \text{Control variables} + \varepsilon. \quad (4)$$

Given that we use survey data for our analysis, we acknowledge the possibility of common methods bias (CMB) arising from the self-reported measures (Richardson *et al.*, 2009). This is usually caused by general measurement methods as opposed to the measured independent variables of interest (Chang *et al.*, 2010; Conway and Lance, 2010). This potentially has severe effects on the results. Consequently, CMB may result in biased estimates of the effects of key independent variables (Podsakoff *et al.*, 2003). Nevertheless, several aspects of our analysis diminish the potential for CMB. First, we estimate a model where the dependent variable, innovation performance is measured at the end of the reference period, and the independent variables reflecting absorptive capacity and marketing capabilities are measured during the previous three years. Second, the answer scales for the outcome variable and independent variables are markedly different. Lastly, we estimate a relatively complex model that includes non-linear effects (i.e. the squared term for openness) that are unlikely to be part of a respondents cognitive map (Chang *et al.*, 2010)[8].

4. Results

The difference in means between non-innovative firms and innovative firms and the descriptive statistics and correlation matrix for the data used in our estimations are shown in Tables II and III, respectively. Table II reveals significant differences between the

Variables	Non-innovative firms	Innovative firms	Difference
Innovation performance	0.00	35.06	−35.060***
Turnover	1,667.60	1,649.80	17.805
Openness	6.57	24.21	−17.637***
Formal training	0.93	0.92	0.012
New product marketing	0.18	0.62	−0.442***
Marketing innovation	0.54	0.77	−0.232***
Firm age	12.85	14.57	−1.725*
Firm size	167.98	191.26	−23.282
Education level of employees	0.26	0.32	−0.066*
Exports destination	0.92	0.94	−0.026
R&D expenditure	2.40	14.09	−11.691***
Intellectual property rights	0.17	0.31	−0.145***
Origin of innovation	0.00	0.89	−0.889***
Sector dummy	0.52	0.66	−0.134***
Group	0.12	0.23	−0.114***
n	315	316	

Notes: *t*-test on equality of means. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table II.
Difference in means between non-innovative firms and innovative firms

Table III.
Descriptive statistics and correlation matrix

Variables	Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Innovation performance	17.56	30.13	0.00	100.00	1.00													
Innovation turnover	1,658.68	13,451.93	0.10	200,000.00	0.01	1.00												
Openness	15.40	20.12	0.00	100.00	0.40*	−0.01	1.00											
Formal training	0.92	0.27	0.00	1.00	0.02	0.02	−0.05	1.00										
New product marketing	0.40	0.49	0.00	1.00	0.43*	−0.04	0.48*	−0.04	1.00									
Marketing innovation	0.65	0.48	0.00	1.00	0.32*	−0.03	0.27*	−0.03	0.38*	1.00								
Firm age	13.71	12.66	1.00	151.00	0.00	0.26*	−0.05	0.01	0.10*	−0.03	1.00							
Firm size	180.00	1,100.00	8.00	17,000.00	−0.03	0.59*	−0.01	0.04	0.03	−0.05	0.26*	1.00						
Education level of employees	0.29	0.45	0.00	1.00	0.07	0.11*	0.13*	0.06	0.02	0.13*	0.08*	0.10*	1.00					
Exports destination	0.93	0.25	0.00	1.00	0.08*	−0.10*	0.01	−0.01	0.06	0.05	−0.04	−0.06	−0.04	1.00				
R&D expenditure	8.25	49.89	0.00	775.00	0.15*	0.14*	0.09*	−0.02	0.12*	0.07	0.06	0.16*	0.11*	0.01	1.00			
Intellectual property rights	0.24	0.43	0.00	1.00	0.10*	0.04	0.25*	0.02	0.21*	0.12*	0.01	0.05	0.02	−0.03	0.12*	1.00		
Origin of innovation	0.45	0.50	0.00	1.00	0.52*	0.01	0.34*	−0.03	0.42*	0.23*	0.05	0.02	0.02	0.05	0.10*	0.15*	1.00	
Sector dummy	0.59	0.49	0.00	1.00	0.09*	0.01	−0.01	−0.03	0.09*	−0.08	0.14*	0.03	−0.30*	0.11*	0.02	0.04	0.15*	1.00
Group	0.18	0.38	0.00	1.00	0.05	0.19*	0.13*	0.06	0.16*	0.08	0.14*	0.23*	0.14*	0.03	0.15*	0.16*	0.06	−0.07

Notes: $n = 631$. Turnover and R&D expenditure are divided by 1,000,000. The correlation coefficient are significant at the 5 per cent level

characteristics of innovative firms and non-innovative firms on a majority of variables. Innovative firms are those that reported introducing new or significantly improved goods or services. These products are either new to the firm or new to the market. Non-innovative firms are those that did not report introducing new or significantly improved products over the reference period (i.e. 2008–2010). Table II shows that innovative firms have a significantly higher mean on innovation performance. This observation is expected because reporting a value on this variable is contingent on firms innovating. Of particular interest are the independent variables from which we observe that innovative firms have a significantly higher mean on openness, new product marketing and marketing innovation. Notwithstanding, we observe that innovative firms have a lower but non-significant mean on formal training relative to non-innovative firms. Finally, we note that innovative firms have a significantly higher mean on firm age, education level of employees, R&D expenditure, IPRs, the origin of innovation, sector dummy and group.

The results of the descriptive statistics and correlation matrix in Table III indicate that the mean value for innovation performance is about 18 per cent. The mean value of the turnover for 2010 was about 1,658m Naira. Additionally, the mean value of openness is about 15 per cent indicating a low degree of openness. In contrast, 92 per cent of the firms report formal training. For marketing capabilities, 40 per cent of the firms engaged in new product marketing. However, 65 per cent of the firms reported marketing innovation. We also note that the average age of firms in the sample is about 14 years. We also observe that on average, firms have about 180 employees. Turning to the bivariate correlation analysis, the correlation coefficients for openness, new product marketing and marketing innovation are positive and significant. Nevertheless, the correlation coefficient for formal training is positive but non-significant. Hence, the coefficients of the independent variables have the expected signs. However, it is crucial to observe that the results of this analysis do not consider the effects of all the independent variables simultaneously. It is therefore important for us to consider the effect of each variable controlling for other independent variables. Such an analysis provides greater insight into how the independent variables influence innovation performance. Table IV provides results of a multivariate analysis of how openness, formal training, new product marketing and marketing innovation influence innovation performance.

Table IV provides the Heckman sample selection estimates from the multivariate analysis of our main model. We first consider the results from the first stage probit estimation from Model 1 showing firm-level characteristics that are associated with the propensity of product innovation. The coefficient for openness is positive and statistically significant. However, that of the squared term of openness is negative and statistically significant. Furthermore, the coefficient for R&D expenditure is positive and statistically significant. Hence, these factors increase the likelihood of innovation.

We now turn our attention to Model 2, which represents the results from the estimation of the second stage equation. We observe that the coefficient for absorptive capacity measures, including openness is positive and statistically significant. However, the coefficient for the squared term for openness is negative and statistically significant. This finding supports our hypothesis proposing an inverted U-shaped relationship between openness and innovation performance (*H1*). We also find that the coefficient for formal training is positive and statistically significant. Hence, formal training is positively associated with innovation performance (*H2*). Correspondingly, the coefficients for marketing capabilities measures comprising new product marketing and marketing innovation are also found to be positive and statistically significant. In fact, the coefficient for marketing innovation is twice as large as that of new product marketing. Hence, we find support for our hypotheses proposing a positive relation between new product marketing and innovation performance (*H3*), and marketing innovation and innovation performance (*H4*). Absorptive capacity and marketing capabilities are therefore positively associated with innovation performance in Nigeria.

Variables	First stage (1): propensity for innovation Model 1	Second stage (2): innovation performance Model 2	Second stage (2): innovation turnover Model 3
Propensity of product innovation			
Openness	0.053*** (0.007)	0.053*** (0.007)	0.053*** (0.007)
Openness squared	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)
Formal training	0.263 (0.217)	0.276 (0.223)	0.296 (0.217)
Firms age (log)	0.014 (0.080)	0.009 (0.080)	0.0136 (0.079)
Firm size (log)	−0.040 (0.055)	−0.038 (0.055)	−0.028 (0.056)
Education level of employees	0.194 (0.140)	0.212 (0.150)	0.238 (0.149)
Exports destination	0.418 (0.272)	0.425 (0.282)	0.432 (0.281)
R&D expenditure (log)	0.055*** (0.008)	0.056*** (0.008)	0.055*** (0.009)
Intellectual property rights	−0.203 (0.144)	−0.207 (0.151)	−0.198 (0.152)
Sector dummy	0.144 (0.130)	0.147 (0.130)	0.151 (0.127)
Group	−0.104 (0.165)	−0.170 (0.175)	−0.224 (0.163)
Constant	−2.053*** (0.406)	−2.068*** (0.421)	−2.132*** (0.418)
Innovation performance			
Openness		0.680** (0.319)	0.201* (0.108)
Openness squared		−0.007* (0.004)	−0.002* (0.001)
Formal training		11.000** (5.001)	2.331** (1.048)
New product marketing		7.708* (4.532)	1.113 (0.868)
Marketing innovation		14.26* (7.682)	2.229 (1.566)
Firms age (log)		−2.275 (2.612)	−0.237 (0.514)
Firm size (log)		−0.404 (1.971)	0.702 (0.456)
Education level of employees		2.619 (4.514)	0.308 (0.950)
Exports destination		8.237 (10.183)	1.624 (2.252)
R&D expenditure (log)		0.490 (0.332)	0.125 (0.108)
Intellectual property rights		0.884 (4.290)	0.298 (1.078)
Origin of innovation		−9.411 (7.297)	−1.995 (1.373)
Sector dummy		7.977** (3.915)	1.010 (0.784)
Constant		5.563 (19.135)	−5.303 (6.019)
ρ		0.516* (0.270)	1.043* (0.619)
σ		3.217*** (0.082)	1.718*** (0.200)
Observations	631	631	631
Censored		441	441
Uncensored		190	190

Notes: Clustered standard errors in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table IV.
Heckman selection model estimates

4.1 Robustness checks

We examine the robustness of our results to using the total turnover from product innovation as the dependent variable. We compute this variable by multiplying the percentage of total turnover from innovative products – our original dependent variable – by the value of total turnover for 2010 from all products measured in Naira. This yields the total turnover from product innovation. The results for this analysis are presented in Model 3 in Table IV. We find that our results are robust to using innovation turnover as the dependent variable. The coefficients of the independent variables including openness, the

squared term for openness, and formal training, retain their sign and significance. The coefficients for new product marketing and marketing innovation retain their sign but are non-significant. Overall, the results remain substantially similar. Consequently, our qualitative conclusions remain the same.

5. Discussion and implications

The results of this study support our hypotheses to a large extent. We find that absorptive capacity as measured by openness and formal training facilitates the assimilation and use of external knowledge that enhances innovation performance (da Costa *et al.*, 2018; Egbetokun, 2015; Egbetokun and Savin, 2014; Foss *et al.*, 2011; Onyeiwu, 2015; Ritala *et al.*, 2015; Xia and Roper, 2016).

Similar to previous studies, we find evidence of an inverted U-shaped relation between openness and innovation performance (Drechsler and Natter, 2012; Laursen and Salter, 2006; Leiponen and Helfat, 2010; Vahter *et al.*, 2014). As demonstrated by our study, the importance that firms attach to information sources for innovation underlies innovation performance. Thus, openness is a critical capacity for increasing inter-organisational learning for enhanced innovation performance in manufacturing firms in Nigeria (Adebowale and Oyelaran-Oyeyinka, 2012; Egbetokun, 2015). This finding is consistent with extant literature underscoring the role of capacities for innovation in clustered firms (Porter and Kramer, 2019).

Nevertheless, the inverted U-shaped relation between openness and innovation performance suggest that as firms draw intensively from different sources of information, the costs related to building and maintaining relations with an increasing number of actors may outweigh the benefits from these relations. Thus, the balance between the benefits of external linkages to innovation performance, and the potential for an over-search account for the inverted U-shaped relationship (Laursen and Salter, 2006; Leiponen and Helfat, 2010). This implies that beyond the point that innovation benefits are maximised, engaging additional innovation linkages diminishes innovation performance (Vahter *et al.*, 2014).

Furthermore, in contrast to empirical studies conducted by Robson and Obeng (2008) in Ghana and Egbetokun (2015) in Nigeria, we find that formal training is positively associated with innovation performance (Chen and Huang, 2009; Dostie, 2017; González *et al.*, 2016; Michaelis and Markham, 2017; Oyelaran-Oyeyinka and Lal, 2006). Formal training for new product development confers innovation skills and stimulates both inter-organisational learning and intra-organisational learning. This fosters the transfer of knowledge (Martins and Terblanche, 2003; Tsinopoulos *et al.*, 2018), which is pivotal for innovation performance (Cohen and Levinthal, 1990; Keskin, 2006).

We also find that marketing capabilities significantly account for innovation performance in Nigeria. Marketing capabilities are essential for differentiating products from those of competitors and for connecting firms with customers. Marketing capabilities are therefore essential in forming profitable relationships between firms and consumers thereby reinforcing innovation performance (Egbetokun, 2015; Hauser *et al.*, 2006; Ren *et al.*, 2015; Vorhies *et al.*, 2009). New product marketing promotes innovation performance (Gunday *et al.*, 2011; Kanagal, 2015) by creating awareness among existing and potential customers (da Costa *et al.*, 2018; Hills *et al.*, 2010; Slater *et al.*, 2014; Wang and Rafiq, 2014). Furthermore, marketing innovation is likely to accompany the introduction of new products since they are likely to require novel marketing techniques as well (Gunday *et al.*, 2011).

5.1 Theoretical implications

This paper introduced absorptive capacity and marketing capabilities as primary factors accounting for successful commercialisation of innovation within the PFI and DCs theories. We argued that competitive advantage arising from value creation is hinged on value capture emanating from the successful commercialisation of innovative output. Literature

typically focusses on factors accounting for innovation, yet, it is well known that innovation does not necessarily result in firms profiting from the introduction of new products. Furthermore, extant literature and the application of the PFI and DCs theories has generally been limited to the context of developed countries.

Drawing from the PFI and DCs theory, examining how absorptive capacity and marketing capabilities account for innovation commercialisation in Nigeria offers useful insights for understanding innovation in the context of SSA. Similar to most countries in SSA, Nigeria suffers a low absorptive capacity. Yet, non-technological innovation such as marketing innovation has been on the rise. However, the implication of intangible assets relating to absorptive capacity and marketing capabilities on innovation performance has received scant attention particularly in SSA.

Our results reveal that absorptive capacity and marketing capabilities significantly account for innovation performance. These findings demonstrate the practical applications of the PFI and DCs frameworks for understanding the innovation process in its entirety. Our findings are consistent with PFI and DCs theories. These two pertinent theories accent the relevance of specialised complementary capabilities for innovation performance. Our study extends this rationale by explicitly focussing on absorptive capacity measures including openness and formal training, and marketing capabilities relating to new product marketing and marketing innovation. Thus, we advance a conceptual framework that considers the usefulness of internally and externally acquired capabilities for innovation performance. Examining innovation commercialisation using this approach improves our understanding of the overall innovation process.

5.2 Practical implications

The findings of this study imply that the role that inter-organisational learning and intra-organisational learning play in driving innovation performance provide managers with a basis for incorporating absorptive capacity building programs that boost employees' ability to recognise and apply valuable external knowledge to commercial ends. Similarly, firms may benefit from offering marketing capabilities development programs. Such training may impart foundational and advanced marketing skills that are necessary for understanding existing and potential customers. However, the inverted U-shaped relationship between openness and innovation performance implies that firms must purposefully monitor the resources devoted to building and maintaining external relationships since the search costs rise with an increasing number of relationships.

Lastly, we acknowledge that the innovation process involves complex steps. Nevertheless, a comprehensive understanding of how these steps are linked to profiting from new products is imperative for formulating appropriate policies. Most innovation policies in Nigeria are generally designed to focus on fostering innovation activities aimed at developing innovative output. Government support typically revolves around providing diverse forms of financial support such as tax credits, grants, loan guarantees and subsidised loans. As a result, these policies largely ignore the commercialisation phase of innovation. We suggest that over and above supporting the development and introduction of new products, innovation policies ought to support the market introduction of new products. Accordingly, government support explicitly targeting new product marketing and marketing innovation is likely to play a vital role in the successful commercialisation of innovation in Nigeria.

5.3 Limitations and directions for future research

Like most scientific research, this study suffers from some limitations that raise further avenues for research. First, the lack of panel data limits the investigation of causality that is instrumental in substantiating our findings. We acknowledge that firms undergo

continuous changes and that there may be the presence of unobserved or unmeasured heterogeneity. Taking into cognisance that Nigeria is a federal state, cultural diversity and economic factors are likely to differ widely between geographical regions. However, we do not account for variation between regions due to the nature of data which only indicates whether firms are based in Lagos or elsewhere.

Second, while the proposed conceptual framework offers a deeper understanding of innovation performance, examining how integrating activities of the R&D department, human resource department and marketing department affect innovation commercialisation is likely to provide more meaningful insights. Inter-departmental cooperation is imperative particularly in an innovative environment where cross-functional collaboration is required for bringing together individuals with diverse functional expertise. Future studies could, therefore, explore how the degree of inter-departmental cooperation affects innovation performance.

Third, different forms of internal R&D are also vital for building absorptive capacity and marketing capabilities. There is the possibility that some firms commit internal R&D resources for the introduction of new products into the marketplace. Hence, subject to the availability of disaggregated data, future studies could focus on using fine-grained measures relating internal R&D to specific innovation commercialisation activities. In addition, it may be the case that a firm's sector moderates the effect of absorptive capacity and marketing capabilities on innovation performance. Thus, future studies may go beyond the scope of our study to examine the manufacturing and service sector as moderating variables.

Finally, our study only considers the effect of absorptive capacity and marketing capabilities on commercialisation in the final phase of innovation. Nevertheless, investigating how these factors are incorporated in the initial stages of the innovation process may provide a deeper understanding of innovation commercialisation in the context of developing countries in Africa.

Notes

1. The subjective definition of what innovation is in surveys (i.e. new to the firm (market) or significantly improved goods and services) from self-reported measures of innovation may result in incremental innovation being reported as radical innovation in the context of Africa (Cirera and Muzi, 2016). Thus, innovation and new product development are less clearly delineated in the context of Nigeria. This study also uses the terms "innovation performance" and "commercialisation" interchangeably.
2. The NIS is conducted by the New Partnership for Africa's Development (NEPAD), Federal Ministry of Science and Technology, and National Centre for Technology Management. The NIS instrument is similar to that of Europe's Community Innovation Surveys and follows the Oslo Manual (OECD, 2005) guidelines and standards.
3. NEPAD is a technical body of the African Union. It is saddled with the responsibility of enhancing Pan-African socio-economic development.
4. These are formal establishments employing ten persons and above. This category also includes professional services that employ less than ten persons but are highly formalised.
5. These are establishments owned by individuals or businesses employing less than ten people. Informal firms also include those businesses operating with little or no structures, e.g. those in wholesale and retail trade.
6. We admit that firms may have introduced new products later on in the survey period, implying that they may not already profit from such innovation. This is because innovation performance is a stock variable (i.e. total turnover in 2010 from product innovation) where product innovation is a flow variable (i.e. new or significantly improved goods and services introduced between 2008 and 2010).

However, in terms of using stock and flow measures for innovation outcomes, various authors demonstrate that there is high cross-sectional correlation between stock and flow measures of innovation (Crépon *et al.*, 1998; Mairesse and Mohnen, 2004).

7. A properly identified Heckman selection model requires the selection equation to contain at least one variable that is not the outcome equation. We therefore add the variable "group dummy" in the selection equation as a determinant of product innovation. Enterprises belonging to a larger firm have a higher probability of benefitting from technological and innovation capacities of the parent company or other firms within the group (Ayotte, 2017; Yamin, 1999). Thus, enterprises belonging to a group benefit from external networks that stimulate the propensity to innovate (Isaac *et al.*, 2018). The NIS asks whether the enterprise is part of a larger group. A group comprises two or more legally defined enterprises that are under common ownership. Similar to national or regional subsidiaries, individual enterprises may serve different geographical markets or product markets.
8. Harman single-factor test and the marker variable technique have been frequently used as diagnostic tests for CMB. However, these techniques suffer serious conceptual and empirical drawbacks that render them ineffective in controlling for methods effects see (Podsakoff *et al.*, 2003; Richardson *et al.*, 2009; Sharma *et al.*, 2009).

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