

TECHNOLOGICAL COLLABORATION, TECHNOLOGICAL CAPABILITY AND SMES PRODUCT INNOVATION PERFORMANCE

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ABSTRACT

The extant literature fails short of explaining the factors influencing the development of technological capability and product innovation performance in Nigerian SMEs. This paper therefore evaluates the existing literature and found that poor performance of Nigerian manufacturing SMEs has been attributed to their inability to innovate. However, it has been established that innovativeness is a function of firm's resource including technological capabilities. Consequently the study found and conceptually proposes that technological capabilities and product innovation performance are significantly improved with supports from other partners usually obtained from effective technological collaboration. Therefore, validating this model empirically will provide significant implications to industry players, owner/manager, policy makers and other stake holders.

Keywords: Technological collaboration, technological capability, product innovation.

1.1 INTRODUCTION

The desire to survive and enhance competitive position in this dynamic environment has made collaboration a commonly noticeable phenomenon among businesses today (Fadol and Sandhu, 2013). Hence the facts remains that in these changing environment businesses can no longer nurture, develop and manage knowledge-based independently (Pateli, 2009, Pett and Dibrell, 2001). Consequently, this rapid development and growing complexity of knowledge-based in operating business environment made it difficult for a firm to personally develop and capitalize on all relevant know-how and information (Perez, Whitelock, and Florin, 2013). Therefore firms nowadays engage in several collaboration and networking so as to tap resources, knowledge and skills from partners to improve competitive their position (Salisu & Abu Bakar, 2018, Todeva and Knoke, 2005). Madu, (2016) urged that strategic creativity that increases ability to attract, improve and maintain knowledge is essential for any technological oriented organization to meet up and survive the competition in this 21st century.

Adelowo, Ilori, Siyanbola, and Oluwale, (2015) have demonstrated that although firms in Nigeria have developed qualified personnel which enhance their internal learning capability to adapt and absorb external technology to suit their production needs, however there is no effective relationship between the businesses and knowledge institution, which affect the development of their technological capability. However, the production system of Nigerian

manufacturing firms is still based on traditional approaches rather than exploring modern technologies from within and outside the business (Apulu, 2012). Consequently, the international technology transfer policy has been adopted to address these challenges (Sobanke, Ilori, and Adegbite, 2012). Nevertheless, technological developments does not transpire independently, but with rigorous determinations to resuscitate education, develop human capital, and an established integrated industry that will embrace collaboration amongst businesses, government and academic world (Egbogah, 2012). Thus, strategic planning and active implementation of determined collaborative strategy form the basis for sustenance and successful development of technological innovation capability (Aworawo, 2011).

It have been long-established that the aggressiveness of firm's technological capability depends on their collaborative capability (Aloini, Pellegrini, Lazzarotti, and Manzini, 2015). Ryzhkova, (2015) confirmed that collaboration with customers significantly enhance firms innovation performance, however suggested for further study on various innovation performance measures to refine the findings of his study. Despite the important of strategic collaboration in enhancing the firm's access to resource and knowledge which are core to the development of technological capability, limited study exist on the links between technological collaboration, technological capability, and firm's product innovation performance. Therefore, this study presumed that technological collaboration amongst the value chain of Nigerian manufacturing industries will improved the level of technological capabilities and innovative performance.

2. LITERATURE REVIEW

This section of the paper will critically reviewed and evaluates the conceptual relationship between technological collaboration, technological capability and product innovation performance.

2.1 Technological collaboration

Technological collaboration has been described as an inter-firm effort to achieved mutual benefits through the process of sharing information and resources (Tsasis, 2009). Snavely and Tracy, (2002) maintain that technological collaboration surface in recognition that solving technological problem or accomplishing firm's objective alone is difficult if not impossible. Therefore, collaboration entails firms working together with various partners to address common goal through join effort and resources (Guo and Acar, 2005). Burgess, Gules, and Tekin, (1997) justified that firms engaging in collaboration with suppliers and companies are successful in implementing automate manufacturing technology.

Firm's performance and competitive position does not absolutely depends on the resources its possesses, but also collaboration's depth and breadth established with other partners and it ability to acquire and share information, knowledge and resources to complement one another in sharing risk and benefits as well as creating business value (Qing, Weijing, and Wenhui, 2012, Sambasivan and Yen, 2010, Chesbrough, 2003). Thus collaboration becomes necessary in technologically oriented industries in which product complexity, high cost of product development and rapid technological changes (Ju, Chen, Li, and Lee, 2005). Sompong, Igel, and Smith, (2014) urged that firms engage in technological collaboration for the benefit of

establishing mutual prospect from technology, opportunities exploitation and management style that are believes to have positive impacts on both firms commercial and partnership performance. The commonly engagement are in R&D, technology transfer, licensing agreement and manufacturing alliance. Technological networking is created basically in the upper value chain undertakings and usually involves sharing information, skills, experience and knowledge (Das, Sen, and Sengupta, 2003).

Business organizations especially in high-tech industry have turn to all available sources of technological capability to enhance the development life cycle, improving core competencies (Qing, Weijing, and Wenhui, 2012) and achieving wider service network as well as access and penetrating new market (Rajasekar and Fouts, 2009), similarly, competence in marketing, retailing and branding are also important motives for collaboration with partners (Wigley and Aikaterini-Konstantina, 2011). However, Wang et al., (2011) urged that manager of enterprises must analyze and consider their internal capabilities before engaging in alliance with other partners, this because accessing and acquiring external capabilities from partners largely depends on composition of firm's internal capabilities. Yang Liu, Ying, and Fagerlin, (2015) posit that to develop effective technology collaboration portfolio, firms must ensure balance between research institution and industry collaboration particularly in reciprocal and harmonic ambidexterity. Reciprocal entails firm's successive quest for exploitation and exploration across divisions, whereas harmonic ambidexterity concentrate on simultaneous quest for exploration and exploitation within a department (Simsek, Heavey, Veiga, and Souder, 2009).

2.2 Technological Capability

Technological capability (TC) have been described as the totality of organization's abilities directed at obtaining technical knowledge to enhances business performance (Yahya Al-Ansari, Altalib and Sardoh, 2013). Thus the significance of technological capability in influencing the success of business firm in rapidly changing business environment has been extensively recognized practically and academic literatures (Zahra, 1996). Hence businesses firms uses technologies to improve a perpetual competitive position by introducing new products or exploiting new processes (Utterback, 1994). Consequently the intense effects of technology on firms activities has universally manifested in almost all area of economic activities (Zahra, 1996). Thus technological capability has been considered as a critical elements that improve firm's performance(Zhou, Yim and Tse, 2005), therefore, most successful business firms around the globe depends on their technological capability to effectively execute their routine business processes and activities (Ajonbadi, n.d.).

Generally, business engage in developing technological capability so as to improve product, enhance production, reduce production cost, improve turnover and profit as well as international competitiveness (Adelowo, Ilori, Siyanbola, and Oluwale, 2015). Therefore, the position of firm's competitive advantage is determined by its boldness toward technological activities (Hitt and Hoskisson, 1990). Hence, most innovative firms are faithful to investment in research and development and are also proactively aggressive to obtain new and discover new technologies in the course of developing new products that better meets the customer expectations than competitors (Zhou et al., 2005, Hitt and Hoskisson, 1990). Technological

innovation capability increases firm efficiency in fashioning innovation that allow its attain better differential performance in reacting to market demand and environmental challenges (Lestari, Thoyib, Zain and Santoso, 2013). Technological capability is a vital components of firm capabilities that contributes greatly to the achievement of better performance, thus need to be absolutely considered by manufacturing firms(Ahmad, Othman and Mad Lazim, 2014). It enable firms to upgrade product and process, develop new knowledge, foster inter-organizational collaboration, reduce cost and improve efficiency (Chantanaphant, Nabi and Dornberger, 2012).

Therefore, the consequences of short product life, the multidimensional nature of technologies and the cumulative knowledge processes, organization must progressively engage in sourcing knowledge from external partners to complement the internal research and development activities (Chesbrough and Crowther, 2006, Brunswicker and Vanhaverbeke, 2014). Thus the role of external source of knowledge in influencing technological innovation has been adequately emphasized in the open innovation theory (Chesbrough, 2003). Hence the view guiding open innovation theory postulates that, organizations can attain key knowledge and skill for innovation from various external sources (Alvarez and Iske, 2015). Organizations may involve in open innovation in two ways: (1) Inbound open innovation, and (2) Outbound open innovation (Chesbrough and Crowther, 2006). Inbound open innovation means the internal technology transfer, where organizations scan and evaluates their operating environment with a view of identifying sourcing technological knowledge and blend them into their knowledge base (Alvarez and Iske, 2015). On the other hand, outbound open innovation refers to external technology transfer, in which organizations look for external bodies that are superior to appropriate commercialize the identified technology (Lichtenthaler and Lichtenthaler, 2009).

Therefore, organization's ability to continually supersedes competitors depends on its access to relevant external technologies and information uniquely held by other participants in the market (Huang, 2014). Furthermore the rising pressure from rivals and rapidly changing technology in today's business environment (Davis, 2007) made collaboration with other market participant an crucial condition for enhancing market success (Davis, Bell, Payne, and Kreiser, 2010). Thus the quest to outperform competitors is main reason nowadays organization engaged in collective activity and inter organization relations in the form of strategic network (Gathungu, Aiko, and Machuki, 2014). Consequently many organizations changed their antipathetic competition relation to strategically cooperative relationship to enhance core competence (Qing, Weijing, and Wenhui, 2012).

2.3 Technological collaboration and Firm's Technological Capability

Acquiring external technology through several inter-organization relationships become a tactical issue and critical for the organizations' survival (Ju, Chen, Li, and Lee, 2005). Inter-organizations collaboration provides opportunities for knowledge access, knowledge transfer and learning (Khamseh and Jolly, 2008). Therefore learning through alliance minimizes cost differentiation in an industry where firms vary in cost structure (Das, Sen, and Sengupta, 2003), thus the key to achieving competitive advantage and enhancing customer satisfaction depends on the ability of organizations to develop an alliance learning capability(Taylor,

2005, Love and Gunasekaran, 1999). The facts that in today's business environment learning process is an interdependent activity through which employers and employees, supplier and customer interact to acquire excellent skills of identifying and exploiting opportunities to enhance performance (Glenn Richey and Autry, 2009, Dealtry, 2008).

Acquiring and exploring external knowledge are crucial elements in achieving firm's sustainable competitive advantage (Bierly, Damanpour, & Santoro, 2009). However, Taylor, (2005) demonstrated that the success of collaborative alliances depends largely on the readiness and openness of partners in the alliance to share competencies and knowledge and in turn absorb new and better knowledge from the partners. This however, is the function of institutionalizing trust and commitment in the alliance (Wahyudi, 2015, Todeva and Knoke, 2005, Taylor, 2005). Thus, trust and commitment are the major factors influencing the success of strategic alliances which in turn facilitate effective learning through problem solving (Valdés-Llaneza and García-Canal, 2015, Davis and Love, 2011, Mellat-Parast and Digman, 2007). However, trust and transfer of knowledge among partners is built by coordination, interdependence agreement and social capital (Wahyudi, 2015).

Hence through effective management of inter-organizational learning; individual and collective goals can be achieved (Thorne and Wright, 2005). It has been established that business alliances allow access to important market information and the collective resources of partners can be adequately leveraged to achieve better customer satisfaction, higher product quality and flexibility (Ford, et al., 2003). Alliances provide more resources available for investment and effective marketing (Ricciardi, 2014). Trifilova, Bartlett, and Altman, (2013) maintained that Russian business enterprises engage themselves in collaboration with customers and suppliers on a short-term basis to liberate the industry, consequently R&D institutions in the country have achieved tremendous progress in the course of moving out of command to market driven economy and are adjusting to environmental changes.

Accordingly, firms specialize and utilize inter-organizational relationships to supplement their knowledge (Yang Liu, Ying, and Fagerlin, 2015, Davis and Love, 2011). This creates an interdependent environment where effective management of interaction is considered as a basis of achieving competitive edge (Thorne and Wright, 2005). Therefore enterprises targeting to develop superior products need to collaborate and learn from channel members, customers, suppliers and other organizations on a separate basis (Dealtry, 2008). The prospective learning from successive interactions between organizations in the long run creates opportunities for collective value conception and innovation (Taylor, 2005). Hence, Qing, Weijing, and Wenhui, (2012) postulated that alliances with appropriate partners significantly improve autonomous innovation capability, while compatibility, reputation and standardization ability of partners in alliances affects innovation performance.

Through strategic technological collaboration firms transfer patented knowledge and pool of unique resources as well as employees' skills into collaborative R&D projects and sometimes achieve technological innovation with extensive product application that produces market payouts for all partners (Todeva and Knoke, 2005). Therefore, to sustain innovativeness and higher competitive edge in today's rapidly changing environment firms must develop R&D collaboration with public research institutes to reap the benefits of combined partners'.

competencies and knowledge to develop new joint-technological solutions (Belderbos, Cassiman, Faems, Leten, and Van Looy, 2013). Accordingly, developing R&D partnership with other research institution allows firms to minimize the cost burden of R&D and share the risk of failure with co-partners, thus enhance efficiency of participant's innovation process (Briggs, 2015). Consequently collaboration in R&D leads to the development of joined innovative solutions (Natalicchio, Petruzzelli, and Garavelli, 2017).

Thus the trends of strategic collaboration is significantly rising particularly amongst Chinese firms that want to technically catch up and improve competencies in internationalization and allows firm the opportunities to learn from markets leaders technological capabilities (Zhang, Duysters, and Filippov, 2012). However, Zineldin and Dodourova, (2005) previously contended that strategic and managerial motives are more important than technological and financial motive for automobile firms going into alliance with partners. Nevertheless, Natalicchio, Petruzzelli, and Garavelli, (2017) demonstrated that technological collaboration helps technological diversified firms to innovate a higher impacted technological patents. Thus in order to keep up with industry players and successfully satisfy the customer demands SMEs engage in open innovation or collaboration (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009). Therefore, establishing technological collaboration with customer, competitors and research institution will be an effective strategy that Nigerian firms can adapt to access external capabilities and knowledge to individually or jointly develop innovative capabilities based upon the Chesbrough, (2003) open innovation model.

2.4 Technological Collaboration and Product Innovation Performance

The extant literature indicates that successful product innovation entails commitment of resources and technical efforts (Abu Bakar and Ahmad, 2010), which may not be readily available in SMEs (Saunila, Pekkola, and Ukko, 2014) and businesses in developing economies (Adeodun, Daniyan, Omohimoria, and Afolobi, 2015, Olughor, 2015). As firms cannot provide all the required resources and capabilities to continually develop new products, technological and innovative oriented firms develop collaboration with all relevant bodies within and outside their supply chain (Shakeel, Kannan, Brah, and Hassan, 2017). Todeva and Knoke, (2005) urged that through strategic technological collaboration firms acquires, transfer patented information and pool of distinctive resource as well as skills to achieve successful product innovation. Hence, knowledge is an undeniably essential factor in innovation process. Therefore, external players such as customers, suppliers, competitors and research institution provides technological solution that can enhance firm's innovation, at the same time exploit solutions the firm's developed (Huizingh, 2011).

Consequently, due to the wide intense dissemination of knowledge in the operating business environment firms in various industries resort to all sources of accessing valuable knowledge outside their boundaries (Ryzhkova, 2015). This development is contingents upon the concept of open innovation (Chesbrough, 2003). This concept entailed various practice aimed that utilizing both internal and external knowledge flows. However, technological collaboration for alliance sake is not enough; if firms are to sphere their competitiveness, advance and sustain their performance, collaboration must facilitate the development of new and distinctive value to the firms and it stake holders (Bititci, Martinez, Albores, and Parung,

2004). Normally participants in collaboration bring different skills and resources which improve and compliment firm’s innovation capability and enhance innovation performance (Salisu & Abu Bakar, 2018, Becker & Dietz, 2004).

Customer participation is one of the most effective strategies extensively valued in open innovation theory (Gassmann, 2006). Accordingly, Briggs, (2015) maintained that establishing R&D collaboration with other research institution allows firms to share the risk of failure and minimize the cost burden of R&D, thus enhance efficiency of product innovation process. Tsai, Tsai, and Wang, (2012), demonstrated that firm’s technological capacity enhances the influence of supplier alliance on new product performance. In their study conducted on firms in US manufacturing industry Caner and Tyler, (2013) recounted that collaboration in R&D with other participants positively affects product innovation. while, Aloini, Pellegrini, Lazzarotti, and Manzini, (2015) reported that strategic collaboration enhance the effect technology and firm’s innovation performance. Accordingly, numerous studies reported that collaboration with partners significantly affect firm’s product innovation (Mitrega, Forkmann, Zaefarian, and Stephan, 2017, Qing et al., 2012, Nieto and Santamaría, 2007).

2.5 Technological Capability and Product Innovation Performance

The role of technological capability in generating perpetual stream of product innovation is more important today than ever in improving firm’s performance in this rapidly changing technology, intense global competition and shorter product life cycles (Löfsten, 2014). Thus fashioning a philosophy that value external capabilities and know-how is essential for collaborative innovation (Gassmann, Enkel, & Chesbrough, 2010). Consequently, the major disquiet to firm’s managers is managing the complexity of product innovation. In this regard technological capability may be essential to resolve the concern in managing innovation process. Technological capability enable firms create differentiation in responding to changing marketing environment through efficient innovation process (Lestari, Thoyib, Zain, and Santoso, 2013). Thus technological capability is a strategic resources in facilitating the process of acquiring and combining emerging knowledge into valuable new products, and the development of complementary abilities to facilitate the production and distribution of those products (Nerkar and Roberts, 2004). TC is as an important strategic resource enables firms to achieve competitive advantage within its industry (Chantanaphant, Nabi and Dornberger, 2013). Therefore firms that developed superior TC achieve greater efficiency in innovations pioneering process and superior differentiation by innovating products that response adequately to the rapidly changing market demand (Tsai, 2004). The figure 2.1 below represent the propose framework:

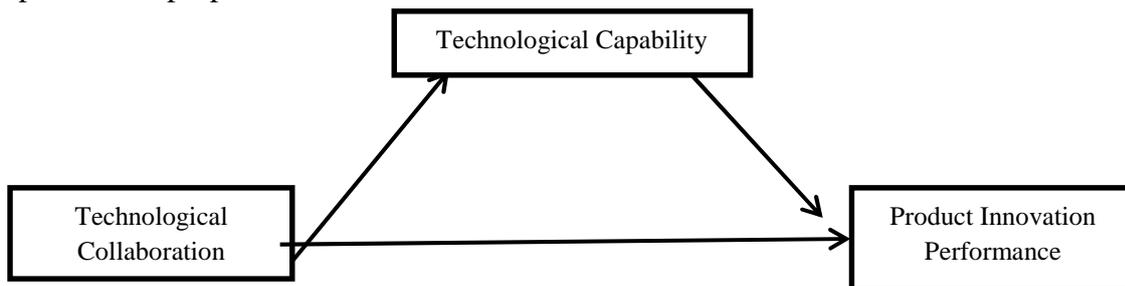


Fig. 2.1: Propose Research Framework

2.6 Conclusion

The quest to keep up with competitors and effectively satisfy the customer demands are the major motives driving SMEs to engage in open innovation or collaboration (van de Vrande *et al.*, 2009), to enhance innovative process (Salisu & Abu Bakar, 2018). Therefore, developing technological collaboration with other partners is an effective strategy that Nigerian firms can adopt to access external capabilities and knowledge in order to jointly develop innovative technological capabilities contingents with the Chesbrough, (2003) open innovation paradigm. The directorial objective of this study is to theoretically validate the significance of technological collaboration in enhancing SMEs technological capability and product innovation performance. Numerous studies critically reviewed have vindicated the potential significant relationship between technological collaboration, firm's technological capability and product innovation performance. Hence, the relationship between these variables as depicted in the figure above will provide clear comprehension of the situation and reveal to the owner/manager the important of technological collaboration, technological capability in enhancing product innovation performance and competitive advantage if empirically validated.

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