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Effect of Cluster Dynamics on Small and Medium Enterprises' Performance in Northwest Nigeria: The Mediating Role of Knowledge Spillovers

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Abstract

This research examines how inter-firm collaboration (IC) raises the performance of the small and medium-sized enterprise (SME) in clusters by hypothesizing the mediating effects of knowledge spillover (KS). Although the positive relationship between collaboration and performance is widely acknowledged, the actual processes by which collaborative efforts are converted into the inevitable performance results are under-investigated. The data were gathered through a quantitative research design in which 500 SMEs were selected from three cluster areas (Kano, Kaduna and Kebbi). The proposed mediation model was tested using regression analysis in line with the steps as proposed by Baron and Kenny (1986). The findings indicate that there is a strong direct impact of inter-firm co-operation on the SME performance, and the model captures 45.6 percent of the performance variance. More importantly, the addition of knowledge spillover in the model revealed the spillover as an influential and meaningful predictor of performance. Inter-firm collaboration had a significantly smaller effect which implies a partial mediation. The total mediation model has explained 64.2 percent of the variation in SME performance, much better. The results are strong empirical evidence that knowledge spillover is an important intervening factor that conveys the gains of inter-firm partnership to improved performance of SMEs in clusters. The paper concludes that it is not only the managers who ought to invest in the development of collaborative partnerships, but also develop organizational structures and cultures that actively enable the absorption and use of the resulting knowledge that spills out of these alliances.

Keywords: Inter-firm collaboration, knowledge spillover, SME performance.

1. Introduction

Both micro and small and medium enterprises are recognized as being of great importance in the economic development, employment creation, and elevation of living standards, which has been verified worldwide, and several governments have taken active steps to ensure them (Melo, et al., 2023). In Nigeria, SMEs play a critical role in the economic growth since they act as a major source of employment and also contribute significantly to the gross domestic product (Nkennebe, 2014). Although their inputs are vital, Nigerian SMEs have to face serious challenges, such as inadequate access to finance, market, and technology adoption, which significantly undermine their performance and sustainability (Gumel, 2017; Asogwa et. al., 2023). Such a risky state of affairs requires a further analysis of alternative policies, including business clustering, which might theoretically alleviate these common problems and improve the stability and development path of these businesses (Onuoha, 2025; Raymond, 2023; Sakariyau et al., 2025).

Clusters are viewed as a regional ecosystem of related industry and competences, with a wide range of inter-industry interdependencies. Groups of firms associated economic actors, and institutions that are close to each other and have attained a large enough scale to gain specialized expertise, services, resources, suppliers, and skills are termed business clustering (Cheung, 2022). In particular, clustering can provide SMEs with better access to common infrastructure, regional labour pools, and joint learning settings, which help with innovation and competitiveness in a regional environment (Cao & Shi, 2021). The benefits of a cluster to SMEs, especially in a developing economy are collective efficiency, sharing of resources, and ensuing access to markets and technology, and lead to their sustainability and growth (Venugopal et al., 2018; Afolayan et al., 2015). In this light, the insight into how strategic formation and exploitation of business clusters can respond specifically to the distinctive demands on SMEs in north-west Nigeria is of paramount importance in policy-making and economic planning processes. Clusters form a knowledge eco-system in which tacit knowledge spreads informally by labour mobility, through imitation and through social interaction. Agribusiness clusters in North-Central Nigeria expose that, the systematic knowledge sharing is directly proportional to innovation capacity and productivity (Sakariyau et al., 2025). In Nigeria and clustering in particular, inter-firm cooperation and knowledge spill over are the results (Onuoha, 2025; Raymond, 2023; Sakariyau et al., 2025).

One major advantage in the business clusters is knowledge spill-over which facilitates the spread of innovative practices, technical and market intelligence among the member firms (Zeng, 2010). Furthermore, Knowledge spillovers are a fundamental process in terms of which clusters promote the innovation and performance of SMEs (Cheung, 2022). Similarly, inter-firm cooperation has been found to have a major effect on enhancing the performance of small and medium-sized enterprises (SMEs) in different aspects, such as financial, market, and international performance (Mustapha et al., 2023). Collagenization can help SMEs to break the limitation of resources and reach new markets, especially when it comes to companies in the developing economies.

In Nigeria, the phenomenon of clustering has become the topic of discussion as a possible solution to the problems of SMEs (Sakariyau et al., 2025; Atemoagbo, et. al., 2024; Gumel, 2017). Research has found different clusters around the nation, such as the Otigba Computer Village in Lagos and footwear clusters in southeastern Nigeria have a positive effect on the performance of SMEs (Oyelaran-Oyeyinka, 2005; Cheung, 2022; Sakariyau et al., 2025). Nonetheless, the systematic study of cluster impacts on the SME performance in North-West states in particular is underrepresented, so there is an excellent research gap. The North-West region, with various economic activities of agriculture to manufacturing, offers special opportunities to the development of clusters. Moreover, it is necessary to go beyond the re-establishment of the existence of a cluster effect to examine how exactly the benefits are contributed to by the cluster. This paper will concentrate on two of these important mechanisms that are inter-firm collaboration and knowledge spillovers. We suggest that they are the most important channels by which geographic location of a cluster can be transferred into physical performance enhancement of SMEs. Therefore, Lack of a mechanistic empirical model that explain how clustering translates into improved SME performance in North-West Nigeria is the core problem this study addresses. The research aims to fill this gap by postulating that knowledge spillovers are not just a benefit of clustering, but a critical mediator that explains the relationship between inter-firm collaboration and improved SME outcomes. In particular, the research aims at identifying the following questions:

1. To what extent do knowledge spillovers influence the performance of SMEs in these clusters?
2. Does the presence of knowledge spillovers mediate the relationship between inter-firm collaboration and SME performance?
3. Does Knowledge spillovers mediate the relationship between inter-firm collaboration and SME performance.

It is believed that the results of this research will contribute to useful theoretical and practical additions. In theory, it will contribute to the existing body of literature on cluster theory in that it would also present empirical evidence to an emerging and in many cases volatile situation. In practical terms, the findings will provide practical information on how policymakers and business support organizations in Nigeria can successfully design and execute cluster-based developmental strategies that help to create collaboration and innovation.

2. Literature Review and Theoretical Framework

2.1 Clusters and SME Performance in Nigeria

Clustering activities in Nigeria has become a topic of scholarly interest, especially considering that a cluster has the potential to create economies of scale, resource consolidation, and increased profitability by SMEs (Raymond, S. 2023). Inter-firm cooperation and sharing of resources in Nigerian contexts are facilitated through clusters and is essential considering resource scarcity among SMEs. Research addressing textile clusters and industrial clusters in Nigeria suggests that clustering has a positive effect on SME performance in the form of increased access to market, social networking, and efficiencies (Raymond, S. 2023); Sakariyau et al., 2025). Nevertheless, not many studies investigate explicitly the role of knowledge spillovers in mediating the collaboration-performance relationship within Nigerian clusters, and it is one of the gaps that the present research aims to fill (Xu, et. al, 2023).

2.2 Inter-firm Collaboration and SME Performance

One of the pillars of a performing cluster is inter-firm collaboration, which is described as the mutual relation between two or more firms to obtain shared gains (Grant, 2004). It plays a vital role in business clusters, enabling the SMEs to jointly resolve the problems of poor infrastructure and expensive operations (Oyelaran-Oyeyinka, 2005). Such a collaborative strategy is easy to share resources, bulk buying and joint marketing efforts that are not always available to the individual SME (Dohse & Fehrenbacher, 2025). These types of collaborative efforts are not only effective in increasing the operational efficiencies, but also in creating an atmosphere that supports innovation and the transfer of knowledge to help the firms break the usual market barriers and attain the economies of scale (Le, et. al., 2023). This is especially important in developing economies where SMEs do not usually have the personal abilities to invest in the latest technologies or comprehensive market research (Adebowale and Oyelaran-Oyeyinka, 2012). Moreover, the local digital solutions and collaborative networks that are implemented by African SMEs can serve to show how collective approaches can address shortages of infrastructure and create resilience (Asekunowo et. al., 2023). The inter-firm collaboration becomes an important tool that plays a crucial role in achieving cluster benefits. Joint ventures and other unofficial partnerships can be used as collaborative programs that allow knowledge sharing and decrease inefficiency in operations. It is also noted that SMEs that actively participate in collaboration demonstrate a much more favorable performance in the sphere of innovation and competitiveness on the market (Ramdani et. al., 2017).

2.3 Knowledge Spillovers and Performance

A major advantage in the context of business clusters is known as knowledge spill over that facilitates sharing of innovative practices, technical skills and market-based intelligence between member firms. One of the studies by Ogbonna 2022 emphasized the role of informal exchange of ideas and the growth of professional networks within clusters as effective in increasing problem-solving skills and speed at which new technologies are adopted by Nigerian SMEs. This mechanism of informal knowledge transfer is essential to a supportive environment of innovation, especially in those geographic areas where research and development infrastructure might not be formal (Awoleye, 2022). Moreover, due to the close geographical location and developed trust among cluster members, the dynamic learning process occurs, in which the best practices and new tendencies in the industry are quickly acquired and implemented (Maswana and Munisi, 2020). This trend also known as learning by interacting becomes central in updating the technological and managerial skills of the members of the cluster, and thus leading to eventual growth and competitiveness amongst the cluster members. cluster firm performance differs from other firms because of the easier access to knowledge spillovers that cluster firms have (Bell 2005; Deeds et al. 1997).

2.4 Mediating Role of Knowledge Spillovers

Knowledge spillovers can be viewed as an important mediating variable, and it has been established that technological, managerial, and market knowledge spillover between firms can promote learning and diffusion of innovation. Spillovers of tacit knowledge that usually require trust and close proximity are particularly essential in the Nigerian context (UNCTAD, 2019; Ogbonna, 2024). Such spillovers will translate into better sales growth, profitability and sustainability of SMEs. Recent studies have demonstrated that based on mediation analyses, the knowledge spillovers result in practical innovation and growth effects of collaborative efforts (Li et. al., 2020). This mediation effect brings to the fore the necessity of learning not only the immediate effects of collaboration but also the knowledge flows underpinning such relationships through which SMEs can capitalize on them. Also, such environmental and organizational variables as digital adoption and market turbulence can mediate these effects, which further complicates the situation (Cao and Shi 2021).

Nevertheless, the quantitative studies that have applied advanced mediation models to explicitly measure the knowledge spillover effect are significantly lacking, which implies the careful necessity of additional practical research (Onuoha, 2025).

2.5 Theoretical Framework

The present research is based on two important theoretical approaches, the

Network Theory and Knowledge-Based View (KBV) of the firm. Network Theory describes how network-based firms can access valuable resources and knowledge via relationships and therefore improve their innovative and performance efforts (Granovetter, 1985; Nohria and Eccles, 1992). The network framework established by inter-firm collaboration in the context of clusters fosters trust, sharing resources, and solving problems together, which are very critical to SME development and competitiveness (Lechner & Leyronas, 2019).
The Knowledge-Based View emphasizes strategic significance of knowledge as a key resource of competitive advantage. It assumes that companies that successfully obtain, combine, and utilize external knowledge are able to improve their levels of innovation and performance (Grant, 1996; Nonaka and Takeuchi, 1995). Enabling SMEs to enjoy the benefits of external knowledge assets through the spill over of tacit and explicit knowledge, knowledge spillovers are natural phenomena in the cluster with geographic proximity and collaboration facilitating the knowledge flow between firms (Audretsch and Feldman, 1998).
Combining these views, the framework has thought of inter-firm collaboration as the medium through which knowledge spillovers happen, which subsequently lead to desirable performance results of SMEs.

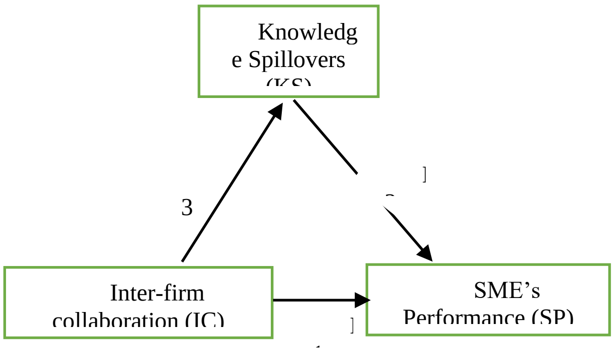
Hypotheses

H1: Inter-firm collaboration positively influences SME performance.

H2: Knowledge spillovers have a positive effect on SME performance.

H3: Knowledge spillovers mediate the relationship between inter-firm collaboration and SME performance.

Figure1: Conceptual Model



3. Methodology

3.1 Research Design

The research uses quantitative research design in order to empirically examine the impacts on the performance of SMEs in Northwest Nigeria using inter-firm collaboration, knowledge spillovers and clustering. There is a quantitative approach, which can be chosen because it provides the opportunity to systematically measure variables, test hypotheses, and investigate relationships between constructs with the help of statistics (Sekaran and Bougie, 2017).

3.2 Population of the Study

All phone repairs and accessories, Small and Medium Scale Enterprises (SMEs) functioning in the three clusters in North-West Nigeria, the Farm center cluster in Kano, the Makarfi Plaza cluster in Kaduna State, and the Olumbo cluster in Kebbi State, will be the target population of this study. The three clusters were selected in order to provide an alternative viewpoint on operations in different geographical settings in the region.

3.3 Sampling

Both practical feasibility and the selection of different views within the clusters were taken care of through a two-stage mixed-method sampling approach. Three cluster areas (Kano, Kaduna and Kebbi) were chosen purposely on three criteria: Such a purposive selection is not intended to be statistically generalized to all possible clusters, but analytically generalized, so that the operation of cluster effects in diverse, although contextually relevant, settings can be explored in depth. Since there is no one verified directory of all SMEs in these clusters, pragmatic sample strategy was chosen in each location.

Enumerators were posted to the cluster sites. The enumerators started with a starting point contact as supplied by the local cluster association. They adopted a snowball sampling approach whereby each SME owner/manager in the participating group was requested to provide them with the names of two additional businesses operating within the cluster and which suited the requirements of the study. To reduce the bias of snowball sampling (e.g. only sampling connected firms), enumerators were advised to attempt referrals across network branches and to sample SMEs within a specific subsector within each cluster.

A total of 500 SME owners/managers were used as the final sample. This figure was calculated using Cochran formula on unknown population at 95 percent confidence limits and 5 percent margin of error giving a minimum sample size of 385. To cover possible non-response and to guarantee sound subgroup analysis within the three clusters, the sample was expanded to m=500. An owner or manager needed to belong to the study in terms of the OECD (2022) definition of an SME: Small Enterprise: Employing between 10 and 49 people and Medium Enterprise: Employing between 50 and 249 people. Because the size of the population of each cluster was not known, the sample size was proportionally distributed using the available estimates of each cluster population. These estimations were made after consultation with local cluster association heads, and reconnaissance by research enumerators in the beginning. The estimated size of the clusters was calculated to be as follows: Kano Cluster: 50 percent of the total population, Kaduna Cluster: 35 percent of the total population, Kebbi Cluster: 15 percent of the total population. As a result, a final sample of 500 SME owners/managers was distributed as follows: 250 respondents were selected in the Kano leather cluster, 175 respondents were selected in the Kaduna automobile cluster and 75 respondents were selected in the Kebbi phones cluster.

3.4 Data Collection and Measures

The structured questionnaire that will be used to gather primary data will measure Inter-firm collaboration, knowledge spillovers and SME performance (e.g., sales growth, profitability, market share). Inter-firm collaboration was measured with a modified scale that had been created by Seppanen (2008) to measure important segments of collaboration such as trust, mutual decision-making, and sharing of knowledge. The items included in the scale are five items rated on a Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The original scale has proved to be quite reliable in terms of reliability and validity in situations of organizational research (Seppanen, 2008; modified to suit the Nigerian SME situation).

The measurement of knowledge spillovers was based on a perceptual scale that had been modified in accordance with the researches by Almeida and Kogut (1999) and later used in SME clusters (e.g., UNCTAD, 2019). The scale measures how frequently, how intensive, and useful knowledge exchanges with cluster firms are, again on a 5-point Likert scale. This method indicates the broadly employed subjective spillover measures in which objective data is difficult to determine.

The performance of SMEs was operationalized using a multidimensional scale based on the Balanced Scorecard framework that was adapted to the performance of SMEs (Kaplan and

Norton, 1992; further adapted by Nkamnebe, 2014). It has financial indicators (growth in profits, growth in sales) and non-financial indicators (expansion of customer base, product innovation, employee knowledge). Respondents reported on performance using a 5-point Likert scale where items like; our company sales have improved tremendously over the last three years and our firm has recently developed new products or services, etc. The scale has been proved to be valid in the similar developing country SME settings.

3.5 Reliability of the Scale Items

The internal consistency of all scales was assessed using Cronbach's Alpha. The knowledge sharing (KS) scale (5 items) showed good reliability across two analyses (α = .746), Inter-firm collaboration (IC) with 5 items scale also showed good reliability (α = .758) while the strategic planning (SP) scale (5 items) demonstrated high reliability (α = .811).

3.6 Analytical Techniques

Coded data will be analyzed with the help of the Statistical Package of the Social Sciences (SPSS) software. Regression Analysis is used to estimate the direct impact of inter-firm collaboration and knowledge spillover on SME performance to assess the mediating impact of knowledge spillovers in the collaboration to performance relationship through the mediation analysis measures that include the Baron and Kenny approach. The regression coefficients and their 95% confidence intervals were estimated using bootstrapping (5,000 samples, bias-corrected and accelerated method).

4. Result and Discussion

To test the hypothesis that knowledge spillover (KS) mediates the relationship between inter-firm collaboration (IC) and SME performance (SP), a sequence of regression analyses has been carried out. Below the model fit and significance of these regressions are reported.

TABLE1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.675[a]	.456	.455	1.85759
2	.763[b]	.604	.603	1.33104

Source: *Researcher's Fieldwork, 2025*

As Table 1 indicates, Model 1, in which inter-firm collaboration was the sole predictor (IC), was statistically significant. The model described a significant amount of the variance of SME performance with R2 =.456. This shows that inter-firm collaboration is only able to explain 45.6% of SME performance variation. Model 2 when the knowledge spillover (KS) is added brought about a large increase in the explanatory power of the model. The difference in R2 was .148. The entire model (IC and KS) accounted 60.4% variation in SME performance (R2 = .604) which is substantial and significant compared to Model 1. The standard error of the estimate also reduced by 1.858 in Model 1 to 1.331 in Model 2, which shows that the second model gives more accurate estimations.

TABLE 2: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1440.341	1	1440.341	417.411	.000[b]
	Residual	1718.427	498	3.451		
	Total	3158.768	499			
2	Regression	2278.256	2	1139.128	642.974	.000[c]
	Residual	880.512	497	1.772		
	Total	3158.768	499			

a. Dependent Variable: SP
b. Predictors: (Constant), IC
c. Predictors: (Constant), IC, KS

Source: *Researcher's Fieldwork, 2025*

The results of ANOVA in Table 2 show that the two regression models are statistically significant at large. Model 1 F(1, 498) =417.41 p <.001 was significant as well as Model 2 F(2, 497) =642.97, p <.001. This implies that the predictors that are contained in any of the models are reliable in predicting the variance in the performance of the SME.

TABLE 3: Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	t	Sig.
1	(Constant)	8.690	.588	14.767	.000
	IC	.604	.030	20.431	.000
2	(Constant)	1.572	.534	2.946	.003
	IC	.154	.030	5.181	.000
	KS	.642	.033	21.748	.000

Source: *Researcher's Fieldwork, 2025*

TABLE 4: Bootstrap for Coefficients

Model	Predictor	B	Std. Error	Bias	Sig. (2-tailed)	95% CI Lower	95% CI Upper
1	Constant	8.690	0.460	−0.001	.000	7.787	9.600
1	IC	0.604	0.025	0.000	.000	0.554	0.653
2	Constant	1.572	0.425	−0.007	.000	0.722	2.383
2	IC	0.154	0.032	0.000	.000	0.089	0.215
2	KS	0.642	0.032	0.001	.000	0.704	0.837

Source: *Researcher's Fieldwork, 2025*

In the first step, the overall effect of independent variable (IC) on the dependent variable (SP) was analyzed (Model 1). Regression analysis showed an important positive effect of inter-firm collaboration on SME performance, $\beta = 0.604$, SE = 0.030, t = 20.431, p <.001. This implies that a one unit rise in inter-firm collaboration is associated with a 0.604-unit increase in SME performance, which confirms that there is a significant total effect to be mediated.

The proposed mediator was then included in regression model (Model 2), which was knowledge spillover (KS). The findings indicate that in model with knowledge spillover, relationship between inter-firm collaboration and SME performance was noteworthy, but significantly lower, β = 0.154, SE = 0.030, t = 5.181, p =.001. Importantly, knowledge spillover per se was a powerful and meaningful predictor of SME performance, β = 0.642, SE = 0.033, t = 21.748, p < .001. It can be seen that the beta coefficient (β) of IC in Model 1 (.675) decreases to Model 2 (.172) indicating partial mediation. This implies that most of the impact of the inter-firm collaboration to the performance of the firms relied on the mechanism of knowledge spillover.

This mediation model is also supported by the zero-order correlations. There is a positive correlation between inter-firm collaboration and both SME performance (r = .675, p < .001) and knowledge spillover (r =.763, p < .001, in Model 2), and knowledge spillover is positively correlated with SME performance (r =.763, p <.001).

Because both the models were significant, mediation analyses were tested using bootstrapping method. In the present study, the 95 percent interval of the indirect effect was obtained with 5000 bootstrap samples (preacher and Hayes, 2008). In Model 1, Inter-firm collaboration significantly predicts the dependent variable (B = 0.604, p < .001, 95% CI [0.554, 0.653]). In Model 2, adding knowledge Spill over as a predictor increases model explanatory power. Knowledge Spill over shows a strong positive effect (B = 0.604, p < .001), while Inter-firm collaboration remains significant but with a reduced coefficient (B = 0.154, p < .001), suggesting that Knowledge spillover partially accounts for the relationship between Inter-firm collaboration and the Sme's performance.

Discussion

The results of this research show that knowledge spillovers (KS) are partially mediated in the dependence between inter-firm collaboration (IC) and SME performance (SP) in Nigerian context. The findings show that although there is a significant direct impact of inter-firm collaboration on the SME performance (β = .675, p < .001), the introduction of the knowledge spillovers as a mediating variable significantly modifies the relationship, decreasing the direct impact of IC on SP (β = .172, p < .001) but provides a significant mediating pathway via KS (β = .642, p < .001). According to this mediation pattern, it can be concluded that about 64.2 percent of the overall impact of inter-firm collaboration on the SMEs performance is mediated by the knowledge spillover. The implications of these findings are important to a number of key literature streams as well as have important implications to both practice and theory regarding emerging economies, especially in sub-Saharan Africa. The existence of strong mediating value of knowledge spillovers in this study is consistent with the study of Cao, & Shi, (2021) and the Knowledge Spillover Theory of Entrepreneurship and Innovation (KSTEI) which assumes that knowledge generated in one organization can be spilled over to the other entities, promoting innovations and economic prosperity.

The result of this study also agrees with studies from Asia and Europe (Cao, Z., & Shi, X. 2021; Cao & Shi, 2021; Li et al., 2022; Fabbri et al., 2025; Li et al., 2023), the 64.2% mediation observed in Nigeria stands out as notably higher. The Higher mediation value obtained in this study could have been because of the increased significance of informal knowledge sharing in the countries with institutional voids and less-developed formal innovation systems. Contrary to this, Asia and European areas have organized channels and robust intellectual property regimes that may lessen the effect of spillover as a mediator. In the presented study, we present empirical evidence to support this theory in the Nigerian setting and argue that knowledge does act as a public good with non-rivalry and partial non-excludability. The fact that the direct impact of inter-firm collusion decreases as the knowledge spillovers are incorporated into the equation indicates that a large portion of the good of collaboration does pass through the knowledge resource sharing and recombination process. The fact that knowledge spillovers contribute to the overall effect to this magnitude points to the fact that recombination of knowledge is an important factor to consider in terms of the effects of collaborative relationships on the growth of the Nigerian SMEs. As was stated by Acs, et. al., (2021), spillover knowledge between an initiating firm flows out and is integrated by receiving firms with complementary knowledge to generate new opportunities and new learning experiences. The process of recombination seems to be especially important to the companies working in the unpredictable business situation of Nigeria, which is characterized by institutional voids and infrastructural difficulties.

Limitations and Future Research

Although it has contributed, this paper has a number of limitations that can be narrowed down in the future research.

- The cross-sectional type of data first makes our definitive causal claims impossible. The mediation model is theoretically based but longitudinal design or the experimental design would present greater evidence on the causality relationship as proposed.
- The paper pays particular attention to domestic inter-firm collaboration due to the pre-existing research that indicates its specific significance in the Nigerian environment. But future studies could examine the question of whether some forms of inter-firm collaboration (e.g., with suppliers, customers, or competitors) are especially productive in creating valuable knowledge spillovers. In addition, the research fails to look into the moderating variables that could be affecting the strength of the relationships identified.
- Future studies could examine the moderating role of factors like absorptive capacity, technology capability or institutional support in relation to the association between collaboration, spillovers of knowledge and performance.
- The study is based on the knowledge spillovers as a mediator, but other mediating mechanisms can also have significant roles. Further studies could investigate other mediated variables like resource complementary, or risk sharing or access to the market which could determine the effect of inter-firm collaboration on the performance of SMEs.
- The findings may be limited in their generalizability, as the Northwest Nigerian context could have peculiarities. Future studies ought to look into whether such patterns of mediation exist in other African economies that have different institutional settings and economic systems.

5. Conclusion and Recommendation

The findings confirm both the theoretical view that recombination of knowledge via spillovers is a major process by which collaboration enhances firms, and that in resource-bound settings, where formal R&D capacity is restricted, the process is essential. The paper can help researchers and practitioners improve innovation and performance in the emerging economies by explaining how inter-firm cooperation can help SMEs in these settings and offering a guideline on actions that managers and policymakers should take to encourage innovation and performance in such environments. The study also provides research with new possibilities because it sheds light on the significance of knowledge spillovers as a mediating mechanism and how various forms of knowledge can be transferred to other firms in ways that maximize benefit to firms. With the further development and integration of African economies into the global knowledge economy, the knowledge creation, sharing and utilization mechanisms including inter-firm collaboration and knowledge spillovers will be essential to formulate and design effective policies and strategies to promote sustainable economic growth.

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