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Exploring the Factors Shaping Technological Capability in Nigeria's Leather Industry

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ABSTRACT

This paper assessed determinants of technological capability among leather firms in Nigeria. Technological capability enables firms to assess the technological requirements of the market by selecting and adopting specific technologies as needed, while generating new technologies in response to the competitive business environment. The survey method was employed for data collection, using a structured questionnaire administered to 216 leather firms in the study area, which comprised the Southwest, Northwest, South-south, North-central, and Southeast regions of Nigeria. Technological capability was measured through four indicators, including investment, production, innovation, and linkage capabilities while the effects of factors such as internal, external, and government support variables were assessed on the leather firms. The result showed that the leather firms have average technological capability in the areas of production while the firms showed low capability in terms of innovation. The PL-SQM results showed that government support (t = 2.147, $p < 0.05$) and external (t = 3.888, $p < 0.001$) and internal (t = 6.562, $p < 0.001$) factors are the most influential drivers of production-related technological capabilities, while linkage (internal: t = 7.016, $p < 0.001$) and external: t = 4.492, $p < 0.001$) and investment (internal: t = 4.706, $p < 0.001$; external: t = 9.816, $p < 0.001$) capabilities are influenced by firm-specific characteristics than by government interventions factors. The paper concludes that for firms in the Nigerian leather industry to be competitive in the international market, they will need to enhance their ability to innovate by paying closer attention to their investment abilities.

Keywords: Technology capability, Leather processing firms, leather fabricating firms, Nigeria, MSMEs

INTRODUCTION

The global leather industry has long been recognised as a significant contributor to economic growth, employment generation, and value chain development. Among the leading nations in this sector, Nigeria stands out as a major producer of leather and finished leather products, with immense potential to further expand its economic contributions (Nigerian Economic Summit Group, 2017). The country not only boasts the largest resources of goatskin and kidskin in Africa but also accounts for approximately 46% of the West African market and 18% of the continent's total (NESG, 2017). Furthermore, the industry contributed approximately 24% to the GDP of the Nigerian agricultural sector and plays a crucial role in job creation, with over 750,000 workers employed in leather processing and fabricating activities. In addition, approximately 8,000 jobs were generated by the country's 11 active leather exporting firms alone according to NESG (2017). For instance, in 2022, the industry earned approximately $272 million from the export of raw hides and skins, as well as semi-processed leather (Ezenwe *et al.*, 2001; Gimba *et al.*, 2023). Despite these strengths, Nigeria's participation in the global value chain for leather products remains under-realised, constrained by limitations in technological capability, policy implementation, and competitive positioning (Shadrach *et al.*, 2022).

Industry reports suggest that the Nigerian leather industry has the potential to generate over US$1 billion annually, a projection that underscores both the scale of current operations and the opportunities for growth (NESG, 2017; Gimba *et al.*, 2023). The sector's export orientation is evident in the substantial volumes of semi-finished and finished leather sent to prominent markets in Italy, Spain, India, South Asia, China, and various African countries (King, 2022). However, a paradox emerges in the persistent gap between Nigeria's resource endowments and its position as a net importer of fabricated leather products, with annual imports estimated at $500 million. This situation is compounded by industry challenges and insufficient government intervention, resulting in an estimated annual revenue loss of $300 million. The competitive pressures from imports, particularly from China, further highlight deficiencies in local manufacturing capabilities, technology adoption, and product quality (Danyaro, 2013; NESG, 2017).

From the foregoing, the notion of technological capability assumes critical importance. Technological capability refers to the unique competencies that a firm, industry, or nation can deploy to enhance performance, drive innovation, and secure competitive advantage (Lin & Lai, 2021). It encompasses a wide array of resources, including skills, knowledge, experience, machinery, equipment, systems, and procedures that collectively enable the performance of technical functions and the development of new products and processes (Al-Mamary *et al.*, 2020). Studies suggest that technological capability is a major determinant of manufacturing performance of both small and large firms (Ahmad *et al.*, 2019; Sobanke *et al.*, 2014). In the context of developing countries, Sobanke *et al.* (2014) observed that the accumulation of firm-level and national technological capabilities is recognised as essential for productivity improvements and innovation. Therefore, this paper assesses the technology capability of leather processing and fabricating firms in Nigeria, with a view to informing policy interventions that can foster industry development and innovation. The objectives of this study are to examine the level and identify the factors influencing technological capability in Nigerian leather processing firms.

LITERATURE REVIEW

Technology Capability: Conceptual foundations and empirical evidence

Technological capability is widely recognised as a core resource that enables firms, industries, and nations to achieve a competitive advantage in terms of profitability, organisational performance, and innovation (Sobanke *et al.*, 2012; Lin & Lai, 2021). It encompasses the collective skills, knowledge, experience, machinery, equipment, systems, and procedures required to perform technical functions and develop new products and processes (Al-Mamary *et al.*, 2020). Technological capability is thus both an outcome of investment in research and development (R&D) and human capital, and a determinant of a firm's ability to adapt to changing market conditions and technological paradigms. Lin and Lai (2021) argue that technological capability is not a static attribute but a dynamic competency that evolves through learning, adaptation, and innovation. Firms with high technological capability are better positioned to assess market needs, select and utilise appropriate technologies, and adapt these technologies to local contexts. This process of technology assimilation, adaptation, and innovation is particularly critical in developing countries, where firms often face challenges related to resource constraints, institutional weaknesses, and technological dependence (Sobanke *et al.*, 2014).

Technology Capability and Manufacturing Performance

Empirical studies have demonstrated that technological capability is a major factor influencing the manufacturing performance of both small and large firms (Ahmad *et al.*, 2019). Firms with higher levels of technological capability tend to exhibit superior operational efficiency, product quality, and innovation outcomes. Al-Mamary *et al.* (2020) further emphasise that technology capability arises from the interplay of tangible and intangible assets, including state-of-the-art machinery, skilled personnel, codified knowledge, and organisational routines.

Furthermore, the accumulation of technological capability is a central challenge for developing countries seeking to enhance productivity, competitiveness, and participation in the global value chain. Sobanke *et al.* (2014) emphasize the importance of firm-level initiatives, supported by enabling policy environments, in fostering technological learning, innovation, and diffusion. This perspective is echoed by Huq (1996), who argues that developing capabilities for selecting, assimilating, adapting, designing, and generating technology is essential for responding to dynamic economic environments.

In Nigeria, the imperative to build technological capability is further accentuated by the need to diversify the economy, reduce dependence on oil exports, and create sustainable employment opportunities. In the context of the leather industry, which has an extensive resource base, technological capability determines a firm's ability to move up the value chain, from the production of raw and semi-finished leather to the manufacture of high-quality, finished goods that can compete in international markets. This transition requires not only investment in modern equipment and processes but also the development of specialised skills, quality assurance systems, and market intelligence. In this study, technology capability is operationalised through four principal proxies: investment, production, innovation, and linkage capabilities. These proxies are themselves influenced by three primary categories of determinants: internal factors (such as firm resources and managerial practices), external factors (including market environment and inter-firm collaborations), and government support factors (including policy incentives, infrastructure, and funding schemes). The study hypothesizes that both external and internal contexts, as well as government interventions, shape the technological competencies of firms.

RESEARCH METHODS

The study area of this research comprises the key states across five out of Nigeria's six geopolitical zones, including the South-West, North-West, South-South, North-Central, and South-East. The North-East zone was excluded due to prevailing security concerns, a limitation acknowledged in the generalisability of the findings (Chamba *et al.*, 2022). This multi-regional approach enables the capture of spatial heterogeneity in technological capability, reflecting the broader diversity of Nigeria's industrial landscape. Also, the study population comprises all registered and operational firms engaged in leather processing (e.g., tanning, curing) and leather fabrication (e.g., production of footwear, handbags, belts, upholstery) in Nigeria. These firms are classified according to the International Standard Industrial Classification (ISIC Rev. 4), specifically division 15, which encompasses the manufacture of leather and related products (United Nations, 2008). The inclusion criteria extend to micro, small, medium, and large-scale enterprises (MSML), capturing the full spectrum of organisational sizes and structures in the sector. The sampling frame was constructed using the comprehensive database of the Manufacturers Association of Nigeria (MAN), which contains updated records of active leather firms across the country's major industrial hubs. A stratified random sampling technique was adopted to ensure proportional representation of firms across geopolitical zones, firm sizes, and product categories (Chamba *et al.*, 2022; Knapen *et al.*, 2023). To supplement the random sample and capture hard-to-reach or underrepresented firms, a snowball sampling method was employed. This involved soliciting referrals from initial respondents, thereby expanding the sample to include firms that are not listed in the MAN database.

This study employed a primary data source through the administration of a structured questionnaire, designed to capture detailed information on technology capability and its determinants. The research instrument was administered through online surveys using Google form, and paper-based self-administered surveys (Chamba *et al.*, 2022; Knapen *et al.*, 2023). The research Items were adapted to reflect the specificities of the Nigerian leather sector, with particular attention to the operationalisation of technological capability. Both descriptive and inferential statistical techniques were employed using Microsoft Excel, Statistical Package for Social Sciences (SPSS), and SmartPLS. The multi-software approach facilitates both preliminary data management and advanced modeling procedures. Frequencies, percentages, and means were employed to generate the main characteristics of the sample and the distribution of key variables. Bivariate and multivariate statistical techniques were conducted to assess the associations between technological capability proxies and the factors influencing them. Multivariate analysis was implemented using Partial Least Squares Structural Equation Modeling (PLS-SEM), as operationalised in SmartPLS.

Study Variables and Measurement

The central construct of technological capability is operationalised through four main indicators, each measured via a multi-item scale on a four-point Likert continuum (0 = "never," 1 = "rarely," 2 = "sometimes," 3 = "always"):

Investment capability: Captures the firm's ability to identify and execute feasible investment projects, acquire appropriate technologies, design and engineer production facilities, and manage plant construction, commissioning, and start-up. Items probe the frequency and depth of activities such as technology scouting, capital investment, and project management.

Production capability: Assesses process and product engineering functions, including equipment calibration, part replacement, quality control, adherence to production specifications, accreditation, in-house product development, inventory control, production scheduling, and productivity monitoring.

Innovation capability: Evaluates the firm's potential to develop or adopt new technologies, restructure existing processes, and support experimentation and learning. Items focus on research and development activities, patenting, and engagement with external knowledge sources.

Linkage capability: Reflects the extent and quality of the firm's interactions with actors in the national innovation system, such as suppliers, customers, universities, research institutes, and industry associations.

Factors influencing technological capability are categorised accordingly, and a total of thirteen variables are assessed as potential determinants of technological capability, reflecting the multi-layered influences documented in the literature (Chamba *et al.*, 2022). Each is measured on a four-point Likert scale.

Internal factors: Encompass firm-specific attributes such as leadership commitment, employee skills, organisational culture, resource allocation, and internal communication.

External factors: Include market conditions, competitive intensity, supplier relationships, customer feedback, and access to external knowledge networks.

Government support factors: Captured through five variables representing policy incentives, access to public funding, infrastructure support, regulatory environment, and participation in government-led programmes.

RESULTS AND DISCUSSION

Enterprise Ownership Formation in Nigeria's Leather Industry

Table 1 provides a detailed breakdown of ownership structure among the sampled Nigerian leather enterprises. The data indicate that 197 firms, accounting for approximately 91%, operate under sole proprietorship. Furthermore, 196 enterprises, or about 90% of the total sample, are entirely owned by Nigerians, while only one firm is exclusively foreign-owned. Partnerships are less prevalent, with 25 enterprises falling into this category. Of these, 22 are owned solely by Nigerian partners, one is a foreign partnership, and two involve mixed Nigerian and foreign ownership. Joint ventures constitute a smaller segment, comprising 20 firms, with 15 under full Nigerian ownership and the remaining five fully foreign-owned. These findings align with the broader context provided by SMEDAN (2017), which notes that most Micro, Small, and Medium Enterprises (MSMEs) in Nigeria are mostly owned by Nigerians. This trend may be attributed attributed to lower risks and relatively minimal government intervention. Notably, single ownership confers comprehensive control over business operations, which can have a pronounced effect on innovation and productivity. The technological implications of ownership structure are significant. Rashid (2020) observed that foreign-owned enterprises often surpass domestic ones in accounting and marketing capacities, largely owing to superior access to technological resources, advanced human capital, and research and development outcomes through international networks. This perspective is particularly relevant to Nigeria's leather sector, which faces challenges in terms of technological sophistication and competitiveness at the global level (Sobanke *et al.*, 2014). The prevalence of wholly Nigerian-owned enterprises suggests both strengths in local entrepreneurship and potential limitations in accessing foreign expertise and technology transfer. To remain competitive internationally, the sector must be open to foreign partnerships and investment to facilitate the acquisition and assimilation of advanced technologies (Ahmad *et al.*, 2019).

Table 1: Ownership Structure of Responding Firms

Ownership structure	Nigerian	Foreigner	Both	No response
Sole proprietorship	196(90.7)	1(0.5)	-	19(8.8)
Partnership	22(10.2)	1(0.5)	2(0.9)	191(88.4)
Joint venture	15(6.9)	5(2.3)		196(90.7)

Firm Age Structure in Nigeria's Leather Industry

Table 2 indicates a predominance of younger firms in Nigeria's leather processing sector. Specifically, 60.2% of surveyed firms commenced operations between 2011 and 2020, signifying that the majority have less than a decade of industry experience. In contrast, only 6.5% of firms were founded before 1990, and 6.0% between 1991 and 2000. This indicate that just 12.5% of the firms have been operating for over twenty years. Furthermore, 25.9% of companies were established between 2001 and 2020, further confirming the sector's youthful profile. This distribution suggests that most firms are relatively new entrants, with a limited segment possessing extensive industry experience. Such demographic characteristics have significant implications for the accumulation of technological capability. The age of a firm is closely linked to its technological advancement. As observed by Kristiansen *et al.* (2003) and Cowling *et al.* (2012), older firms often benefit from accumulated expertise and operational independence, which can enhance their innovative capabilities and resilience. In contrast, younger firms, while potentially more agile and open to new ideas, are generally at a higher risk of failure, particularly if they lack robust initial support or strategic direction. In the context of Nigeria's leather industry, the dominance of young firms may present both challenges and opportunities. While the sector's dynamism can drive innovation and adaptation, the limited presence of older, more established firms may constrain the transfer of tacit knowledge and best practices essential for building robust technological capability (Kristiansen *et al.*, 2003; Cowling *et al.*, 2012).

Firm Size Categorization and Distribution

The distribution of sampled firms according to the number of employees is presented in Table 3. Micro-scale enterprises, comprising 1 to 10 employees, represent 64.8% of the sampled firms. Small-scale firms, those employing between 11 and 50 people, comprise 29.6% of the total.

Table 2: Distribution of Firms by Year of Establishment

Year of establishment	Frequency	Percentage
1990 and below	14	6.5
1991 – 2000	13	6.0
2001 – 2010	56	25.9
2011 – 2020	130	60.2
2021 and above	3	1.4
Total	**216**	**100**

Enterprises employing between 50 and 100 individuals are fewer, with only nine firms (4.2%), while large firms with over 100 employees accounted for only 1.4% of the sample. These results indicate a sector dominated by micro, small, and medium scale enterprises (MSMEs). The observed pattern aligns with international trends, as the Organisation for Economic Co-operation and Development (OECD) reports that MSMEs typically account for approximately 90% of all business establishments globally (OECD, 2013). Firm size is a significant determinant of a company's capacity to influence policy. Larger firms often possess greater resources and networks, which can potentially exert more substantial impacts on government decisions. On the other hand, the prevalence of micro and small firms in Nigeria's leather sector suggests a fragmented landscape where collective policy influence may be limited unless coordinated through industry associations or clusters.

Table 3: Distribution of Firms by Size

Size of employees	Frequency	Percentage
10 and below	140	64.8
11 – 20	37	17.1
21 – 50	27	12.5
51 – 100	9	4.2
101 and above	3	1.4
Total	**216**	**100**

Innovation Capability in the Leather Industry

Analysis of innovation activities among leather firms from 2017 to 2021 reveals a concerning stagnation in both product and process innovation. Table 4 shows that 39% of surveyed firms reported no introduction or improvement of leather products in the past five years, while 44% had not implemented any new or enhanced production processes. Similarly, 43% of these firms indicated an absence of new or improved market delivery methods, while 60.2% had not innovated or restructured their office operations during this period. These findings suggest that a significant proportion of leather SMEs remain static, with limited engagement in innovation. Although the majority of firms have not engaged in substantial innovation, a nuanced picture emerges regarding the type and novelty of innovations introduced. Approximately 52.8% of respondents perceived their new products as unique to their enterprise, yet only 5.6% believed their offerings were novel at the global level. Regarding process innovation, 7.6% had introduced fundamentally new methods of production (radical innovation), while 43.5% reported incremental improvements. Additionally, 8.3% of firms adopted radically new approaches to market delivery.

Table 4: Breakdown of Innovation Capability of Firms

Innovation	Yes		No
	New to Enterprise	New to the World	
Product *(Inno_1)*	114(52.8)	12(5.6)	84(38.9)
Production process *(Inno_2)*	94(43.5)	17(7.9)	96(44.4)
Market delivery *(Inno_3)*	98(45.4)	18(8.3)	92(42.6)
Office structure *(Inno_4)*	68(31.5)	9(4.2)	130(60.2)

Technology Capability of Nigeria's Leather Industry

Technological capability (TC) is a critical determinant of industrial competitiveness and innovation, particularly in sectors such as the leather manufacturing industry. In the investment choice category, only the parameter regarding the basic design of the production process was consistently performed by a majority (63%) of firms, while the other three parameters were infrequently or sporadically practiced. In the area of production capability, continuous improvement in product quality and minor adaptations were commonly practiced, while imitation or copying of designs was less frequent.

Table 5: Breakdown of Technology Capability in the Leather Industry

Technology capability	Never	Rarely	Sometimes	Always	Weighted average
Investment:					
Do you carry out feasibility studies in your enterprise? *(Invt_1)*	9(4.20)	40(18.50)	73(33.80)	94(43.50)	2.17
Does your enterprise perform technology search? *(Invt_2)*	12(5.6)	43(19.9)	83(38.4)	78(36.1)	2.05
Does your enterprise perform equipment installation in-house? *(Invt_3)*	43(19.9)	36(16.7)	85(39.4)	52(24.1)	1.68
Do you carry out the basic design of your production process? *(Invt_4)*	9(4.2)	18(8.3)	53(24.5)	136(63.0)	2.46
Product Engineering:					
Does your enterprise imitate/copy product designs from others? *(Prdn_1)*	26(12.0)	34(15.7)	121(56.0)	35(16.2)	1.76
Do you carry out minor adaptations of your products in response to market needs? *(Prdn_2)*	5(2.3)	16(7.4)	79(36.6)	116(53.7)	2.42
Does your enterprise carry out improvements on product quality? *(Prdn_3)*	0(0.0)	5(2.3)	52(24.1)	159(73.6)	2.71
Process Engineering:					
Does your enterprise carry out quality control in raw material selection? *(Prdn_4)*	2(0.9)	8(3.7)	62(28.7)	144(66.7)	2.61
Does your enterprise operate with license/franchise of new products/design acquired from others? *(Prdn_5)*	77(35.6)	46(21.3)	44(20.4)	49(22.7)	1.30
Industrial Engineering:					
Does your enterprise carry out inventory control? *(Prdn_6)*	5(2.3)	31(14.4)	54(25.0)	126(58.3)	2.39
Does your enterprise use work schedules to meet up with production targets? *(Prdn_7)*	0(0.0)	10(4.6)	57(26.4)	149(69.0)	2.64
Connect with other partners (linkage):					
Does your enterprise network with domestic suppliers of materials used in production? *(Link_1)*	6(2.8)	14(6.5)	67(31.0)	129(59.7)	2.48
Does your enterprise network with foreign suppliers of materials used in production? *(Link_2)*	54(25.0)	44(20.4)	53(24.5)	65(30.1)	1.60
Does your enterprise interact with educational/research, vocational or skills acquisition institutions? *(Link_3)*	30(13.9)	64(29.6)	77(35.6)	45(20.8)	1.63
Does your enterprise give licenses/permission to other firms to produce similar design of your leather products? *(Link_4)*	101(46.8)	48(22.2)	31(14.4)	36(16.7)	1.01

Similarly, only the control of raw material quality was consistently performed, with other parameters, such as operating under external licenses or franchises, being less common. In addition, all aspects of industrial engineering were regularly executed, indicating strong capability in this construct. Regarding linkages, only networking with domestic suppliers was regularly practiced, while other forms of inter-firm collaboration were limited, further highlighting weak technological learning through external connections. The weighted average (w.a.) scores provided a nuanced perspective on capability levels. For investment, the lowest w.a. score was found in in-house equipment installation (1.68), indicating a weak capability, whereas other parameters exceeded the threshold of 2 thus, denoting higher capability. Similar patterns were observed in product engineering and linkages, while industrial engineering consistently demonstrated high capability. The overall aggregate score of 2.06 suggests a generally high, but not exceptional, technological capability, bordering on the weak capability threshold. The findings reinforce the notion that targeted improvements in evaluation investments could enhance technological learning and, consequently, elevate overall technological learning levels. The observed patterns align with broader theoretical perspectives on innovation and technology management. For instance, Coccia (2020) emphasizes that radical innovations, while driving cyclical technological change, require organisations to invest in both technical and evaluative capacities to sustain growth and adaptation. Similarly, the need for continuous, restrained innovation within system boundaries, as discussed by Lokuge and Sedera (2018), mirrors the leather industry's challenge in moving beyond initial, technical investments to ongoing strategic and collaborative initiatives. Sobanke *et al.* (2012, 2014) further support the premise that technological learning and capability development are contingent upon a firms' ability to engage in both internal improvements and external collaborations, which is a finding echoed in this study's results.

Factors Influencing Technology Capability of Nigeria's Leather Industry

Table 6 shows that leather firms frequently conduct in-house training (w.a = 2.30) and encourage the acquisition of technical skills from external sources (w.a = 2.16). These practices contribute to building in-house technological capabilities. This result aligns with findings that emphasize the importance of continuous employee development and knowledge sharing for innovation (Yannou, 2013). However, there is a marked reluctance to invest in external or overseas training for employees (w.a = 0.84), likely due to financial constraints, which limit exposure to global best practices and opportunities for radical innovation (Lokuge & Sedera, 2018). External challenges, such as the scarcity of essential raw materials (w.a = 2.27) and the influx of imported finished leather goods (w.a = 2.13), significantly impede the production capabilities of leather firms. Moreover, the lack of domestic market acceptance of their products undermines efforts to accumulate and apply advanced manufacturing technologies.

Table 6: Distribution of Factors Influencing Technology Capability

Factors	Never	Rarely	Sometimes	Always	Weighted average
Knowledge Sharing:					
Does your enterprise share technical knowledge with similar leather firms? *(Infactor_1)*	14 (6.5)	58(26.9)	98(45.4)	46 (21.3)	1.81
Does your enterprise engage in acquiring technical knowledge/skills from other stakeholders? *(Infactor_2)*	4 (1.9)	24(11.1)	121(56.0)	67(31.0)	2.16
Employee Training:					
Does your enterprise conduct in-house training for employees? *(Infactor_3)*	18(8.3)	19(8.8)	60(27.8)	119(55.1)	2.30
Does your enterprise send employees for external/oversea training? *(Infactor_4)*	121(56.0)	33(15.3)	38(17.6)	24(11.1)	0.84
Government Support:					
Has interest rates in the country presently affects your enterprise production capacity? *(Govtsupport_1)*	7(3.2)	11(5.1)	36(16.7)	162(75.0)	2.63
Does access to money/funds/grants affect your enterprise production capacity? *(Govtsupport_2)*	7(3.2)	11(5.1)	62(28.7)	136(63.0)	2.51
Does foreign exchange rate in the country affect your enterprise's production capacity? *(Govtsupport_3)*	2(0.9)	20(9.3)	72(33.3)	122(56.5)	2.45
Is your enterprise's capacity to produce goods affected by government taxes and regulations? *(Govtsupport_4)*	16(7.4)	15(6.9)	72(33.3)	113(52.3)	2.31
Is your enterprise's capacity to produce goods affected by the availability of public infrastructural facilities? *(Govtsupport_5)*	11(5.1)	9(4.2)	68(31.5)	128(59.3)	2.45
Other Factors:					
Is your enterprise's capacity to produce goods affected by the availability of critical raw materials? *(Exfactor_1)*	12(5.6)	16(7.4)	89(41.2)	99(45.8)	2.27
Has your enterprise's capacity to produce goods been affected by the importation of finished leather products? *(Exfactor_2)*	11(5.1)	21(9.7)	112(51.9)	72(33.3)	2.13
Is your enterprise's capacity to produce goods affected by the availability of skilled personnel in the country? *(Exfactor_3)*	41(19.0)	49(22.7)	76(35.2)	50(23.1)	1.63
Is your enterprise's capacity to produce goods affected by local acceptance in Nigeria? *(Exfactor_4)*	41(19.0)	21(9.7)	69(31.9)	85(39.4)	1.92

These findings align with research that emphasizes the influence of market dynamics, resource availability, and consumer perceptions on the diffusion and adoption of innovation (Leung, 2026; Coccia, 2020). The competitive pressure from imports can hinder local technological development, especially when firms lack sufficient support to overcome these barriers. Government policies and infrastructural support are crucial for enhancing technological capabilities. The surveyed firms reported that high interest rates, limited access to funding, exchange rate volatility, regulatory burdens, and insufficient infrastructure collectively had a major adverse effect on their business operations. These systemic constraints align with the broader literature, which emphasizes the importance of conducive policy environments, access to finance, and infrastructural investments in fostering both incremental and radical innovation (Labazova *et al.*, 2021; Yannou, 2013).

Technological Capability and Influencing Factors

Measurement model

The measurement model for technological capability and influencing factors in Nigeria's leather industry was developed using Exploratory Factor Analysis (EFA). The initial analysis revealed eight constructs comprising twenty observed variables, with satisfactory high factor loadings.

Table 7: Factor Loadings of Observed Variables

Factors	External Factors	Government Support	Internal Factors	TC Innovation	TC Investment	TC Linkage	TC Prdn-Link	TC Production
Availability of skilled personnel *(Exfactor_3)*	0.935							
Local acceptance id products *(Exfactor_4)*	0.929							
Interest rates *(Govtsupport_1)*		0.859						
Access to money/funds/grants *(Govtsupport_2)*		0.744						
Sharing technical knowledge *(Infactor_1)*			0.887					
Acquiring technical knowledge/skills *(Infactor_2)*			0.819					
Product *(Inno_1)*				0.839				
Production process *(Inno_2)*				0.904				
Market delivery *(Inno_3)*				0.939				
Office structure *(Inno_4)*				0.870				
Feasibility study *(Invt_1)*					0.832			
Technology search *(Invt_2)*					0.851			
Equipment installation in-house *(Invt_3)*					0.756			
Network with domestic suppliers *(Link_1)*						0.814		
Network with foreign suppliers *(Link_2)*						0.874		
Licenses/permissions *(Link_4)*							0.927	
Imitate/copy *(Prdn_1)*								0.767
Minor adaptations of products *(Prdn_2)*							0.938	
Minor adaptations of products *(Prdn_2)*								0.812
Improvement on product *(Prdn_3)*								0.709

Among these, internal and external factors and government support emerged as key determinants of technological capability. The technological capability construct itself was further divided into five categories: investment, production, innovation, linkages, and production-linkages, each supported by multiple observed items. Reliability analyses confirmed the robustness of most constructs, with Cronbach's alpha values exceeding the 0.7 threshold for external factors, firm performance, innovation, investment, and production-linkage capability (see Table 8). While some constructs such as government support and internal factors fell below this threshold, the theoretical and contextual importance justified their retention (see Hair *et al.*, 2010). To further strengthen the model, composite reliability (rho_c) was calculated, demonstrating that all constructs surpassed the recommended 0.7 minimum, thereby ensuring internal consistency (Hair *et al.*, 2010). Convergent validity was established using the average variance extracted (AVE), with all constructs exhibiting values above 0.5, thus meeting the conservative standard recommended by Malhotra and Dash (2011). Discriminant validity, assessed via the Heterotrait-Monotrait Ratio (HTMT), indicated that constructs were sufficiently distinct, with HTMT values below 0.85, supporting the construct validity of the measurement model. Despite these strengths, model fit indices revealed some limitations. The standardized root mean square residual (SRMR) was slightly above the optimal threshold (0.105 vs. <0.08), suggesting a modest misfit (Hu & Bentler, 1999; Hair *et al.*, 2010). Nonetheless, the retention of theoretically significant constructs, even with marginally lower reliability coefficients, aligns with best practices in innovation research, where the complexity and systemic nature of organisational environments often necessitate methodological flexibility (Yannou, 2013).

Table 8: Construct Reliability and Validity of Latent Variables

	Reliability and Validity			Discriminant Validity – HTMT							
Construct	**Cronbach's alpha**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**	**EF**	**GS**	**IF**	**TC-Inno**	**TC-Invt**	**TC-Lnk**	**TC-PL**	**TC-P**
External Factors	0.849	0.930	0.869								
Government Support	0.459	0.784	0.646	0.119							
Internal Factors	0.632	0.843	0.729	0.291	0.250						
TC Innovation	0.912	0.937	0.790	0.106	0.181	0.092					
TC Investment	0.748	0.855	0.663	0.708	0.086	0.554	0.102				
TC Linkage	0.601	0.833	0.714	0.500	0.285	0.742	0.160	0.755			
TC Prdn-Link	0.849	0.930	0.869	0.358	0.411	0.398	0.079	0.537	0.589		
TC Production	0.648	0.807	0.583	0.212	0.385	0.546	0.088	0.187	0.373	0.143	

Bivariate analysis of dependent and independent variables

The correlation analysis presented in Table 9, examined the relationships between technological capability and the various internal and external factors. Results showed that investment capability is strongly influenced by both internal ($r = 0.400$; $p < 0.001$) and external ($r = 0.562$; $p < 0.001$) factors. Linkage capability, similarly, is shaped by technological capability investment ($r = 0.517$, $p < 0.001$), internal factors ($r = 0.457$, $p < 0.001$), and external factors ($r = 0.369$, $p < 0.001$). Production capability benefits from internal factors ($r = 0.355$; $p < 0.01$), government support ($r = 0.208$; $p < 0.01$), and technology capability linkage ($r = 0.211$; $p < 0.01$). On the other hand, the interaction between production-linkage capability and government support was significant but negative ($r = -0.262$; $p < 0.01$), suggesting that the current implementation of government support may be inadequate or even detrimental (Labazova *et al.*, 2021). These findings align with broader literature on innovation and organisational change, where radical innovation and internal capability building are shown to be key drivers, while inadequate or misaligned external interventions can hinder innovation diffusion and

Table 9: Correlations of Dependent and Independent Variables

Correlations	EF	GS	IF	TC-Inno	TC-Invt	TC-Lnk	TC-PL	TC-P
External Factors	1							
Government Support	0.025	1						
Internal Factors	0.223**	0.118*	1					
TC Innovation	-0.082	-0.096	-0.057	1				
TC Investment	0.562***	0.049	0.400***	-0.037	1			
TC Linkage	0.369**	0.043	0.457***	-0.104	0.517***	1		
TC Prdn-Link	0.307**	-0.262**	0.295**	0.013	0.428***	0.49***	1	
TC Production	-0.155	0.208**	0.355**	0.035	0.066	0.211**	-0.080	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 (2-tailed). ***Correlation is significant at the 0.001 (2-tailed)

organisational adaptability (Lokuge & Sedera, 2018; Coccia, 2020; Leung, 2026). For example, Leung (2026) demonstrates that innovation diffusion depends not only on the radicalness of the innovation but also on the alignment of support structures and social networks. Similarly, Coccia (2020) highlights the cyclical nature of technological change and the critical role of radical innovation in driving industrial shifts.

Structural model

In analysing the impact of the factors on technological capability variables within the leather industry, structural equation modeling, specifically Partial Least Squares Structural Equation Modeling (PLS-SEM), was employed to understand the complex relationships among latent variables. The model presented the direct effect of internal, external, and government support factors on various capabilities—production, linkage, innovation, investment, and production-linkage. Table 10 shows that internal and external factors exert substantial influence on investment capability (internal: t = 4.706, $p < 0.001$; external: t = 9.816, $p < 0.001$), though government support does not. Production capability is shaped by internal factors (t = 6.562, $p < 0.001$), external factors (t = 3.888, $p < 0.001$), and government support (t = 2.147, $p < 0.05$). Linkages capability is significantly affected by internal (t = 7.016, $p < 0.001$) and external (t = 4.492, $p < 0.001$) factors.

Table 10: Direct Effects of Path Coefficients

Path Coefficients	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics
External Factors -> TC-Innovation	-0.073	-0.070	0.086	0.848
External Factors -> TC-Investment	0.498	0.499	0.051	9.816***
External Factors -> TC-Linkage	0.281	0.283	0.063	4.492***
External Factors -> TC-Prdn-Link	0.253	0.255	0.061	4.153***
External Factors -> TC-Production	-0.246	-0.249	0.063	3.888***
Government Support -> TC-Innovation	-0.091	-0.099	0.085	1.066
Government Support -> TC-Investment	0.002	-0.001	0.058	0.036
Government Support -> TC-Linkage	-0.011	-0.012	0.067	0.170
Government Support -> TC-Prdn-Link	-0.301	-0.305	0.066	4.582***
Government Support -> TC-Production	0.168	0.168	0.078	2.147*
Internal Factors -> TC-Innovation	-0.030	-0.028	0.095	0.317
Internal Factors -> TC-Investment	0.289	0.291	0.061	4.706***
Internal Factors -> TC-Linkage	0.396	0.399	0.056	7.016***
Internal Factors -> TC-Prdn-Link	0.274	0.274	0.069	3.980***
Internal Factors -> TC-Production	0.390	0.394	0.059	6.562***

*= $p < 0.05$; **= $p < 0.01$; ***= $p < 0.001$

Notably, innovation capability appears resilient to these influences, with no significant associations detected thus, underscoring potential barriers or misalignments in innovation processes (Yannou, 2013; Leung, 2026). Production-linkage capability, a composite construct, is significantly influenced by internal factors (t = 3.980, $p < 0.001$), external factors (t = 4.153, $p < 0.001$), and government support (t = 4.582, $p < 0.001$). This comprehensive effect suggests that integrated capabilities responding to multiple organisational and environmental stimuli are most likely to drive firm performance. These results reinforce the importance of context-sensitive, systemic approaches to innovation and capability development. As Yannou (2013) emphasizes, understanding the ecosystem and processes of a company is critical for effective innovation practice, especially in industries where process and production integration are central to value creation. The pivotal role of internal and external factors, as well as government support in some dimensions, highlights the necessity for firms to cultivate both inward-facing competencies and outward-facing linkages. Additionally, production and linkage-related capabilities, shaped by internal, external, and governmental factors, are crucial drivers in this study.

CONCLUSION

This study reveals that the technological capabilities of leather firms in Nigeria are predominantly weak to average, with only a limited number of capability parameters available in significant proportions across investment, linkages, process engineering, and product engineering. The analysis identifies government support and other external and internal factors as the most influential drivers of production-related technological capabilities, underscoring the critical role of infrastructure, finance, regulatory frameworks, and access to raw materials in enhancing the sector's capabilities. In contrast, linkage and investment capabilities were found to be shaped more by firm-specific characteristics than by government interventions, highlighting the importance of internal firm orientation, strategic choices, and managerial capacity. Notably, knowledge sharing and employee training, although essential for sustainable capability development, performed relatively poorly compared to government and external support factors. Overall, the findings suggest that advancing technological capability and innovation in the leather sector requires a multi-pronged approach that combines strong government and institutional support with deliberate firm-level efforts. Without targeted improvements in skills development, technical partnerships, access to finance, and sector-wide restructuring, the leather industry's potential for higher productivity, competitiveness, and innovation will remain constrained. A coordinated strategy involving government, industry stakeholders, financial institutions, and training providers is therefore essential to transition the sector from its current capability levels toward a more innovative and globally competitive leather industry.

Data Availability

The data supporting this study are available from the corresponding author upon request.

Conflict of Interests

The authors declare no conflict of interest related to this study.

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