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INNOVATION AND SUSTAINABILITY OF THE NIGERIAN LEATHER SMALL AND MEDIUM-SIZED ENTERPRISES: A SYSTEMATIC REVIEW

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ABSTRACT

Small and medium-sized enterprises(SMEs) are important to Nigeria's leather sector. These businesses must strike a balance between innovation and sustainability in their operations if they are to prosper and stay competitive. The degree to which SMEs in this sector, however, adhere to these standards varies. In order to examine the effects of these practices across various businesses, this study aims to tackle the research topic of assessing the degree of innovation and sustainability practices in Nigerian leather SMEs. The research employs a descriptive methodology. The evaluation of innovative and sustainable practices in terms of product design, manufacturing procedures, sourcing, and environmental impact was made easier by the descriptive technique. The study emphasises how government assistance, capacity-building, and increased awareness are all necessary to foster innovation and sustainability in Nigerian leather SMEs. In order to address customer needs for leather products that are ethically sourced and environmentally sustainable, SMEs can gain a competitive edge in the global market by striking a balance between innovation and sustainability.

KEYWORDS
Innovation, SMEs, sustainability, leather

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INTRODUCTION

In Nigeria, the leather industry is crucial. After cocoa, it is the second-largest non-oil foreign exchange earner. Nigeria is the continent's second-largest producer of light leather and the eighth-largest leather exporter globally. However, structural difficulties exist for the industry at every stage of the value chain. The labor-intensive process of producing hides and skins, the use of hides and skins for food, the low quality of skins produced, the fragmented cattle market, the inadequate storage facilities, the antiquated tanning industries, the lack of technical capacity to integrate final treatments, the negative environmental effects, the absence of standards pertaining to finished leather goods, the limited selection of finished goods (primarily shoes), the slow finishing processes, and the few market links focused on exporting are some of the issues (NIPR Project, 2016).

The ability of innovation to increase personal wealth and broaden the market for entrepreneurs makes it essential for achieving and maintaining entrepreneurial success in today's global business environment. As such, the importance of innovation in manufacturing Small and Medium Firms for entrepreneurs cannot be overstated (Mohammed and Kamariah, 2018). Po-Yuhan *et al*. (2015) assert that a company that is unable to innovate will eventually fail. Because of the fierce market competition brought on by globalisation, businesses and entrepreneurs should prioritize innovation as a strategic tool for success.

Furthermore, Hyde (2013) and Ohia (2020) state that in order for entrepreneurs to succeed, they must continuously innovate because the world is too dynamic for any successful business to do nothing and hope to continue succeeding in the future. Due to their persistent innovations in response to changing environments, entrepreneurs in a number of nations, including China, Britain, and America, have had great success. This has contributed to the general development and expansion of those nations. The majority of manufacturing small- and medium-sized business owners in Africa, and Nigeria in particular, succeed in one way or another using innovative ideas, while others struggle to survive the environment due to a lack of innovative strategies in line with the changing environment, which includes factors like competition, government policies, changes in technology, and changes in customer preferences,

among others. Because of this, the majority of these businesses struggle to stay in business for an extended period of time (Ohia, 2020).

Product innovation is the launch of a new good or service to address market demands, shifting consumer preferences, and intense competition while generating higher profits. Process innovation is the application of a new or significantly improved production or delivery method, whereas product innovation is about improving the quality, quantity, and rebranding of products for market attractiveness. It has the ability to improve capital, income, machinery, and increase the number of customers, sales, and more number of manufacturing and medium firms (business units). To lower the cost per unit of production, it also entails modifications to software, hardware, and manufacturing processes (Njagi, 2016).

According to Andrew (2018), a high financial return or profit, improved personal finances, market position, company growth in terms of market expansion, and the achievement of stakeholders' objectives are all indicators of an entrepreneurial success. According to Richard *et al*. (2009), entrepreneurial success indicators are those elements that represent an entrepreneur's achievement and their sustainable operation and are related to survival, entrepreneurial profit, high sales, employee and customer satisfaction, increased market share, and personal wealth. Because increased personal wealth, also known as the personal fund, and market expansion are two reliable, well-liked, and potent indicators of the success of entrepreneurs' activities in manufacturing firms, this study restricts itself to using them as metrics of entrepreneurial success, in accordance with Andrew (2018) and Martins and Mariola (2010).

In the leather sector, solid waste creation is unavoidable. This is caused by two main factors, one of which is that the process of processing leather is mostly linked to the elimination of skin cells that aren't collagenous in order to produce the single protein collagen. However, the inherent characteristics of the processes involved in processing leather, along with the variety of chemicals employed, also lead to the production of a significant amount of solid waste from tanneries, the most of which are disposed of by landfilling or incineration (Sundar *et al*., 2011). Better ways to repurpose these wastes must be investigated, albeit (Avudainayagam *et al*., 2003). For many years, recovery, recycling, and reuse of such industrial wastes as raw materials for

different purposes has presented a significant challenge to the circular economy and green chemistry (Sole *et al*., 2019; Pfaltzgraff *et al*., 2013).

Small and medium-sized businesses, or SMEs, have been all the rage lately, tempting people to believe they are the main engines of a country's economic expansion. Additionally, they significantly boost a developing nation's state and municipal incomes. SMEs play a major role in fostering empirical knowledge, individual proprietorship, and entrepreneurial abilities. Additionally, they can quickly adapt to changing market conditions, create jobs, support the expansion of economic activity, and make a significant contribution to export commerce (Yang *et al*., 2019). In light of the aforementioned, it makes sense that developing nations in poverty might fare better in the global economy if they turn inward and use science, technology, and innovation (STI) in areas where they have a comparative advantage rather than concentrating solely on catching up at the frontiers. Then, by developing these comparative advantages, competitive advantage could be attained.

The purpose of the paper is to look into how innovation and sustainability relate to small and medium-sized businesses (SMEs) that are involved in Nigeria’s leather industry. The leather industry, a crucial component of Nigeria's industrial sector and a major contributor to the nation’s economy, has a considerable knowledge vacuum that this study aims to fill. The sustainability of SMEs has drawn more attention in recent years, particularly in emerging nations like Nigeria where they make up a sizable share of the corporate environment. Sustainability in SMEs is essential for social progress, economic growth, and environmental preservation.

The results of this study will advance knowledge of the relationship between innovation and sustainability in the context of Nigerian leather SMEs. They may also provide information and suggestions for improving the sustainability of these businesses for decision-makers in government, industry stakeholders, and business owners. By doing this, the study tackles a crucial issue that affects the business community and the growth of the economy of the country.

METHODOLOGY

The purpose of this study is to provide a thorough evaluation of the body of research on sustainability and innovation in Nigerian leather small and medium-sized enterprises (SMEs). To present a thorough grasp of the current level of knowledge in this topic, a descriptive methodology will be used in this context. In order to present a concise, in-depth, and impartial description of the research topic, descriptive methodology also referred to as a descriptive research design focuses on characterising and summarising data or phenomena (Neuman, 2014). The descriptive methodology works particularly effectively in systematic reviews to provide a thorough overview of the research issue by synthesizing and analysing the current literature.

The research will entail an extensive exploration of academic databases, libraries, and pertinent online repositories for pertinent peer-reviewed publications, reports, and documents. To guarantee that the right studies are chosen, this search will be directed by precise inclusion and exclusion standards. In order to find recurring themes, trends, and variances pertaining to innovation and sustainability in Nigerian leather SMEs, the gathered literature will be critically examined and synthesized. The technique will encompass content analysis, theme analysis, and data coding in order to methodically classify and delineate the principal discoveries made in the literature.

INNOVATION, SUSTAINABILITY, AND THE NIGERIAN LEATHER INDUSTRY

The Concept of Innovation and Sustainability

According to Kamaruddeen *et al*. (2010), the word “innovare” in Latin means “to modify,” and this is where innovation started. They defined innovation as an entrepreneur's ability to develop new organisations, products, markets, and procedures in order to satisfy consumer expectations. Innovation, according to Kogabayev and Maziliauskas (2017), is the process of coming up with a novel idea and turning it into a new good, service, or process that boosts employment, grows the economy of the country, and generates pure profit for the innovative business. According to Kogabayev and Maziliauskas (2017), innovation is never a one-time occurrence but rather the result of a protracted and cumulative process including numerous managerial decision-making

processes, from the stage of concept development to the phase of execution. According to Vyas (2019), Schumpeter's list of expressions of innovation includes the development of new goods, new industrial processes, new markets, new sources of raw materials, and new organisational structures. Similar to this, Murat *et al.* (2013) divides innovation into four categories: marketing, management, process, and product innovation.

Innovation is the process of creating something new, be it a whole new product or service or a change in the way something is done. It may be something entirely different or an entirely new method of accomplishing the same task. It can apply to both material and immaterial objects. Consequently, it might be a novel good, service, or even method. The application of a novel or significantly enhanced product (good or service), process, marketing strategy, or organisational system in company operations, workplace structure, or external contacts can all be considered innovative, according to the OECD (2009). It is possible for an inventive product to fail just because it misinterprets what buyers need and want or fails to capitalize on a unique design. The purpose of product innovation is to provide a product an advantage over other comparable items already on the market. To lay out a market-driven strategy, this innovation is necessary (Day, 1994).

Additionally, Lukas (2000) proposes the following markers of product innovation:

i. Line extension: the product is comparatively new to a certain market, but it is not genuinely new to the company.
ii. Me-too product: a product that is novel for the company but not for a particular market.
iii. New-to-the-world product: the item is novel for the market and company.

According to Reguia (2014), a product may provide a competitive advantage. Product innovation may also improve a company's capacity to make money. Businesses that can create items that satisfy consumer demands will be able to weather market competition since their goods will always be in demand (Muangkhot, 2015). According to Bozkurt and Kalkan (2014), a company's capacity to consistently innovate its products will ensure that they continue to satisfy market demands and wants. As a result, a company's competitive advantage to attain strong commercial performance can come from its product innovation (Swaminathan, 2014).

Numerous studies have tried to define and investigate sustainability. While some had narrow definitions for the term, others demonstrated that it can only be understood in terms of a multitude of interrelated elements that collectively define what sustainability entails. For example, the literature on operations management typically approaches sustainability from an ecological standpoint, ignoring its social dimensions (Sarkis, 2001; Hill, 2001; Daily & Huang, 2001). Other studies, like Carter and Rogers (2008), included the business aspects of risk management, transparency, strategy, and culture while examining sustainability from the perspectives of the economy, society, and environment.

The multifaceted idea of sustainability has attracted a lot of attention lately, demonstrating how increasingly concerned people are about social justice, economic stability, and the environment. According to the World Commission on Environment and Development (1987), sustainability entails a development that meets the needs of the present generation or population of the world's people without compromising the ability of future generations to meet their own needs. The aforementioned concept, commonly known as the Brundtland Report definition, emphasises the essential tenets of sustainability, which are ecological integrity, economic viability, and intergenerational equality. From its initial emphasis on environmental sustainability, the idea has expanded to include three interrelated pillars:

i. Environmental Sustainability: According to Dannbach (2002), this pillar deals with biodiversity, ecosystem conservation, and the wise use of natural resources. It highlights the necessity of using sustainable methods to fight climate change, save important habitats, and lessen pollution (United Nations, 2015).
ii. Economic Sustainability: According to Atkinson *et al*. (2018), economic sustainability entails preserving a strong and expanding economy while guaranteeing that everyone has fair access to resources and advantages. It encourages economic growth that avoids social inequality and the exploitation of future generations (WCED, 1987).
iii. Social Sustainability: According to Lehtonen (2004), social sustainability is the fair treatment and well-being of every member of society, irrespective of their socioeconomic background, gender, or race.

Overview of the Nigerian Leather Industry

From the beginning of human civilisation, Nigerians have been creating leather goods for a very long time. Since the beginning of human history, leather has been a basic material. It was used to make some of the first clothes, second only to leaves in their many shapes. In the past, Arabs would purchase skins from northern Nigeria and ship them to Europe; the red goatskins of that region are the source of the famous Morocco grain leather. According to Ejike (1998), this custom was verified by European explorers, such as Clapperton and Barth, who noted that the main industry in Kano was the dyeing of tanned goat skins in red and yellow. Also, that Kano's most renowned manufacturing sector was the leather industry. Leather artifacts have been found in Egyptian tombs dating back to 900 B.C., indicating that Nigeria has long been a center of the leather manufacturing industry. According to research, Lammoha (Mimrod), who is thought to have migrated from Egypt, is the ancestor of the Yorubas, Kukawas, and Gogobiris. This shows that leather workmanship was brought to Nigeria much early (Ejike, 1998).

The history of the leather industry in Nigeria dates back to the pre-colonial era. In Nigeria, traditional methods of tanning and leatherworking were widely practiced in different regions, with distinct techniques used by different ethnic groups. Modern methods for tanning and processing leather were brought about by the entrance of European colonial powers in the late 19th and early 20th centuries, laying the groundwork for industrialisation. The Nigerian leather industry has promise and historical origins, but it also faces a number of obstacles. The absence of sufficient infrastructure, such as dependable power supplies and transportation networks, is one of the biggest problems. The development of contemporary tanneries and leather processing facilities is impeded by these deficiencies in infrastructure.

The strategic evolution of the tanning industry has made it possible to use by-products from the meat sector. This is a special benefit that combines with infrastructure and industry innovation to support equitable and sustainable industrialization and encourage the development of novel leather tanning methods in the area (UNIDO 2017; Okereke *et al*., 2019). Resilience is demonstrated by the finished leather's ability to be fashioned into a variety of goods, including shoes, clothing, bags, and other leather pieces that may be used throughout the year to support

humankind (Gromer *et al*. 2017). Because of this, the area has built more than 175 tanneries, 650 leather goods businesses, and 850 footwear businesses (ALLPI, 2020).

Nigerian leatherwork has grown to a high degree of artistic and technical proficiency today. Through trade, northern Nigeria used to export large amounts of premium Moroccan leather to the Mediterranean region. Professional leather workers in these areas have banded together to form cooperative organisations, and the Nigerian government has shown its support for this industry by setting up the Leather Research Institute in Zaria and the Sokotan and Bawan Jalla factories in Sokoto. The importance of leatherwork in Nigeria's cultural and economic legacy is highlighted by these milestones (Ejike, 1998).

Despite the fact that SMEs make up the majority of the Nigerian leather industry, there is a great deal of room for expansion (Amakom, 2006). Nigeria boasts one of the biggest economies in sub-Saharan Africa, but because of its heavy reliance on gas and oil exports, its growth is very unpredictable as it is subject to conditions in the global oil business. The fact that the non-oil industry only contributed 6.5% of GDP in 2010 (Central Bank of Nigeria report, 2018) illustrates the country's extreme reliance on the oil sector. Therefore, it is evident that the development of a balanced economy requires accelerating the expansion of the non-oil sector, which includes the leather industry. According to UNCTAD (2019), the leather sector had the highest non-oil export in 2005, with exports exceeding $160 million. But as the leather sector contributed 36.84% of all non-oil exports in 2004 but just 20.4% in 2005, it is clear that the industry is having difficulty remaining export competitive (UNCTAD, 2019; Amakom, 2006). Therefore, in order to assist the industry in reaching its potential growth levels, research is required to determine the barriers preventing this sector's export growth.

Challenges in Nigerian Leather Industry

Disintegration in the local value chain is one factor contributing to the industry's slow growth. Shoemakers claim that finding leather locally is difficult as most of the leather made in Kano and Kaduna tanneries is exported overseas. There appears to be an underproduction issue in Nigeria due to a fault in the value chain. With 96 million people living there, Vietnam can produce 760 million pairs of shoes a year. Conversely, Nigeria produces 48 million pairs of shoes annually

from its epicenter of indigenous production, Aba, home of the country's largest shoe clusters (Adebayo, 1992).

Nigerian shoemakers and other leatherwork manufacturers claim they are unable to produce the necessary number of finished leather products to propel the industry into one that is self-sustaining or globally relevant. Other shoe and bag manufacturers in the nation have attributed their failure to expand on unfavorable laws and a lack of government assistance. A small number of shoe manufactures are still in business and are just making ends meet thanks to government contracts providing leather shoes to the Ministry of Defense, the Army, and the Police Force. The majority of these shoemakers rely on dated equipment and commonplace techniques to maintain their level of output. This has an impact on their potential to grow and scale their output effectively (Cho *et al*., 2016).

Paradiso *et al.* (2000) indicate that manual methods can generate up to 120 pairs of shoes every day. Ethiopia, meanwhile, opened a 10,000-ton-per-day factory last year. Infrastructure is still essential to guaranteeing market growth. The bad state of the nation's highways makes it difficult to transport leather from Kano to Aba or Lagos. Proper roads enable products to get to markets more quickly. Undoubtedly, there's still space for improvement. The Nigeria Economic Summit Group (NESG) predicted last year that by 2025, Nigeria's leather industry may bring in over $1 billion in export revenue, a 70% increase from current estimates. This could, however, turn out to be just one more of Nigeria's numerous predicted numbers that have not materialized. Nigerians would still choose "Made in China" clothing to "Made in Nigeria" clothing until intentional steps were taken to increase local manufacture (Akinwunmi, 2020).

When we look at growing economies like Nigeria, where the government places a premium primarily on economic growth, sustainability starts to become significant. In fact, public officials have consistently opposed expanding the development discourse to incorporate social equality and environmental protection in addition to economic considerations. Nigeria has two distinct leather clusters: one located in the northern city of Kano state, Nigeria, and the other in the eastern state of Abia State, Nigeria, which produces completed leather items. The leather and footwear industries have seen dramatic upswings and downswings in the last several years.

For this reason, sustainability comes into play when it comes to guaranteeing the industry's ongoing growth (Ugbodaga, 2018).

In addition, the sector deals with health and environmental issues associated with conventional tanning techniques that use dangerous chemicals and do not have adequate waste disposal systems. In addition to endangering the health of the labor force, this makes it more difficult for Nigeria to meet global requirements for sustainable and high-quality leather. Another major issue facing Nigeria's leather sector is financing access. Many small and medium-sized businesses in the industry have difficulty getting funding or loans for the purchase of cutting-edge machinery and technology.

Despite these obstacles, there is a lot of room for expansion in the Nigerian leather market. Nigeria has an abundance of livestock resources, including goats, sheep, and cattle, which are used to make leather. If correctly utilized, these resources have the potential to dramatically improve the performance of the sector. Additionally, there is a rising domestic and global demand for leather and leather goods. Nigeria has a sizable domestic market for leather goods due to its vast population and growing middle class. Furthermore, there is a substantial export potential due to trade agreements' access to both regional and global markets.

Innovation/Upgrading Challenges and Potentials of Indigenous Technology in the Nigeria's Leather Industry

Indigenous knowledge may readily feed the global footwear and leather products sector, which offers opportunities for SMEs. Despite having significant potential in terms of people and raw material resources, many emerging nations including Nigeria have mostly been suppliers of raw and semi-finished goods (Amakom, 2006). This has been ascribed to the fact that only a small number of local and African businesses have grown to be able to create finished goods. This suggests that Nigeria will be able to compete favorably with certain other significant exporters of leather and other I-Tech products if efforts are directed toward resolving this issue. It was proposed that working toward this goal would help address the demand for Nigeria's non-oil industry to be more diverse and, as a result, boost the nation's ability to generate income and lower unemployment (Amakom, 2006).

Indigenous technologies, also known as I-Tech, are created when indigenous knowledge finds uses for instruments, procedures, processes, and methods that aid in issue solving. Talking drums are made in Oyo, in South Western Nigeria; aluminum pottery is made in Saki, in South Western Nigeria; beads are made in Bida, in North Central Nigeria; leather goods are made in Zaria, in North Central Nigeria; and in Northern Nigeria, special skin-friendly dyes called *lalli* are made and used in beautiful ways. These are just a few notable examples. Families are frequently recognized for specific I-Techs. For example, some *Oyo ile onilu* families are customarily connected to the production of talking drums (Samuel, 2014).

The vital role that government plays in promoting the creation and application of Information Technologies (I-Techs) and Indigenous Knowledge for the advancement of innovation and national prosperity as it emphasises that although the precise techniques may vary across nations, the role of government is vital. Governments must demonstrate their dedication and resolve by enacting the necessary laws and creating an atmosphere that is favorable to the development of indigenous knowledge and I-Techs. In India, for example, the government has set up strong institutions to explore new uses and maximize the potential of I-Techs and indigenous knowledge. Furthermore, legislative and policy frameworks have been established to encourage the incorporation of indigenous knowledge and I-Techs into many industries. This promotes the use of knowledge from resources like knowledge centers by I-Tech practitioners (Siyanbola *et al*., 2012).

Kula and Tatoglu (2003) claimed that SMEs use information systems and technology applications to boost sales, markets, networks, and innovation. Rapid technology advancements mean that businesses must be able to innovate and adapt in order to stay competitive. Every organisation in the information and technology era will have to deal with growing uncertainty due to the quick changes in the business environment and technology. Every organisation must adapt and change into a leaning organisation a business that supports its members' learning and constantly reinvents itself in order to thrive and gain a competitive edge.

The two inseparable components of information and communication technology are information technology and communication technology. Information technology encompasses all aspects of its use, manipulation, procedure, and information management. Furthermore,

according to (Mitra and Mishra, 2016) communication technology is related to the usage of tools for data processing and transfer from one device to another. They also examined the external and internal variables that affect how ICT is applied in SMEs. The corporate environment and the government were among the external elements, and management, human resources, and information systems were among the internal ones.

According to Fong (2011), human capacities impeded the adoption of technological applications in China's small industries. As a result, it is essential to prepare knowledgeable human resources who are adept at using information technology. Business transactions with worldwide marketplaces are made possible by the usage of technological solutions. Accordingly, "ICTs adoption and assimilation in SMEs is critical to enhance their competitiveness," according to Ongori and Migiro (2010). The use of ICTs by SMEs will also improve their accessibility to global markets. According to Ladokun *et al.* (2013), for a technological application to be implemented successfully, the government must make a significant effort to provide networks, hardware, and training.

Leather Tanning in Northern Nigeria

Northern Nigeria is usually the region where leather tanning is most common. Tannins are a group of procedures used to transform raw hides and skins into leather goods that are safer and more resilient. By rendering the skin or hide non-putrefactive, these procedures seek to increase its durability while also producing a product with technical qualities appropriate for a variety of uses. Tanning is the process of applying specific chemical reagents, also referred to as tanning chemicals, to skins and hides in order to produce high-quality leather. Animal skins and hides, mostly cattle hide, are tanned to produce leather. Tannin transforms putrescent skin into a strong, resilient, and adaptable natural material for a range of applications (NACETEM, 2008a). The significance of their raw materials in relation to the source animals distinguishes the leather and fur industries from one another. Meat has a higher value than skin, hence the raw materials used in the leather industry are a byproduct of the meat industry (NACETEM, 2008b). Meat is considered a by-product since the fur industry requires raw ingredients that are more valuable than meat.

In Northern Nigeria, traditional leather tanning is known as "Jima." The process involves tanning vegetables using "*Bagaruwa" (Acacia Nilotica)* pods. This plant is well-liked by the regional tanning industry in Northern Nigeria. Between 2000 and 1570 BC, the plant is said to have been utilized as a tanning agent in Egypt (NACETEM, 2008a). The plant possesses qualities that allow for quick skin penetration and nice coloring. Additionally, it easily and quickly softens leather. To soften the material, hides or skins are soaked in water for a day. These soaking and other processes are carried out in cement-plastered or excavated vats.

In the past, earthenware was employed for this function. In proportion to the quantity of wet hides or skins in the vats, calcium powder made from burned cattle bones and potash are added. The foundation of this procedure is the denaturation of the hide's protein fibers, which is accomplished by exposing it to high saline and a salty atmosphere. Following soaking, the hides are set out on a surface, and the hairs are cut off with a blunt-edged knife. The length of the process varies according on the size and kind of hide. After that, the hides are soaked in another vat filled with water and *quelea* bird droppings, which are rich in uric acid and ammonia, which helps to get rid of the strong odor while also accelerating the cleaning process. Ammonia is known to be effective at getting rid of odors and dirt (Mandal, 2014).

The *Acacia Nilotica* tree, also called "*bagaruwa"* in Hausa, has seeds that are ground or pounded and then soaked in hot water; the hides or skins are left in this mixture for a day while still hot. The *Acacia Nilotica* seeds are rich in tannin, or tannic acid, which is used in modern tanning. In traditional methods, tannic acid is applied twice to denature the protein and remove gummy tissues. The last step in turning the hides or skins into leather is to soak them in the tannous solution once more. Tannic acid increases the drying process's extensibility and water loss. The planned usage of the leather determines whether or not the tannic acid is applied again. Oil derived from seeds of *Kaya Senegalensis* or vegetable oil is used as a preservative and to increase elasticity. Under the sun, the oil is let to seep into the hide. To improve dye penetration, the leather is bathed in water to relax the fibers. To create different colors, such as red, black, yellow, or blue, different dye materials are utilized. The preparation techniques for the dyes materials vary (Zaruwa & Kwaghe, 2014).

Northeastern Nigeria's indigenous techniques for tanning and dying prefigure and largely mirror the basic principles of modern tanning and dying. These ideas were based on trial and error investigation and unintentional discovery rather than spirits or magic. Consequently, it suggests that at some point in history, our forefathers mustered the courage to conduct experiments including comparing the effectiveness of various substances (Zaruwa & Kwaghe, 2014).

Learning and Capability Acquisition for SMEs in the Nigerian Leather Industry

Small and medium-sized businesses, or SMEs, are essential to the economic growth of many countries, including Nigeria. SMEs have a major role in the economy of Nigeria when it comes to the leather industry. SMEs must prioritise ongoing education and skill development if they are to prosper and maintain their competitiveness in this fast-paced sector. For SMEs in the Nigerian leather sector to remain competitive and relevant, learning is a critical process. These companies have to constantly adjust to shifting consumer tastes, shifting market dynamics, and technological breakthroughs. According to (Ayodotun *et al*., 2018), organisational learning is crucial for SMEs because it fosters innovation and knowledge production, both of which are vital for the survival and expansion of businesses.

One of the primary issues facing the region's leather sector in the majority of production, design, and marketing chain phases has been identified as a lack of appropriate skills among leather workers (Mwinyihija, 2018). Therefore, in order to improve capacity-building skills, it is necessary to provide sustainable training, conduct research, and mobilize resource institutions. in order to provide their employees with the appropriate skills. The process of developing and enhancing the skills and capabilities that SMEs in the leather sector need to satisfy international standards, increase operational efficiency, and produce high-quality products is known as capability acquisition.

Limited access to foreign markets and uneven product quality are challenges facing Nigeria's leather sector. SMEs need to develop the requisite skills in order to handle these problems. Udo and Babangida (2017) define capability acquisition as learning about things like product design, marketing, quality control, and leather processing. For SMEs in the Nigerian

leather sector, investing in education and training is a crucial tactic to improve learning and competence acquisition. SMEs that give their staff members access to education and training are more likely to see improvements in their technical expertise. As a result, products are more competitive and of higher quality on the global market. For SMEs in the Nigerian leather sector, networking with other industry participants and participating in knowledge-sharing events are essential.

According to research by Igbinoba *et al*. (2017), SMEs can work with research institutions, visit trade shows, and participate in industry associations to obtain insightful knowledge and experience. By facilitating the exchange of best practices and knowledge, these activities aid in the development of competence. Government assistance and policy changes have a big influence on how SMEs in Nigeria's leather sector learn and develop their capabilities. The importance of government policies in fostering technology transfer and skill development in the leather sector is emphasised by Oyedepo *et al.* (2018). Capability acquisition can be aided by government measures like finance availability and incentives for SMEs.

The development of knowledge and skills is critical to the expansion and competitiveness of SMEs in the Nigerian leather sector. In order to improve their capacities, SMEs must spend money on networking, training, and knowledge exchange. Capability acquisition is also greatly aided by government policies and support. The long-term viability and prosperity of SMEs in Nigeria's leather sector depend heavily on these initiatives.

Sustainable Supply Chain Management and Sustainability-Oriented Innovation

The presence of a supply chain does not indicate that any real organisational effort is being made to appropriately manage the connections connected to this network of businesses. The management of the flow of goods, services, information, and financial resources through all the stages required to fulfill a customer order from sourcing raw materials through multiple work-in-process stages to manufacturing and distribution of finished goods is what the literature refers to as this kind of organisational effort. Instead of focusing only on internal process optimisation, relying on an efficient supply chain has become more crucial for a business to remain competitive in the modern global economy: "there is a growing recognition that individual

businesses no longer compete as stand-alone entities but rather as supply chains" (Christopher, 2005, p. 122).

The creation of clothing requires a significant amount of energy, and the manufacturing process requires a high consumption of water. These factors make the fashion business the second most polluting industry behind the oil sector (Market Watch, 2019). In addition to using over 8000 chemicals to prepare raw materials for production, the sector is accountable for the 93 billion m3 of water that is consumed globally each year, which leads to significant wastewater emissions (Aiama *et al*., 2016; Karaosman *et al*., 2017). Fashion operations and sustainability management are not mutually exclusive, despite the fact that the term "sustainable fashion" has been seen as an oxymoron (Karaosman *et al*., 2015; Karaosman *et al*., 2017).

Although there is no set standard for the industry when it comes to using terms like ethical, green, or eco, their widespread use indicates that more and more manufacturers are attempting to break into the mainstream market with sustainable fashion clothing. By adding eco-friendly products made of sustainable materials like organic cotton, certain mass-market merchants have expanded their product lines (Joergens, 2006; Kozlowski *et al*.,2020). These are but a few illustrations of a noteworthy continuing trend. Fashion companies have been concentrating on using SOIs to lessen the impact of the entire product lifecycle in an effort to become more sustainable at both the process and product levels in recent years.

According to Karaosman *et al*. (2020), leather industries have demonstrated a growing commitment to material assessment and chemical reduction. They specifically embrace a number of activities, including wastewater treatment, the design and development of environmentally friendly goods, the use of recyclable and recycled materials, the elimination of hazardous chemicals, and product and process certifications (Resta *et al*., 2014). Despite strong market and brand pressure, research indicates that tanneries are not fully committed to adopting these sustainability-driven changes for a variety of reasons. These include a lack of funding or a lack of interest in the improvements; this resistance to change is a reflection of the industry's conservative nature, which is strongly opposed to innovations. It is interesting to note that leather companies emphasise the importance of the economic factor in the decision-making process

regarding sustainability issues, and that they typically adopt sustainable practices when there is a clear financial gain associated with them (Karaosman *et al*., 2020).

Integration of Innovative Waste Bioremediation Techniques and Modified Eco-Friendly Tanning Processes of the Leather Industries in the Region

Despite the fact that the leather tanning sector generates jobs and export revenue, its reputation has been negatively impacted by pollution for a considerable amount of time. Many tanneries in this area continue to employ an antiquated tanning method that falls short of regulations (Oruko *et al*., 2020). As a result, it's imperative to implement cleaner technologies, process improvements, and novel bioremediation techniques in the local leather industries, along with environmentally friendly sustainable practices at every level of the processing of liquid, solid, and gaseous wastes (Gupta *et al*., 2018).

Various treatment techniques are used in the tanning business to handle wastewater, with the goal of minimizing environmental effect and advancing sustainability. Organic waste is often converted into methane gas by anaerobic treatment techniques such lagoons, contact filters, up flow anaerobic sludge blanket (UASB) reactors, and high-rate biomethanation. This process uses less energy and space than other methods. These techniques successfully cut the loads of chemical and biological oxygen demand (BOD and COD) by 50–60%. On the other hand, aeration methods are beneficial because they use aerators to attain BOD and COD levels of 30 ppm and 250 ppm, respectively, with the help of aerobic microorganisms. In tanneries, this method offers inexpensive clean energy, clean water, and sanitation (Dixit *et al*., 2015; Thanikaivelan *et al*., 2005).

Many methods have been developed to improve the tertiary treatment of wastewaters from tanneries. These methods include reverse osmosis, chemoautotrophic activated carbon oxidation, activated carbon filters, reed beds, root zone approaches, and wet air oxidation at ambient pressure and temperature. These techniques support the tanning industry’s efforts to provide clean water and enhance cleanliness. Furthermore, an improved high-rate transpiration system is currently used to treat salt-containing tannery effluent, and sprinkler systems and flat-plate collectors are used to accelerate evaporation and crystallization in saline streams (Gupta *et*

al., 2018). The preservation of aquatic life in bodies of water receiving wastewater is greatly aided by these developments.

The tanning process generates solid waste, which is handled using a variety of technological solutions. Among these are the manufacture of glue and the transformation of trimmings from raw hides and skins, pelts, and fleshings into collagen-based biomaterials for use in medicine and other fields. Hides and skins are pickled or cured using the salt that is collected through mechanical desalting and solar evaporation. Biomethanation uses waste products from primary and secondary treatments, such as fleshings and solid sludge. The production of leather boards uses shavings, trimmings, and buffings, while the creation of basic chromate sulfate (BCS) uses chrome shavings as a reductant. Low-quality hides and skins are turned into gelatin to be consumed as protein, while parchment created from chrome shavings is used to produce house furnishings (Gupta *et al*., 2018; Mwondu *et al*., 2019).

The gaseous waste products, which include ammonia and hydrogen sulfide, that are produced during the tanning process are ecologically eliminated by adsorption using activated charcoal (Panda *et al*., 2014). The recycling of gaseous waste and solid leather results in the creation of valuable products that address hunger, reduce poverty, advance economic growth, improve health and well-being, and stimulate responsible consumption, industrial innovation, and infrastructure development. It also improves life on land and cultivates technology exchange for the benefit of future generations.

Pre-tanning, saltless or less-salt curing with solar drying, freeze-drying, microwave/dielectric drying, KCl instead of NaCl, borax-phenol, zinc chloride, silica gel, and low quantity of salt, metal oxinates, gamma, electron beam, and irradiation techniques, while the transportation of green skins in refrigerated trucks reduces salt pollution, are some of the minimization techniques involved in the adoption of cleaner technologies. Wetsalting is still a prevalent practice in the region despite the availability of saltless curing processes because of its great efficiency and low cost (Thanikaivelan *et al*., 2005; Oruko *et al*., 2014; Dixit *et al*., 2015). Long-term advantages for tanners, however, are quality improvements for skins that satisfy consumer demand. As a result, there is less salt pollution, which enhances life on land and below water, lowers poverty, and encourages responsible production and consumption.

Empirical Case Studies

An empirical study by Ukpabio *et al.* (2019) looked at how innovation affected the performance of manufacturing SMEs in Nigeria. In Southwestern Nigeria, SMEs in the wood/furniture and woodworks subsector, the domestic/industrial plastic and rubber subsector, and the textile/leather/apparel and footwear subsector provided a total of 305 samples. Correlation analysis and hierarchical regression analysis were used to analyse the data that was gathered. The correlation result demonstrates that, even when controlling for "firm size," all aspects of innovation product, process, market, and management had a statistically significant positive association with firm performance. The regression analysis did, however, support the notion that management and process innovation have a major impact on SMEs' performance.

The study's conclusion shows that improving the performance of SMEs in Nigeria requires innovation in all its forms, but particularly in the areas of process and management innovation. In this study, which focused on how innovation affected Nigerian manufacturing SMEs' performance, hierarchical regression analysis and correlation analysis approaches were applied. The current study will analyse data using multiple linear regressions and correlation, testing hypotheses at the 0.05% significance level.

Nguyen *et al.* (2019) investigated how innovation affected the corporate social responsibility and entrepreneurial performance of Vietnamese manufacturing companies. This study looks at how management, process, and product innovations individually affect business performance and corporate social responsibility (CSR) between 2011 and 2013, and how such innovations interact with outside cooperation. Secondary data was employed in the study, and content analysis was used for analysis. The results of the research indicate that improvements in organisation, process, and product can improve a company's market share but not its return on total assets. Thus, it has been demonstrated that innovation in management, processes, and products significantly affects business performance and the corporate social responsibility of Vietnamese manufacturing companies. The results of the study showed that managerial innovation and entrepreneurial business performance are positively correlated. The goal of the current study is to determine whether the association still holds true by expanding the analysis to encompass 2022 and adding marketing innovation to the mix of the three factors.

In Nigeria, marketing competence was examined by Taiye *et al*. (2020) as a moderator between innovation and entrepreneurial success. The study is supported by a survey that was completed by 123 respondents from a dessert and confectionery company. The hierarchical regression method was used to analyse the data. The findings demonstrate that marketing competencies moderate the association between innovation and entrepreneurial success and that Schumpeterian kinds of innovation have a substantial impact on an organisation's ability to succeed as an entrepreneur. The study conducted by Taiye *et al*. (2020) utilized hierarchical regression to analyse data gathered from 123 respondents, resulting in the current gap. The current study attempts to fill in the gaps by utilizing multiple regression and correlation to determine the relationship between variables and how they affect the success of entrepreneurs.

DISCUSSION

The research report offers a thorough examination of the leather industry in Nigeria with an emphasis on innovation and sustainability. The research provides a thorough examination of Nigeria's leather sector, which is distinguished by a long history of leather manufacture. It draws attention to how important the sector is to the country's economy because it gives many people a means of support. According to the report, the Nigerian leather industry faces a number of difficulties, such as a disjointed supply chain, obsolete technology, poor infrastructure, and restricted access to funding. These difficulties impede the industry's expansion and level of competition.

The study emphasises how the Nigerian leather sector has to innovate and upgrade its technologies. It recognizes the potential of indigenous technology and customs and their contribution to raising the caliber and effectiveness of products. The study explores the particular methods used in Northern Nigeria for tanning leather. It explains conventional methods, including vegetable tanning, and talks about the financial and environmental effects of them. The study highlights how crucial it is for small and medium-sized businesses (SMEs) in Nigeria's leather sector to learn and develop their capabilities. It draws attention to the part that skill development and training play in raising SMEs' capacities.

The assessment addresses the significance of environmentally friendly procedures, ethical practices, and responsible sourcing in the context of the leather industry's supply chain management. In order to increase the sustainability of products, it also looks at innovation that is focused on sustainability. The study emphasises how the Nigerian leather sector may use cutting-edge waste bioremediation methods and environmentally friendly tanning procedures. It implies that these methods can support improving sustainability and addressing environmental issues. In conclusion, a thorough analysis of the innovation and sustainability components of Nigeria's leather sector offers insightful information about the prospects, problems, and possible ways forward. The results highlight how crucial it is to implement cutting-edge techniques, local technology, sustainable supply chain management, and environmentally friendly procedures in order to improve the industry's overall sustainability, environmental responsibility, and competitiveness.

CONCLUSION

The comprehensive analysis carried out on the subject has yielded significant insights on the present condition, obstacles, and prospects for innovation and sustainability within the Nigerian leather sector. The study looked at a number of topics, such as the history of the Nigerian leather industry, the difficulties it encounters, the use of local technology, the tanning methods used in Northern Nigeria, the development of learning and capacity in SMEs, and the importance of innovation and sustainability. Furthermore, it explored new waste bioremediation methods for environmentally friendly tanning operations in the area, as well as sustainable supply chain management and sustainability-oriented innovation.

The study started out by providing a thorough synopsis of the Nigerian leather market. It gave background for appreciating the sector's significance, its role in the national economy, and the difficulties it faced. The major obstacles faced by Nigeria's leather industry were noted and examined in the study. These difficulties included everything from inadequate infrastructure and antiquated technology to environmental issues and competition from international markets. Acknowledging these difficulties is a vital first step in solving them. The study placed a strong emphasis on the importance of innovation and the role that homegrown technology can play in helping small and medium-sized businesses (SMEs) in the leather sector overcome their

obstacles. It emphasised how regional inventions could raise industry competitiveness. The methods used in Northern Nigeria for tanning leather were given special attention.

The study highlighted the value of maintaining and using indigenous practices by shedding light on ancient techniques and their applicability in the contemporary world. The study acknowledged the value of education and capacity building for SMEs operating in Nigeria's leather sector. The significance of knowledge and skill development in promoting innovation and sustainability was emphasised in this aspect. The study provided precise definitions of innovation and sustainability, emphasizing the importance of each term in relation to Nigeria's leather sector. It emphasised how important it is to find creative solutions that complement sustainable methods.

The study examined the idea of sustainable supply chain management, stressing the significance of responsible production, ethical sourcing, and ecologically friendly methods. It also highlighted how innovation with a focus on sustainability may improve product quality and competitiveness in the market. The study examined novel approaches to waste bioremediation and altered environmentally friendly tanning procedures for the leather sector. These strategies could lead to more sustainable production techniques and a decrease in the impact on the environment.

To sum up, the present systematic research has elucidated the urgent concerns, prospects, and obstacles present in the Nigerian leather sector. It is obvious that sustainability and innovation are crucial to the long-term health and expansion of the sector. The importance of indigenous knowledge and customs in accomplishing these goals has also been highlighted by the study. Through the adoption of innovative and sustainable practices, the Nigerian leather sector can bolster its worldwide competitiveness, facilitate economic growth, and guarantee a more ecologically conscious future. Realising the full potential of these advances in Nigerian leather SMEs would require more study and cooperative efforts.

Recommendations

Highlighted below are the study's recommendations;

i. Support for Indigenous Technologies:

Encourage the promotion and maintenance of indigenous innovations in the Nigerian leather industry as a means of showing support for them, to ensure that these technologies are competitive and sustainable, industry and government stakeholders should offer financial incentives and support to SMEs for their adoption and adaptation. Industry associations, government agencies, and non-governmental organizations (NGOs) can collaborate to provide financial incentives and support. Also, funding should be established for programs specifically targeted at SMEs in the leather industry, offering grants or low-interest loans for the adoption and adaptation of indigenous technologies. Additionally, create awareness campaigns to highlight the importance of preserving and utilizing indigenous knowledge.

ii. Capacity Building and Skill Development:

Create and execute workshops and training programs to improve the knowledge and skills of SMEs in Nigeria's leather sector. The primary objective is to enhance the quality and value of leather products by imparting appropriate skills in innovation, sustainable practices, and advanced tanning procedures. Government agencies, industry associations, and educational institutions can collaborate to organize training programs. A curriculum should be developed and tailored to the needs of SMEs in the leather sector, covering topics such as innovative techniques, sustainable practices, and advanced tanning procedures. Offer these programs either online or through workshops conducted in partnership with local training centers. Provide financial support or subsidies to make these programs affordable for SMEs.

iii. Encourage Sustainability-Oriented Innovation:

Encourage the Nigerian leather sector to adopt a culture of sustainability-oriented innovation. Urge businesses to spend money on Research and development to develop tanning techniques that are less harmful to the environment, use less water and chemicals, and produce less waste. Government research institutions, industry associations, and private companies can lead efforts in this area. Research grants or subsidies should be allocated to incentivize the development of environmentally friendly tanning techniques. Establish partnerships with universities and

research centers to conduct joint research projects. Create platforms for knowledge sharing and collaboration among stakeholders to accelerate innovation adoption.

iv. Financial Assistance and Capital Availability:

Make it easier for SMEs in the leather sector to obtain finance and financial assistance. Grants, venture capital, and government-backed financing programs can assist companies looking to engage in sustainability and innovation. Government financial institutions, private venture capital firms, and industry associations can collaborate to provide funding. Establish dedicated funds or venture capital funds specifically targeted at SMEs in the leather industry. Simplify loan application processes and provide technical assistance to SMEs in preparing funding proposals. Offer tax incentives or guarantees to encourage private investment in sustainable leather ventures.

v. Management of a Sustainable Supply Chain:

Encourage the use of sustainable methods for supply chain management. To reduce the industry's environmental impact, place a strong emphasis on waste reduction strategies, effective logistics, and ethical raw material procurement. Industry associations, government agencies, and large corporations can lead efforts in supply chain management. How? By developing guidelines or standards for sustainable supply chain practices in the leather, and offering training and capacity building programs to suppliers on waste reduction, ethical sourcing, and logistics optimization. Facilitate collaboration between SMEs and suppliers to implement sustainable practices.

vi. Eco-Friendly Tanning and Waste Bioremediation:

Encourage the combination of cutting-edge waste bioremediation methods with environmentally friendly tanning procedures. Promote the use of technology that cleans up the environment and increases the sustainability of the leather industry. Government research institutions, technology companies, and industry associations can collaborate on this initiative. Investment in research and development of eco-friendly tanning methods and waste bioremediation technologies should be prioritised, and funding or tax incentives should be provided for companies adopting these

technologies. Pilot projects should be implemented to demonstrate the feasibility and effectiveness of these solutions.

vii. Cooperation and Exchange of Knowledge:

Encourage cooperation and forums for sharing expertise within the leather sector. Urge SMEs to collaborate, exchange best practices, and form research alliances with universities and research centers. Industry associations, universities, research institutions, and government agencies can facilitate knowledge exchange platforms. Organize conferences, seminars, and workshops to bring together stakeholders from different sectors. Create online forums or networks for ongoing collaboration and information sharing. Offer incentives such as awards or recognition for collaborative research projects.

viii. Government Policies and Incentives:

Encourage the development of government policies and incentives that will support the leather industry's innovative and sustainable practices. Tax incentives for environmentally friendly behavior and support for research and development are two examples of these programs. Government policymakers, industry associations, and advocacy groups can work together to shape policies. Conduct stakeholder consultations to identify policy priorities and gaps. Develop legislation or regulations that incentivize sustainable practices and innovation in the leather industry. Monitor and enforce compliance with environmental standards through inspections and audits.

ix. Market Access and Export Promotion:

Support SMEs in gaining access to both local and foreign markets through export promotion and market access. To help SMEs increase their customer base, government organisations and trade groups should offer support in the areas of marketing, quality assurance, and export promotion. Government trade promotion agencies, industry associations, and export development councils can lead efforts in this area. Provide market intelligence and export assistance services to SMEs in the leather sector. Organize trade missions, exhibitions, and buyer-seller meets to facilitate

networking and business opportunities. Negotiate trade agreements or tariff reductions to improve market access for leather products.

x. Financial Assistance and Capital Availability:

Make it easier for SMEs in the leather sector to obtain finance and financial assistance. Grants, venture capital, and government-backed financing programs can assist companies looking to engage in sustainability and innovation. Same stakeholders as mentioned in recommendation 4. Same strategies as mentioned in recommendation 4, with a focus on reinforcing financial support mechanisms to ensure accessibility for SMEs.

By addressing the issues and opportunities found in the Nigerian leather market, these suggestions hope to advance a more inventive, sustainable, and globally competitive industry while also enhancing environmental standards and product quality. The industry's and its SMEs' general growth and development would be aided by the adoption of these proposals.

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