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Cashew In West Africa: A Systematic Review

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Abstract- The cashew (Anacardium occidentale L.) has recently gained global recognition due to Africa's increasing integration, particularly in West Africa, and its role in cashew nut production. West African countries, including Côte d'Ivoire, Ghana, Guinea-Bissau, Benin, and Nigeria, maximize cashew farming annually, resulting in increased cashew nut yields. West African countries, particularly Côte d'Ivoire, are significant players in the cashew value chain, with a total production of 3 million tons in 2024. However, despite the large production of cashew nuts, West Africa is not reaping the full benefits of its production due to inadequacies in processing and value addition. Nations that process cashews earn more than West African countries. This implies that poor or a lack of processing facilities contributed to revenue loss in West Africa. Inadequate infrastructure, limited access to finance, market volatility, weak research and extension systems, and quality control challenges all contribute to low revenue generation. This review was therefore carried out to itemize the problems associated with cashew production and marketing, explore their potential solutions, and examine the sustainability, continuity, and expansion factors for cashew and cashew nut production and processing. The creation of Policy and institutional frameworks that support cashew development, improved financing, trade, and market dynamics, as well as sustainability and climate change considerations, including gender, youth, and inclusive development, are among the means to address the identified problems. In conclusion, West Africa has the potential to earn more from cashew and cashew derivatives if value additions are properly explored and local investors are encouraged.

Keywords: Cashew, Cashew Nuts, West Africa, Production and Processing.

I. INTRODUCTION

In West Africa, apart from being one of the most economically important crops, Cashew (Anacardium occidentale L.) has helped advance rural landscapes, improve livelihoods, and positively impact export revenues, changing the region's reputation over the last thirty years. Earlier on, Cashew is renowned as a minor crop gained rapid recognition through west African countries including Cote d'Ivoire, Ghana, Guinea Bissau, Benin and Nigeria exposing the world to its sweet nutritious edible nuts, high agronomic suitability in the savannah areas and high economic viability for both public and private sectors prompting the world to grow, invest and trade it (Monteiro *et al.*, 2017). Furthermore, the early 2020s demonstrated to the world the extent of effort West Africa has invested in raw cashew nut (RCN) production, making it a significant player in the cashew value chain (Food Business Africa, 2023). Due to this, cashew processors, traders, and agents, both internationally and domestically, have recognized both cashew and West Africa.

However, though cashew has improved West Africa, the full benefits of cashew have not been felt due to the persistent gap between primary production and cashew processing. Unprocessed raw cashew nut is exported out of West African countries in large tonnage to countries such as Vietnam, where they are processed, and value is added to increase gains, profits, and revenues. The processing conducted in these countries includes deshelling, peeling, grading, and packing, giving them better recognition than the actual producing countries. This has created a profit paradox whereby producing countries only gain a fraction of the revenue and recognition that processing countries generate from cashew internationally (CBI, 2022). This degree of profit imbalance is exacerbated by low industrial development, outdated processing technologies, exchange rate instability, international market fluctuations, and low wages prevalent in West Africa (Ton *et al*., 2018).

Value addition in West Africa is less explored, slowing down the rate of development in the region. Industrial development, such as good livelihoods, good housing, access to potable water, good food, adequate processing machines, and ergonomics, is not adequate. Poor technicalities, including the provision of proper working tools and equipment, improper deshelling method, nonavailability of mechanized deshelling technology, inadequate grading methods, intermittent cashew nut quality, and poor moisture and impurities control means are lacking (Monteiro *et al*., 2017). Instability in exchange rates resulting from poor economy, high importation rates, low production rates, and political instability is highly experienced. Fluctuations in the international market occur due to global turmoil, instability in buyers' demand and preference, political issues, and a poor export and import taxing system (Reuters, 2024). Low wages in West Africa result from low economic livelihood, low industrialization, government instability, low agricultural investments, inadequate government policies, and low international market accessibility (Ton *et al.*, 2018).

However, West African countries' governments are waking up to the importance of processing, thereby finding means to bridge the gap through webinars, seminars, private investors' encouragement, and policy relaxation (ACA, 2023). These strategies have been highly adopted by leading producers to encourage processors to intensify efforts and innovate more in cashew processing. Research and development (R&D) have been a priority of these governments, providing more funds to farmers and research institutes to enhance production. Recently, private investors have emerged and increased in the region, affirming their interest in the cashew value chain through the provision of processing infrastructure, independent groups' collaboration, training programs, and influencing government policies to favor the cashew value chain (Monteiro *et al*., 2017). One of the ways adopted to actualize this is by laying emphasis less on financial gains and more on poverty alleviation and rural development (ACA, 2023).

Apart from bridging the production and processing gap, the various uses of cashew need to be spread and understood in West Africa to fully gain its economic and non-economic value. Some of these uses include production of cashew-apple products, including fermented beverages (Jayeola *et al.,* 2018), animal feeds, bagasse, bio-gas, jams, and juices (Odeyemi *et al*., 2024). Application of cashew nut shell liquid (CNSL) in agrochemicals, construction, adhesives, brake linings, paintings, and coatings (Adeigbe *et al.,* 2015). Extraction of CNSL has gained attention with several publications reporting different local and international methods, such as those by Nyirenda *et al*. (2021), Idah *et al.* (2014), and Akinhanmi *et al.* (2008). Another interest in cashew is the use of cashew in soil conservation and diversifying farm income in agroforestry systems. Also, post-harvest handling means and cultivar selection studies have positively affected the quality and kernel outturn yield (KOR) (ACA, 2023), attracting investors. West African countries such as Burkina Faso have targeted the improvement of their facilities to process 20,000 tons of Cashew apple by 2030 (Food Business Africa, 2023). Also, Guinea-Bissau has implemented research on Cashew sustainability production (Monteiro *et al.,* 2017). These are necessary for West Africa to have continual interest in cashew production, thereby influencing policies and investment to maximize the benefits of cashew (ACA, 2023).

Despite all these efforts, cashew faces certain issues necessitating a contemporary review. Some of these issues are the concern of storage losses, oversupply, and price instability, which is a result of Increased cashew production due to increased planting and good weather (Food Business Africa, 2023). This is evident through the production of more than 3 million tons in West Africa alone, but less than 10% are processed locally in 2023 (Statista, 2025). Issues such as buyers' preferences, currency differences, and tariff pressures are affecting exports, causing instability in global markets (Reuters, 2024). Also, expansion in cashew plantations has raised questions on the impact on environmental and social lives, such as in Benin, where cashew plantations are expanding into reserved areas (Dotonhoue *et al.*, 2025). Also, equality in benefits realization among farmers, traders, and processors is less considered, raising the issue of imbalance among smallholder farmers (Yin *et al*., 2023). All these issues necessitate the need for a comprehensive analysis that cuts across environmental, social, economic, technical, and cultivation assessments.

Due to these reasons, this systematic review adopts three interconnected ideologies, which are;

- Sustainability and continual production to processing with economic viability.
- Technicalities, policy, and institutional factors affecting local processing.
- Effect on expansion on environmental and social lives.

By reviewing reliable recent policy documents, practical studies, industry reports, technical analyses, and global trends, this review will identify areas for improvement, declining areas, constraints, and the best approach to improve value addition locally while preserving social and environmental goals. The following section examines the production and commerce position, sales, and technical constraints in relation to processing, new product innovation, and policy decisiveness that have been adopted to kindle the cashew value chain.

II. ECONOMIC IMPORTANCE AND PRODUCTION TRENDS IN WEST AFRICA

In the last 30 years, West Africa has been gaining advancement through Cashew (*Anacardium occidentale L*) cultivation. However, the contributions of this region in the global market of cashew have always been insignificant, but presently its contributions are widely applauded. The region presently contributes up to 60% of raw cashew nuts globally, improving rural livelihood and regional recognition through an unimaginable exportation rate (FAO, 2023). The crop has been studied to thrive in the savannah and transitional zones of Cote d'Ivoire, Nigeria, Ghana, Guinea-Bissau, and Benin areas associated with rainfall, soil conditions, and temperatures adequate for cashew cultivation (World Bank, 2024).

2.1 History and regional adoption

In the 16th century, Portuguese traders introduced the cashew tree as a means to control soil erosion and ornamental pieces (Ohler, 1979; Woodroof, 1967). The apple (false fruit) was taken as food, though limited due to its astringent taste and perishability level, to ease hunger without importance to the nuts (Aliyu, 2012). However, cashew significance was not considered earlier on in the global market, but later came into the limelight in the early 1990s through the increase in global demand for edible nuts (Ton *et al*., 2018). In 2024, the total region production rose by more than 10% to above 3 million tons, compared to 2020, when it witnessed a total of 2.7 million tons, all due to increased planting area and improved agronomical practices (Food Business Africa, 2023). Since 2023, Cote d'Ivoire has become the largest producer of RCN with a total of 1.25 million tons, surpassing India and Vietnam, which have always been at the forefront and remain so to date (Reuters, 2024). Furthermore, Nigeria, Benin, Guinea-Bissau, and Ghana follow behind Cote d'Ivoire with a total of 320,000, 250,000, 230,000, and 200,000 tons, respectively (ACA, 2023). Also, other nations in the region, including Togo, Sierra Leone, and Burkina Faso, all produce a significant amount of RCN.

The increase in the adoption of cashew cultivation in the region is a result of favorable policies, a surge in cashew investment, and integration of the international market (FAO, 2023). As a way to reduce pressure on cocoa and cotton as revenue generation through exportation, West African countries prioritized the cashew crop by relaxing policies and investing more in cashew (World Bank, 2024).

2.2 Socio-economic Importance

Rural areas have been transformed by cashew through employment creation and revenue generation. An analysis carried out by the Climate Bonds Initiative (CBI) in 2022 discovered that more than 3 million small enterprise farmers create several thousand seasonal jobs for people through harvesting, processing, and trading of cashew (CBI, 2022). In 2023, cashew exports accounted for more than 80% and 10% of Guinea-Bissau and Côte d'Ivoire export earnings, marking cashew export as an economic significance for both countries (UNCTAD, 2023).

Cashew production in West Africa these days is denoted by a poverty alleviation scheme. The fertile lands, favorable weather, tree durability, low technology know-how, and low input needed in its cultivation make its production adequate in West Africa (Saidou *et al*., 2022). Ogunniyi *et al*. (2021)

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reported that farmers who cultivate cashew generate 20-30% more profits than farmers who don't cultivate it in Nigeria and Benin.

Cashew is noted for creating jobs for both genders. In West Africa, Women and men alike are involved in the cashew value chain. Although they are underrepresented in ownership and decision-making, women play a significant role in the sorting, peeling, collection, and handling of cashew nuts (ACA, 2023). This has been possible through the integration of the African Cashew Initiative (ACi) and the United States Agency for International Development (USAID) in the West Africa and Investment Hub, which encourages and promotes women in agriculture financially and educationally (USAID, 2024).

2.3 Production Structures and Agronomic Factors

The production structure of Cashew in West Africa is under small enterprise farmers with an average farm land of 3 hectares (FAO, 2023). These farmers have low access to loans, pesticides, fertilizers, mechanized farming, and advanced agricultural equipment, thereby relying majorly on traditional intercropping with tubers and cereals (Yao *et al.,* 2023).

Yields per hectare in West Africa have been proven to be lower compared to those of other nations such as India and Vietnam (Amanoudo *et al*., 2022). In India and Vietnam, average yield per hectare is 1,000kg/ha and 1200kg/ha, respectively, whereas that of West African countries is between 400-600 kg/ha (World Bank, 2024). Some of the factors affecting West African cashew yield include adoption of traditional cropping systems, overused plantations, absence or low extensionists, and uncontrolled fungal infections and pest issues (*Helopeltis spp*) (Saidon *et al*., 2022). However, government and private-funded organizations such as Cocoa Research Institute of Nigeria (CRIN), Conseil Ouest et Centre African pour la Recherche et le Developpement Agricoles/West and Central African Council for Agricultural Research and Development (CORAF/WECARD), and ACi have been trying to solve these issues through the creation of new cashew varieties and integrated pest management systems (ACA, 2023; CORAF, 2014).

2.4 Trade Systemization

West Africa mostly trades unprocessed RCN, which gives it dominance in cashew exportation. Almost 90% of RCN produced in West Africa are exported unprocessed to India and Vietnam, where they are deshelled to remove the nut, and then the nuts are cleaned, sorted, packed, and exported to Europe and the US (CBI, 2022). In 2023, Cote d'Ivoire exported more than 1.1 million tons (85% of total production) of unprocessed cashew nuts, while the remaining were processed domestically (Reuters, 2024).

This system of exportation has several implications, including limited value gains and exposing producers to price fluctuations. From the study, RCN exporters only gain between 30% and 40% of cashew nut revenue, and the prices are not stable since they are not fully controlled by the consumers but by the processors, such as Vietnam and India (Eze *et al*., 2023). For instance, in 2023, the global price of cashew fell due to oversupply in Vietnam, thereby forcing farmers to reduce farmgate prices by up to 20% which is a high percentage of loss to cashew farmers (Food Business Africa, 2023).

Approximately 85–90% of West African cashews are exported raw to Asia, primarily to Vietnam and India, where the nuts are processed into kernels and then re-exported to the United States and Europe (CBI, 2022). Côte d'Ivoire alone exported over 1.1 million tonnes of RCN in 2023, while local processing accounted for less than 15% of output (Reuters, 2024).

This export structure has several implications. First, it limits the region's value retention, as raw nuts fetch only 30–40% of the price of processed kernels. Second, it exposes producers to international price volatility caused by fluctuations in Asian processing demand. For example, the 2023 global price decline, caused by surge in supply in Vietnam, reduction of West African farmgate prices by nearly 20%, this has adverse effects on the stability of farmer incomes (Food Business Africa, 2023).

However, some efforts have been put in place to reverse this trend. For instance, In Côte d'Ivoire and Benin export levies on raw nuts have been introduced to encourage domestic processing. In order to achieve 50% local processing by 2030, the Federal Ministry of

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Agriculture and Rural Development (FMARD) in Nigeria, has launched the National Cashew Development Strategy to run from 2021–2030 (FMARD, 2022). In a related development, the African Cashew Alliance has advocated for policies supporting investment in processing infrastructure, quality standards, and market diversification (ACA, 2023).

2.5 Contribution to Rural Development and Food Security

Apart from income generation for farmers, cashew plays a lot of roles in rural development. Cashew trees provide vegetative cover for 20 or 30 years or more and help to keep groundwater levels high to support the growth of annual crops planted near to them. The trees aid in soil conservation and climate mitigation, erosion control and carbon sequestration. According to Yin *et al.* (2023) cashew-based agroforestry systems can improve soil organic carbon by up to 25% compared to monocropping systems

Cashew apple is rich in high levels of vitamin C, minerals, and sugars, offering significant food security and nutrition potential. According to World Bank, (2024) and ACA, (2023) recent pilot projects in Burkina Faso and Ghana are promoting the use of cashew apples in juice and vinegar production to create additional income stream and reduce post-harvest losses.

The environmental impacts of cashew expansion require attention. In parts of Guinea-Bissau and Benin, the expansion of cashew cultivation has led to the deforestation of savannah woodlands, raising concerns about biodiversity loss (Monteiro *et al*., 2017). Disposal of shells causes environmental problem as the topsoils and subsoils are polluted leaving the soil surface with little or no vegetation grows for a long time. Instead of burning cashew shell directly for heating purposes, it can be converted to cashew nut shell oil, briquette and organic fertilizers.
There is the pressing policy of creating balance between economic benefits and sustainable land-use practices. According to (CBI, 2008) there is environmental comparative advantage for West African processors in exporting their cashew kernels to the US and EU markets which are shorter distance when compared to taking them to Vietnam or India for processing. Companies and consumers interested in reducing their environmental footprint involved in local processing may likely consider exportation to near destination.

2.6 Global Positioning and Competitive Advantage

Globally, West Africa's comparative advantage lies in abundant arable land, low labour costs, and suitable agroecology. However, competitiveness is hindered by infrastructural hindrances, including inadequate road networks, limited storage facilities, and inconsistent quality standards (FAO, 2023).

There has been Initiatives such as the West Africa Competitiveness Programme (WACOMP), supported by the European Union and ECOWAS, aimed at improving logistics, certification, and traceability within the cashew value chain (WACOMP, 2023). The region has the potential to become a global leader not just in production, but also in processing and value addition as a result of continued investment in research, farmer training, and industrial clusters.

III. PROCESSING, VALUE ADDITION AND INDUSTRIAL DEVELOPMENT IN WEST AFRICA

The cashew industry in West Africa has achieved remarkable success in primary production, yet value addition through processing remains one of its most significant challenges. There is low level involvement in small-scale cashew processing by farmer associations. However, local processors have limited financial capacity, are buying and selling in volatile markets, and have to compete with commercial organizations that have much better access to financial services and are more closely linked with international markets. (CBI, 2008)

According to Anayochukwu *et al*. (2022) numerous flesh apples and nuts waste away in several cashew farms, simply because most of these producers lack the competence to sufficiently process cashew into more acceptable products for consumption as well as marketing at both local and international markets.

Despite accounting for over 60% of global raw cashew nut (RCN) output, the region processes less than 15% of its total production locally, resulting in loss of potential income, jobs, and industrial diversification opportunities (ACA, 2023; FAO, 2023). The structural imbalance between production and processing reflects technological, financial, infrastructural, and institutional limitations that hinder the sector's complete transformation.

The importance attached to the development of the cashew sector by the governments of Côte d'Ivoire and Benin, expressed in subsidies and favorable investment and taxation policies, will certainly further speed up private capital investment in local cashew nut processing.

Interestingly, the federal government of Nigeria has over the years come up with different agricultural policy interventions including the "Agriculture Promotion Policy (APP) (2016 – 2020)" document, which emphasizes value addition to export crops such as cashew as a way of creating jobs and wealth to value chain actors. However, it is still unclear why cashew processors are unable to exploit this opportunity to improve value addition to cashew

3.1 The Cashew Value Chain and Its Structural Imbalance

The cashew value chain in West Africa comprises production stage which include cultivation, harvesting; primary processing such as shelling and drying; industrial processing which include peeling, grading and packaging and marketing. The region position in the global cashew production has not been reflected in the development of the downstream value chain industry as the bulk of the cashew nuts produced in the region are exported unprocessed to Asia especially Vietnam and India, where more than 85% of the world's RCN are processed (Lawal *et al.* 2011; (CBI), 2022).

This pattern has created a dual dependency whereby West African economies rely on Asian processors for value addition, while Asian firms depend on West Africa for raw materials. For instance, in 2023, Côte d'Ivoire exported 1.1 million tonnes of RCN to Vietnam, accounting for nearly 45% of Vietnam's total imports (Reuters, 2024). The exported nuts are then shelled, peeled, and graded abroad, capturing up to 70% of the total value chain profit (World Bank, 2024).

Local processors in West Africa often face challenges in competing with well-established Asian firms that benefit from economies of scale, advanced technology, and consistent quality standards. As a result, most domestic processors operate below 50% capacity utilization, and several plants have closed due to high operational costs and inconsistent supply of quality nuts (FAO, 2023).

3.2 Status of Cashew Processing Across Key Producing Countries

The establishment of cashew nut processing units largely depend on function of access to RCN and availability of skilled labor, reliability of electricity, the proximity to ports, stability of government policies and enabling investment climate (CBI,2018). As a leading country in development of local processing capacity in the West African region, between 2015 and 2023, Côte d'Ivoire installed capacity has increased from 40,000 to over 250,000 tonnes per year. This is supported by government incentives and appropriate policy including export levies on raw nuts and tax exemptions for processing equipment (World Bank, 2024). Major cashew nut processors, including Olam, CashewCo, and Fludor, have established large-scale facilities that employ thousands of workers, primarily women. Despite this progress, local processing still accounts for only 15–20% of total national output (Reuters, 2024).

Benin and Ghana have made moderate progress, with several small and medium-sized enterprises (SMEs) operating semi-mechanized processing plants. The BeninCajù programme, supported by TechnoServe and the U.S. Department of Agriculture (USDA), has helped train over 10,000 farmers and processors in quality management and value addition (USDA, 2023). Similarly, Ghana's Tree Crop Development Authority (TCDA) is working to integrate cashew into its industrialization strategy (TCDA, 2024).

In Nigeria, processing capacity remains underdeveloped despite being one of Africa's largest

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producers. The National Cashew Development Strategy (2021–2030) aims to increase domestic processing to 50% by 2030, supported by investment incentives and public-private partnerships (FMARD, 2022). However, challenges such as poor infrastructure, limited access to finance, and unreliable power supply constrain progress.

Guinea-Bissau, one of the world's oldest cashew-producing countries, exports nearly all its raw cashew nuts, mainly to India. There is very low level of local processing, with less than 2% of national output transformed domestically (UNCTAD, 2023). Political instability and lack of favourable investment policy remain key barriers.

3.3 Emerging Trends and Opportunities

The West African cashew business is growing, despite ongoing difficulties due to business sector investment. Companies such as OLAM International, Cashew Coast, and Fludor Benin SA are improving processing operations and developing new products like cashew butter, roasted kernels, and snack blends for local markets (Food Business Africa, 2023).

Technological advances are changing the industry. Companies are adopting smart automation and digital tracking to manage supply chains and maintain quality. Yin *et al.* (2023) reported that solar dryers and boilers using cashew shell biomass improved sustainability and energy efficiency.

In addition, the local consumption market is slowly expanding. Rising middle-class incomes and changing dietary preferences in urban centres like Lagos, Accra, and Abidjan are creating an interest in snacks and beverages made from cashew products, reducing dependency on export markets (FAO, 2023). With proper investment in technology, training, and infrastructure, West Africa could transform from a raw material supplier into a comprehensive cashew processing center, increasing its share in the international markets. Table 1 below gives a concise summary of major cashew-producing countries, their estimated processing capacity, and the percentage of raw cashew nuts (RCN) processed locally in year 2023.

Table 1: West African Countries Approximate Processing Capabilities (2023)

Country	Annual RCN Production (metric tons)	Processing capacity (metric tons)	%Processed locally
Cote d' Ivoire	1,200,000	350,000	~29%
Nigeria	290,000	60,000	~21%
Benin	200,000	50,000	~25%
Guinea Bissau	230,000	15,000	~7%
Ghana	110,000	25,000	~23%
Burkina Faso	100,000	20,000	~20%

Source: ACA, 2024.

IV. UTILIZATION PATHWAYS AND BY-PRODUCT VALORISATION IN WEST AFRICA

One of the few crops in West Africa with a variety of uses that transcend much beyond the edible nut is cashew (*Anacardium occidentale L.*). There is economic potential in every part of the cashew tree, including its wood, apple, kernel, and shell. However, by-products are either underutilized or wasted in the majority of West African nations, where use is still limited to the export of raw cashew nuts (FAO, 2023). Optimizing the use of cashew by-products offers a promising chance to increase sustainability in the region's agri-food systems, encourage rural industrialization, and diversify sources of income (UNCTAD, 2023).

4.1 Cashew Kernels and Food Industry Applications

The cashew kernel is the most valuable component in the cashew value chain. It is internationally appreciated for its taste, nutritional benefits, and adaptability in the culinary sector. Cashew kernels consist of approximately 47% fat, 21% protein, along with essential minerals like magnesium, phosphorus, and iron (FAO, 2023). The kernels are classified into categories such as white wholes, splits, butts, and pieces, based on quality standards (CBI, 2022). In West Africa, the local consumption of kernels is minimal since a majority of processed nuts are sent to markets in Europe, North America, and Asia, where the demand for healthy snacks is increasing (ACA, 2023). For example, in 2023, the United Kingdom imported more than 12,000 tonnes of processed cashew kernels from West Africa, highlighting the region's expanding export presence (CBI, 2023).

There is an increasing interest from local entrepreneurs to explore domestic and regional markets, as shifting dietary habits in urban areas like Lagos, Accra, and Abidjan have created fresh demand for nut-based products. In both Ghana and Nigeria, small-scale processors have started to manufacture roasted and flavored cashew snacks and cashew butter, catering to the growing middle-class demographic (TCDA, 2024). Cashew kernels also function as ingredients in the confectionery, bakery, and dairy-alternative sectors. For example, cashew milk and cashew cheese have started to receive attention as plant-based substitutes for conventional dairy products. If scaled appropriately, these new product lines could greatly enhance domestic value addition and minimize post-harvest losses.

4.2 Utilisation of Cashew Apple

The cashew apple, which is a pseudo-fruit connected to the cashew nut, is plentiful yet largely underused in West Africa. It is estimated that for every ton of cashew nut produced, approximately 8–10 tons of apples are discarded (FAO, 2023). The apple is abundant in vitamin C (up to five times the amount found in oranges), minerals, and natural sugars, making it suitable for the production of juice, jam, syrup, and wine (Ogunniyi *et al*., 2021). In nations such as Benin, Nigeria, and Ghana, pilot initiatives have showcased the viability of processing cashew apple juice commercially. For instance, the BeninCajù project, backed by TechnoServe and USDA, has enabled the creation of small-scale cashew apple juice production facilities, which offer seasonal employment opportunities for rural youth and women (USDA, 2023). The Cashew Juice Company in Ghana, established in 2022, produces pasteurized juice and vinegar for local grocery stores (TCDA, 2024). Advances in fermentation technologies have also created possibilities for producing cashew wine and ethanol. In Nigeria, small breweries have started creating cashew apple wine containing an alcohol content of 5–10%, available in local markets (Adebayo *et al.,* 2022). Similarly, research in Côte d'Ivoire has investigated the production of bioethanol from cashew apple juice as a renewable energy alternative, given its high sugar content and quick fermentation capabilities (Yin *et al*., 2023). However, despite its potential, the commercialization of cashew apple products encounters significant challenges, including limited shelf life, seasonal availability, and a lack of consumer awareness. Investments in cold storage, preservation, and packaging technologies are crucial for enhancing the market potential of this product.

4.3 Cashew Nut Shell Liquid (CNSL) and Its Industrial Uses

The cashew nut shell is a by-product containing Cashew Nut Shell Liquid (CNSL), a thick oil abundant in phenolic compounds such as anacardic acid, cardol, and cardanol. CNSL is considered one of the most valuable but underutilized by-products of cashew in West Africa (World Bank, 2024). Worldwide, CNSL is employed in various industrial applications, including the creation of brake linings, paints, coatings, resins, and polymers. Countries like India and Vietnam have incorporated CNSL for these uses, yielding considerable export value (CBI, 2022). Nevertheless, in the majority of West African processing plants, cashew shells are burned as waste or solely utilised as low-grade fuel, contributing to greenhouse gas emissions while forgoing potential revenue opportunities (ACA, 2023). In Nigeria and Côte d'Ivoire, several projects have started exploring the extraction of CNSL. For example, OLAM International's facility in Bouaké (Côte d'Ivoire) extracts CNSL for local industrial use as an alternative biofuel, substituting diesel in boilers (Reuters, 2024). Additionally, Nigerian research institutions have devised low-cost extraction techniques using solvent-based or mechanical approaches to encourage small-scale recovery of CNSL (Saidou *et al*., 2022). The increasing demand for CNSL in the automotive, aerospace, and renewable energy industries presents a major opportunity for West Africa. Establishing small industries based on CNSL could generate eco-friendly jobs and minimize waste in the cashew supply chain.

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In addition to CNSL, cashew shells and husks possess significant potential for bioenergy. When burned in an efficient manner, they can produce heat for drying kernels and generating steam, serving as a renewable alternative to fossil fuels (FAO, 2023). For example, in Benin, small-scale processors utilize gasifier stoves that operate on cashew shells, leading to decreased energy expenses and lower carbon emissions (GIZ, 2023).

Cashew shell ash can also be used as a soil amendment or fertiliser, improving soil structure and nutrient availability. Moreover, cashew tree wood, though not widely commercialized, is occasionally used for fuelwood, fencing, and small-scale furniture production (UNCTAD, 2023).

Recent innovations have explored the conversion of cashew biomass into activated carbon for water purification and biochar for carbon sequestration. These applications not only add value but also contribute to environmental sustainability (Yao *et al.,* 2023).

4.4 Environmental and Health Considerations

Although using cashew by-products offers many benefits, there are concerns for the environment and occupational health. Water and soil contamination can result from improper disposal of cashew shells and apple processing wastewater. Additionally, workers who are exposed to CNSL during manual shelling may get dermatitis, respiratory irritation, and ocular damage (Saidou *et al*., 2022).

To address these challenges, regulatory frameworks must ensure safe handling, recycling, and waste treatment in processing plants. The African Cashew Alliance (ACA) and development partners have been promoting Good Manufacturing Practices (GMP) and Occupational Safety and Health (OSH) training to mitigate health hazards (ACA, 2023).

Adopting circular economy models, where waste from one stage becomes input for another, can significantly reduce the industry's environmental footprint. For instance, shell waste can be converted into energy, while apple pulp can be composted into organic fertiliser for cashew farms (FAO, 2023).

4.5 Opportunities for Research, Innovation, and Investment

Universities and research centers in Nigeria, Ghana, and Benin are increasingly looking into new uses for cashew-derived products as the need for research and innovation in cashew by-product valorization becomes more apparent. Promising areas include pharmaceutical research on anacardic acid for antimicrobial and anti-inflammatory properties, bioplastic development from CNSL derivatives, and nutraceutical products from cashew apple extracts (Yin *et al*., 2023).

Innovation-led growth could be fueled at the policy level by promoting public-private partnerships (PPPs) in research commercialization, offering financial incentives, and bolstering intellectual property protection. Pilot initiatives that demonstrate the economic sustainability of cashew by-product industries are still supported by development partners, including GIZ, USAID, and AfDB (GIZ, 2023; World Bank, 2024).

West African nations might improve rural livelihoods, lower post-harvest losses, and position the cashew industry as a catalyst for the development of a sustainable bioeconomy by including by-product utilisation in the national agro-industrial strategy.

V. POLICY ENVIRONMENT, CHALLENGES, AND FUTURE PROSPECTS OF CASHEW INDUSTRY IN WEST AFRICA

The cashew sector in West Africa is a vital component of the region's agricultural economy, supporting millions of smallholder farmers and contributing significantly to export revenues. However, despite the promising potential of the crop, the sector continues to grapple with institutional, financial, infrastructural, and environmental challenges. Addressing these bottlenecks requires well-coordinated policy frameworks, stronger regional integration, and enhanced private-sector participation to transform the cashew industry into a fully integrated and sustainable value chain (World Bank, 2024).

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5.1 Policy and Institutional Frameworks Supporting Cashew Development

Over the past decade, West African governments and regional bodies have increasingly recognized cashew as a strategic crop for agricultural diversification and rural economic transformation. Consequently, multiple national strategies and regional initiatives have been implemented to strengthen cashew production, enhance processing capacity, and improve market competitiveness across the value chain.

Côte d'Ivoire, Africa's largest cashew producer, has implemented a Cashew Sector Master Plan (2020–2030) aimed at boosting domestic processing capacity, improving quality standards, and enhancing farmer incomes. The plan introduced export levies on raw nuts, fiscal incentives for processors, and the creation of Cashew Industrial Clusters (CICs) to encourage local value addition (FAO, 2023).

In Nigeria, the National Cashew Development Strategy (2021–2030) outlines a comprehensive framework to modernize the value chain. It focuses on enhancing productivity, facilitating access to finance, developing processing infrastructure, and improving export competitiveness through quality assurance and traceability (FMARD, 2022).

Ghana, through the Tree Crop Development Authority (TCDA), has integrated cashew into its broader Tree Crop Development Strategy, emphasizing farmer training, extension support, and private-sector-led processing (TCDA, 2024). The TCDA also plays a regulatory role in coordinating stakeholders and promoting standards for fair trade and sustainability.

At the regional level, the Economic Community of West African States (ECOWAS), in collaboration with the European Union (EU), has been implementing the West Africa Competitiveness Programme (WACOMP) to improve competitiveness in key value chains, including cashew. The programme supports policy harmonization, industrial upgrading, and cross-border trade facilitation (WACOMP, 2023).

In addition, the African Cashew Alliance (ACA) serves as a crucial industry platform for advocacy, quality improvement, and regional integration. Its Quality and Sustainability Seal (QSS) certification initiative ensures compliance with international food safety standards and strengthens the market reputation of African cashew (ACA, 2023).

5.2 Financing, Trade, and Market Dynamics

Access to finance remains one of the most significant barriers to the growth of the cashew sector in West Africa. Many farmers and processors operate as small and medium-sized enterprises (SMEs) with limited collateral, inadequate financial documentation, and weak credit histories, which significantly constrain their ability to secure loans for expansion. Financial institutions, in turn, often perceive cashew-related enterprises as high-risk due to the crop's seasonal production cycle, inconsistent yields, and exposure to global price volatility *(CBI, 2022)*. These financing gaps hinder investment in improved farming practices, modern processing technologies, and value-addition activities across the value chain.

To address these constraints, regional development banks such as the African Development Bank (AfDB), the ECOWAS Bank for Investment and Development (EBID), and the West African Development Bank (BOAD) have introduced targeted agro-processing and value-chain financing schemes to support the growth of the cashew industry *(World Bank, 2024)*. These initiatives are designed to expand access to medium- and long-term credit for processing equipment, working capital, and supply chain upgrading. Notably, the AfDB's Agro-Industrialisation for Africa Initiative has supported the establishment and expansion of multiple cashew processing plants in Côte d'Ivoire and Benin, contributing to job creation, enhanced processing capacity, and increased local value addition *(AfDB, 2023)*.

To address this, regional development banks such as the African Development Bank (AfDB), ECOWAS Bank for Investment and Development (EBID), and the West African Development Bank (BOAD) have launched dedicated agro-processing and value-chain financing schemes to support the cashew industry (World Bank, 2024). For instance, the AfDB's Agro-Industrialisation for Africa Initiative has funded

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several processing plants in Côte d'Ivoire and Benin, creating thousands of jobs (AfDB, 2023).

Trade policies have also evolved to promote regional competitiveness. Some countries, notably Côte d'Ivoire and Benin, have introduced export taxes on raw cashew nuts to incentivise local processing. However, this has sometimes led to cross-border smuggling and distorted markets, especially when neighbouring countries maintain liberal export regimes (Reuters, 2024). Hence, a balanced regional approach is necessary to prevent market fragmentation.

The African Continental Free Trade Area (AfCFTA) provides new opportunities for intra-African trade in cashew products. By reducing tariffs and improving logistics, AfCFTA could enable the establishment of regional processing hubs, allowing West African countries to collectively compete in the global market (UNCTAD, 2023).

5.3 Sustainability and Climate Change Considerations

Climate change represents a significant and growing threat to cashew production in West Africa. Increasing temperatures, irregular rainfall patterns, and prolonged droughts have already negatively impacted yields in key producing regions, including northern Ghana and central Nigeria *(Yao et al., 2023)*. In addition, the expansion of cashew plantations into previously forested areas has raised environmental concerns, particularly regarding deforestation, habitat loss, and declining biodiversity. These challenges underscore the need for sustainable production practices and climate-resilient strategies across the cashew value chain.

To address these issues, several countries are promoting climate-smart agricultural practices, including intercropping, soil moisture conservation, and the use of drought-resistant cashew varieties (FAO, 2023). For example, the BeninCajù Programme has introduced training for farmers on sustainable orchard management, organic fertilization, and integrated pest control (USDA, 2023).

Sustainability certifications, such as the Rainforest Alliance and Fairtrade, are also becoming more relevant in export markets, providing incentives for environmentally responsible production. However, the cost of certification remains a challenge for smallholders. Collaborative models, where farmer cooperatives share certification costs, have been proposed as practical solutions (GIZ, 2023).

5.4 Gender, Youth, and Inclusive Development

The cashew industry presents substantial opportunities for inclusive economic growth, particularly for women and youth. Women account for more than 60% of the workforce in cashew processing plants across West Africa, engaging primarily in shelling, peeling, and packaging activities, making cashew a vital source of income for rural households *(ACA, 2023)*.

In Nigeria and Ghana, gender-focused initiatives such as the Women in Cashew Initiative (WIC), supported by ACA and GIZ, have strengthened women's participation in leadership positions within cooperatives and associations *(GIZ, 2023)*. Concurrently, youth entrepreneurship programmes have been established to foster innovation in value addition, marketing, and agro-processing.

Despite these advances, structural barriers including unequal access to land, credit, and training continue to limit full participation. Effectively addressing these disparities requires targeted policies, affirmative action, and enhanced investment in extension services and capacity-building programmes to empower women and youth across the cashew value chain *(World Bank, 2024)*.

5.5 Key Challenges Facing the Cashew Sector

Despite notable progress, the West African cashew industry continues to confront several structural and operational constraints that limit its growth and competitiveness:

Low Processing Capacity: The majority of cashew nuts are still exported in raw form, with local processing rates remaining below 15% of total production *(FAO, 2023)*.

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Inadequate Infrastructure: Poor Road networks, unreliable electricity supply, and limited storage facilities increase production costs, exacerbate post-harvest losses, and reduce the efficiency of the value chain.

Limited Access to Finance: High interest rates, stringent collateral requirements, and perceived sectoral risk restrict investment in modern processing technologies and expansion.

Market Volatility: Global cashew prices are highly sensitive to fluctuations in demand from major processors such as Vietnam and India, exposing producers and processors to income instability.

Weak Research and Extension Systems: Many countries lack robust research programs for varietal improvement, pest and disease management, or climate adaptation strategies, which limits productivity gains.

Quality Control Challenges: Inconsistent moisture levels, contamination, and non-compliance with international standards reduce export quality and restrict access to premium markets.

Addressing these challenges requires a coordinated policy approach that integrates agricultural, industrial, and trade development strategies, supported by investment in research, infrastructure, and human capital.

VI. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

West Africa is currently at the forefront of cashew production, ensuring the continuous availability of cashew nuts and cashew derivatives to meet the global demand for environmentally friendly products, healthy snacks, oils, and other uses. However, to ensure its continued existence and subsequent improvement, factors such as steady investments, better consideration policies, cashew value chain sensitization, and institutional restructuring need to be prioritized. West African cashew value chain personnel focus significantly on production, although with considerable revenue, but underestimate the importance of adding value to the nut, such as processing, including breaking, snack production, oil extraction, and many more, which are actually in high demand globally. This has limited the revenue of cashew nut producers compared to cashew nut processors. One of the most crucial actions to improve the West African cashew nut sector is private investment. This will provide the cashew industry sector with the much-needed resources to facilitate the procurement of the required technologies, machines, and equipment for adequate cashew processing. Although West African countries' governments are putting effort into cashew nut production, finished goods are more desirable, appreciated, accepted, and valued than raw material. Although countries such as Ghana, Côte d'Ivoire, and Nigeria have established new agencies within their ministries for special intervention in cashew production, processing needs to be given more attention to fully grasp the benefits of cashew farming. This needs to be emulated by fellow West African countries to derive the utmost advantages of cashew production in their countries.

6.2 Recommendation

- Creation of local processing plants within a country and promoting inter-country collaboration, especially in research and development, through the African Continental Free Trade Area (AfCFTA) to strengthen the cashew value chain, thereby achieving economies of scale.
- Empowering and creating more research and development institutions which will focus on the production of high-yielding, terrain-resistant, pest-resistant, high peel-ability, and jumbo-size cashew varieties
- Creation of cashew-focused financial institutions, loan lines, guarantee schemes, subsidies, and private investment funds which focus primarily on small and medium enterprises and farmer cooperatives.
- Promotion of inclusiveness through gender based and youth-focused programmes, which will ensure an all-population participation in the cashew value chain.
- Creation of by-products focused value addition initiatives, including the usage of cashew apple, cashew bagasse, and cashew nut shell, which will

ensure zero or minimal loss from cashew fruits, thereby encouraging farmers and investors to focus more on cashew

- Construction of cashew value chain line infrastructure, including inter and intra-farm roads, processing buildings, logistics networks, and plantation creation, thereby reducing processing costs, increasing efficiency, and improving ergonomics.
- Harmonization of regional, state, and national policies to ensure continual operation and reduce efficiency loss when interacting between inter- and intra-country cashew value chain lines, thereby controlling market instabilities, trafficking, and improving competitiveness.

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