

Supply Chain Resilience in the Cocoa Industry Amid Global Disruptions: A Comparative Case Study of Ghana and Côte d'Ivoire

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Abstract. The cocoa sector continues to be a backbone for the global agricultural sector, and Ghana and Côte d'Ivoire combined supply more than 60% of the world's cocoa. The industry is economically vital; however, it remains highly susceptible to global shocks, including COVID-19, volatile international commodity prices, climate change, and logistical blockages in global trade. These disruptions have brought supply chain vulnerability to the forefront and have increased the need to respond with resilience to guarantee continued durability and reliability. This article is a comparative case study that investigates supply chain resilience in the cocoa sector in Ghana and Côte d'Ivoire, which are the world's two leading cocoa producers. Based on secondary data sources derived from international organizations, government reports, and academic papers, this work investigates the formative process through which these two countries have responded to global disruptions through instruments ranging from price stabilization, farmer cooperatives, digital platforms, and sustainability certification programs. The results demonstrate that while Ghana is more focused on the bottom-up approach through farmer-led cooperatives and digital traceability, Côte d'Ivoire adopts a more top-down, policy-driven approach, especially in pricing reforms and state control over exports. The comparative insights emphasize how useful it is to combine aspects of each model in order to improve resilience. In addition to offering practical advice to policymakers, supply chain participants, and international development practitioners attempting to strike a fair balance between economic stability and environmental sustainability in international agricultural trade, the study components contribute to the body of literature on the resilience of agricultural supply chains.

Keywords: Supply Chain Resilience, Cocoa Industry, Global Disruptions, Ghana, Côte d'Ivoire.

I. Introduction

The global cocoa industry sustains the world's cocoa economy. It supports the livelihood of countless smallholder farmers through its prominent agricultural value chains. Ghana and Côte d'Ivoire are the world's dominant cocoa producers. Together, they export over 60% of the world's cocoa. As a result, these two nations garner global attention in trade, sustainability, and resilience. Their economies are largely dependent on the cocoa industry (ICCO, 2023). Cocoa holds significant economic value for both producers and consumers. It generates income, employment, and export earnings for producing countries. For example, cocoa accounted for over 30% of export revenue in Ghana and Côte d'Ivoire from 1995 to 2014. Additionally, 40–50 million people depend on cocoa for their livelihoods, as 5–6 million farmers grow it worldwide (WCF, 2012). For most, cocoa is their main or only cash income. Cocoa is widely used in the food, beverage, confectionery, cosmetics, and medicinal industries in consumer countries. As a result, given the significance of cocoa in the global economy, it is imperative that its production be sustainable, especially at a time when the majority of young people do not view farming, including cocoa farming, as a viable career option. In the case of cocoa, this is likely because farming businesses are not profitable and growers' living standards are generally low; in fact, farmers along the cocoa global value chain (GVC) receive relatively low revenues. For instance, according to Cocoa Barometer (2015), farmers only receive 6.6% of the total value added to one ton of sold cocoa beans.² The International Labour Rights Forum (ILRF, 2014) calculated that the average cocoa farmer in Ghana and Côte d'Ivoire with two hectares (ha) of land makes about \$2.69 per day and \$2.07 per day, respectively.³ These amounts fall slightly above the \$1.90 per day global poverty limit. Given that a typical rural home in these nations may have more than five members, the daily net income per person would be well below the poverty threshold worldwide. Furthermore, in an increasingly connected business, the "scattered" nature of cocoa growers sometimes makes their condition worse by lowering their negotiating leverage. The younger generation of farmers is

thus moving to more lucrative off-farm pursuits, such as palm and rubber⁴, or simply moving to capital cities in search of better employment opportunities (ILRF, 2014). Reorganizing the cocoa growing industry will be necessary to enable farmers to earn more money and make it a more attractive source of income in order to draw in younger people and maintain a healthy global cocoa economy (Tsowou, Samuel K. Gayi and Komi, 2015).

Due to the perceived health risks of consuming foods made with dangerous chemicals, the idea of promoting the consumption of organic food has gained significant traction in recent years, particularly among consumers worldwide (Waller et al., 2023). To put it another way, consumers are calling for the use of food safety-compliant farming methods in order to support sustainable living. The goal of organic agriculture is to maintain and enhance the health of agroecosystems through a comprehensive approach to agricultural production. This involves increasing soil biological activity, promoting biodiversity, and sustaining natural biological cycles (Food and Agriculture Organization & World Health Organization, 1999). Using natural elements like compost and soil-covering crops, as well as avoiding industrial pesticides, fertilizers, and genetically modified organisms (GMOs), are all part of organic agricultural practices. However, in order to encourage organic agriculture's growth and guarantee its sustainability, good governance is required to fully achieve its potential (Adduow, 2025). Cocoa has enthralled people all over the world with its rich flavor and variety in confections, giving it the title of "food of the gods" (Carob vs. Cocoa, n.d.). However, beneath this popular commodity's charming exterior lurks a difficult and urgent problem: how to produce it sustainably. The social, environmental, and economic ramifications of cocoa cultivation have become more pressing as the demand for the commodity rises worldwide. Amidst the complex challenges facing cocoa cultivation, the organic cocoa industry presents a ray of hope and a site of revolutionary possibilities.

Despite its global reputation, Côte d'Ivoire receives very little money from its chocolate exports since industrialized countries dominate higher-value cocoa value chain stages like manufacturing and processing. The fact that value addition usually takes place outside of the producing regions draws attention to a structural imbalance that restricts the financial gains for regional stakeholders. Complicating the problems facing the cocoa industry are climate change susceptibility and fluctuating worldwide prices. Production cycles have been increasingly disturbed by extreme weather events, rising temperatures, and irregular rainfall, endangering long-term sustainability (Dago, 2025). Furthermore, the potential for resilience and economic diversification is limited by the underutilization of domestic processing capabilities. With cocoa accounting for over 15% of Côte d'Ivoire's GDP and 7% of Ghana's GDP [3], the two countries jointly control the majority of the world's cocoa supply chain. Cocoa is a vital component of both countries' economies (Diomande et al., 2023). Côte d'Ivoire's vital importance in foreign exchange profits is shown by the fact that cocoa exports make up around 70% of its total export earnings. Research demonstrates Ghana's potential for sustainability [4,5] through agroforestry and efficiency gains (Kouadio et al., 2021; Danso-Abbeam et al., 2020). But even though it produces more cocoa than any other country in the world, Côte d'Ivoire only receives a little portion of the value produced by the worldwide cocoa [6] industry (Abaidoo & Agyapong, 2023). The majority of value addition, such as the production, processing, and distribution of chocolate products, takes place in developed countries where substantial profits are made, making Côte d'Ivoire reliant on exporting raw cocoa and susceptible to changes in the world market [7] (Daya et al., 2023). These vulnerabilities are exacerbated by environmental challenges. Particularly in wooded areas that are cleared for agriculture, cocoa production contributes to environmental degradation and deforestation, which disrupts ecosystems and reduces biodiversity. Additional risks to productivity are posed by the effects of climate change, such as erratic rainfall patterns, rising temperatures, and unpredictable weather. In 2024, rainfall decreased to 1897.50 mm, while average temperatures [8] rose to 29.8 °C (World Bank, 2021).

II. Literature Review

1. Supply Chain Resilience Theory

Global shocks like pandemics, climate change, and geopolitical conflicts have made supply chain resilience more prominent in both academic and practical discourse. (Christopher, 2014), supply chain resilience is the system's capacity to anticipate unforeseen circumstances, react to disturbances, and return to its initial or enhanced form. Robustness (the capability to tolerate shocks), adaptability (the ability to modify procedures and structures), and recovery capacity (the rate of recovery following disruption) are three parameters that are frequently used to analyze resilience (Ponomarov & Holcomb, 2009). These factors are especially pertinent to agricultural value chains, which are vulnerable on a systemic level because of their significant reliance on natural resources, smallholder farmers, and volatility in international markets.

Resilience is an interdisciplinary concept. Holling (1973) defines resilience as a system's capacity to adapt to change. Subsequent authors have described resilience as a system's ability to recover and return to its original state. In organizational contexts, resilience refers to the capacity to persist in volatile environments (Ates and Bititci, 2011). The increasing frequency of disruptions in global supply chains has elevated resilience to a critical concern within the supply chain sector. However, the literature remains inconclusive regarding the measurement and antecedents of supply chain resilience (SCRE), leading to ongoing debate about its conceptualization and assessment (Jüttner and Maklan, 2011). Further development and empirical validation of SCRE measurement constructs are necessary to address these gaps.

The literature on resilience in the context of small and medium-sized businesses (SMEs) is thoroughly reviewed by Bhamra et al. (2011). In order to ascertain whether resilience is a "measure, feature, philosophy, or capability," the authors conclude that there is an urgent need for study to "empirically prove theories (Chowdhury & Quaddus, 2018)." As a component of SCRE, Durach et al. (2015) create a framework of the antecedents of supply chain robustness. In order to handle the "turbulence" in supply chains, the writers also go over both proactive and reactive tactics. The broad "building elements" of SCRE are identified by Hohenstein et al. (2015) through a thorough and methodical literature assessment.

Supply Chain Resilience (SCRES) has emerged in academic literature as a term reflecting the diverse interpretations of resilience across multiple disciplines. The concept of resilience is recognized as both multifaceted and multidisciplinary. However, the literature reveals a lack of consensus regarding the definition of SCRES, largely due to the broad and varied nature of resilience research across different fields. Pettit et al. (2013) define supply chain cooperation as the ability of organizations to collaborate for mutual benefit in areas such as risk sharing, forecasting, and postponement. Cooperation also involves information sharing, which increases transparency, reduces uncertainty, and facilitates the development and dissemination of knowledge related to supply chain risks and uncertainties (Christopher & Peck 2004). Through cooperation, supply chain partners can share the costs associated with building security and resilience (Bakshi & Kleindorfer 2009). Ghadge et al. (2012) state that cooperation influences the processes supply chain partners implement to ensure supply chain recovery. Scholten et al. (2014) argue that cooperation enables organizations to share resources and complementary capabilities necessary for recovery following a disruption. Collaboration further enhances supply chain resilience (SCRES) by facilitating flexible and coordinated responses among supply chain partners during disruptive events, as well as mutual support (Jüttner & Maklan 2011). The cooperation between Toyota and its suppliers after the 1997 Aisin Seiki Kariya plant fire, discussed in Section 3.1 (Nishiguchi & Beaudet 1998), illustrates how certain supply chain relationship practices, including just-in-time supply and single-sourcing partnerships, can increase exposure to risk. These risks must be weighed against the benefits of such practices, including the development of robust networks that support rapid emergency response (Benjamin et al., 2015).

2. Agricultural Value Chains in Africa

Agriculture in Africa is essential to the world's food trade and security. According to the World Bank (2021), Sub-Saharan Africa's agricultural supply chains are extremely susceptible to disruptions due to factors like inadequate infrastructure, restricted financial access, and climate variability. Ghana and Côte

d'Ivoire, in particular, rely heavily on cocoa as a crop for both rural employment and export revenue, making it a vital crop. According to research, coordinated methods involving production, logistics, and governance structures are necessary for agricultural value chains to be resilient (Aday & Aday, 2020). Resilience in the context of cocoa refers to striking a balance between supporting local livelihoods and the needs of global trade.

The global political economy has long included agricultural value chains. The triangular trade (sugarcane, rum, and slaves) is a prominent example of how crucial they were in the early stages of capitalism's formation (Mintz, 1985; Patel & Moore, 2017). The study of global commodities and agricultural value chains has gained popularity over the past decade (Martiniello & Azambuja, 2019). In contrast to the early works, recent scholarship on global value chains interprets the geographical expansion of commodity chains as a component of broader changes in the structure of the global political economy. It attempts to capture the trend of Western firms and corporations becoming more international (Radice, 1975), the creation of a new international division of labor (Frobel, Heinrichs, & Kreye, 1980), and the nature and functioning of newly defined hierarchical circuits of capital (Gereffi & Korzeniewicz, 1994). It is based on the management paradigm and focuses on value chains' performance, design, and operation as vertical coordination tools to lower transaction costs (Winner, 2006).

The growth of global agricultural value chains has received special attention recently, in contrast to earlier times when agriculture was viewed as a highly dangerous area for investment, preventing flows into the circuits of capital accumulation in this sector. The value chain development concept has been promoted by governments, international development organizations, and donors. This policy discourse, which draws its main ideas from the OECD-FAO Guidance for Responsible Agricultural Supply Chains (OECD-FAO, 2016), portrays the creation of well-structured and fine-tuned value chains and the integration of smallholders within them as tools that can simultaneously generate wealth accumulation, improve governance, promote responsible business practices, protect human rights, health and safety, food security and nutrition, tenure rights, preserve the environment, and sustainably use natural resources.

In addition to providing a steady supply of produce that satisfies quality standards, this win-win model—known as responsible contract farming—is thought to have enormous potential to increase family farmers' access to markets and raise their wages. Due to reduced risk, improved produce circulation, and access to previously unattainable markets and inputs, contract farming—a type of agricultural production carried out in accordance with an agreement between farmers and a buyer that imposes conditions on the production and/or marketing of the commodity—is promoted as a tool capable of increasing farmers' productivity and income (Simmons, 2002). According to Poulton, Dorward, Kydd, Poole, & Smith (1998) and Silva (2005), other academics using the new institutional economics method have argued that contract farming is an institutional innovation that lowers transaction costs for agribusiness enterprises operating inside vertically organized global value chains.

Evaluating and enhancing the resilience of the food system has garnered attention recently [27]. They have discovered three "entry points" [15]. The first is at the level of the actual national or regional food system. At this scale, a number of writers have created frameworks for evaluating resilience, or the more general but closely related idea of vulnerability [7,14,15]. The ability to see the ensemble of sub-systems and scales that must work together to deliver and maintain food system functions, as well as the trade-offs within and between scales, is one benefit of using such a broad unit of analysis. By examining the resilience of households, their local agro-ecological systems, or their proximate communities, some articles have adopted a second entry point. Typically, these studies have focused on the trade-offs between food security and other livelihood activities like farming. Cabell and Oelofse (2012) and UNU-IAS et al. (2014), for instance, have suggested markers for evaluating resilience at the farm or farmer-community level [28, 29]. Because farmers are typically viewed as the group most susceptible to shocks, and because of the direct and intricate social and ecological ties that exist at this size, the farm community is a pertinent focal scale for resilience study.

Prior studies on cocoa supply chains

Several obstacles that the cocoa business must overcome put the durability of the supply chain to the test. According to (Gilbert & Morgan, 2010), farmers are frequently caught in poverty cycles due to the volatility of global prices, which exposes them to income shocks. Second, rising temperatures, erratic rainfall, and disease outbreaks, such as the cocoa swollen shoot virus, brought on by climate change, pose a threat to productivity (Läderach et al., 2013). According to Barrientos (2019), vulnerabilities are made worse by structural issues, including child labor, a lack of farmer empowerment, and a lack of bargaining power. These problems show that social and economic sustainability are essential components of resilient cocoa supply chains.

For more than a century, the \$78 billion cocoa supply chains have been plagued by quality problems and risks to social and environmental sustainability (Hasian Jr., 2008). Despite the assurances given by major focal corporations, reports indicate that the issues are getting worse (By-nc, 2021). High demand and fluctuating cocoa prices encourage stakeholders to buy beans from lower-quality "bulk cocoa" cultivars and deforested areas, which impacts established farmers and halts sustainability improvements (Fountain and Hütz-Adams, 2017). Cocoa commoditization adds to the problem because source traceability is frequently lacking. Although supply chain management (SCM) is essential for business performance (Barratt and Oke, 2007), inter-organizational activity monitoring has become more challenging due to supply chain complexity (Williams et al., 2013). In these contemporary, dispersed supply chains, supply chain visibility—defined by Francis (2008, p. 128) as "the identity, location, and status of entities transiting the supply chain, captured in timely messages about events, along with the planned and actual dates/times for these events"—allows managers to regulate important inputs and activities. Organizations should implement management strategies that complement their surroundings, according to neo-institutional theory (DiMaggio and Powell, 1983). It has been demonstrated that the normative (i.e., stakeholder expectations), mimetic (i.e., peer), and coercive (i.e., legal and regulatory) pressures that support these processes encourage sustainable business practices as firms look to gain legitimacy with their stakeholders (Adebanjo et al., 2013).

Although businesses frequently use signals to bolster their legitimacy with important stakeholders, there is evidence that some businesses exploit the information asymmetry between themselves and their customers by indicating that they are adhering to institutional expectations while neglecting or refusing to implement sustainable practices (Gold et al., 2017). In the cocoa industry, this decoupling is demonstrated by the importance of the profit imperative (McLoughlin and Meehan, 2021), which explains why the industry has not created sustainable supply chains (Carmagnac and Carbone, 2019) and why decades of claims to protect children and the environment have not been matched by the actions required to improve conditions. According to Naranjo-Merino et al. (2018), smallholder farmers in isolated tropical regions produce 90% of the world's cocoa, which reduces focal enterprises' visibility and, consequently, their capacity to influence (i.e., force) upstream actors. Important growing areas in eastern South America and West Africa are located in difficult-to-manage locations (Moxham and Kauppi, 2014). According to Ntiamoah and Afrane (2008), Ghana's centralized cocoa trade board has not made much headway in integrating supply chains and capturing downstream production processes, despite government attempts. Without visibility, supplier codes of behavior are not monitored. Third parties are frequently tasked with assurance job.

The majority of Ghana's cocoa production takes place in agroecological forest zones, where the climate encourages growth. Abubakar, RM&E(COCOBOD), pers. communic., 2016, cited in Waarts et al., 2019 states that the Ashanti, Brong-Ahafo, Central, Eastern, Volta, and Western regions are among these ecological zones (i.e., the shaded portion of Figure 1). Interestingly, in 2018 and 2019, several of these areas were renamed, delineated, and politically repartitioned. Examples include the division of the Brong-Ahafo into Bono and Ahafo regions, the division of the Volta into Volta and Oti regions, and the division of the Western region into Western North and Western South regions (Buor, 2023). Small-scale peasant farmers in these forest zones grow cocoa (Figure 1). One to five hectares is the typical farm size (Danso-Abbeam et al., 2014; Kongor et al., 2018). Ghana produces cocoa through a labor-intensive process in

which household members, the majority of whom are below the poverty line, cultivate the crop (Hainmueller et al., 2011). The farmers employ little to no modern technology and are frequently impoverished (Wessel and Quist-Wessel, 2015). Expanding the area of their farm, hoping for better seasons, and raising future yield or output are the most popular ways for them to increase their income (Ferraro et al., 2011). An illustration of Ghana's upstream CSC can be found in Plate 1. It encompasses a number of interrelated processes, stages, and cultural behaviors.

Comparative Approaches: Ghana and Côte d'Ivoire

According to West African cocoa production history, commercial cocoa production started in the 1890s on the Gold Coast. By the 1920s, it was producing more than half of the world's cocoa, making it the top producer (Green and Hymer, 1966). Until 1976, Ghana remained a major cocoa producer. Côte d'Ivoire became the world's largest producer of cocoa beans in 1978, surpassing Ghana, and now accounts for over 40% of global production (World Cocoa Foundation, 2010). Cocoa has a vital part in the economic development of major producing countries and provides work for the majority of people in rural areas (Gyan & Bajan, 2022). Both Ghana and Côte d'Ivoire continue to rely heavily on cocoa as their principal agricultural export. The most profitable product from Côte d'Ivoire is cocoa, which made up over 37% of all exports in 2015 (UNCTAD, 2016). Comparably, according to the International Cocoa Organization (ICCO), which represents most global cocoa production and consumption organizations, cocoa employs over six million people in Ghana and accounts for almost 30% of total export revenue (ICCO, 2022).

Côte d'Ivoire and Ghana both lead the world in cocoa exports, but they take different tacks when it comes to resilience. According to (Grohs H et al., 2023), Ghana has placed a greater emphasis on farmer-driven tactics, including bolstering farmer cooperatives, implementing digital traceability technologies, and supporting global certification programs. In contrast, the government-led measures of Côte d'Ivoire, like the centralized export limits and price stability policies of the Conseil du Café-Cacao, are more important (KPMG, 2016). There are very few comparative studies on these two nations, but their divergent approaches offer important new perspectives on how governance styles influence resilience outcomes.

In addition to important political divergences, such as Ghana's stable democracy and Côte d'Ivoire's history of conflict, the two countries share structural commonalities, such as their geographic position and reliance on cocoa. The economies of the two nations also differ, with Côte d'Ivoire joining the Francophone CFA franc zone and Ghana having its own central bank. Their contrasting colonial legacies of French and British rule also had an impact on their legal systems, administrative frameworks, and even how they approached post-colonial development and national stability. For example, Ghana mostly avoided the violent north-south conflict that Côte d'Ivoire was experiencing due to horizontal inequalities.

Research Gap

Relatively little comparative case study research has been undertaken to explore resilience responses in such a context of global disruption even though studies have already looked into cocoa supply chains in Ghana and Côte d'Ivoire separately. This disparity underscores the need for deeper and more comprehensive scrutiny of how different institutional contexts and stakeholder approaches foster resilience in the cocoa sector.

Conceptual Framework

This study examines Ghana's and Côte d'Ivoire's responses to global shocks in the cocoa business using a paradigm for supply chain resilience. The framework's three interconnected dimensions are as follows:

1. **Robustness:** The ability of cocoa supply systems to endure shocks without experiencing significant disruptions is known as robustness. Examples include government reserves and price stabilization systems.
2. **Adaptability:** Refers to the capacity of actors to modify procedures, systems, or frameworks in reaction to disturbances. For instance, the promotion of certification programs and the use of digital platforms for traceability.

3. Recovery Capacity: The efficiency and speed with which supply chains resume operations following interruptions. Mechanisms like risk-sharing agreements, collaborative funding, and export recovery plans following a crisis are examples of this.

III. Research Method

This research employs a more qualitative comparative approach through case studies to investigate the cocoa supply chain resilience in Ghana and Côte d'Ivoire. A case study approach is fitting in this situation as it offers an opportunity to analyze intricate processes in their natural setting (Yin, 2018). This study examines the resilience mechanisms of the two largest cocoa producers in the world to offer a comparative perspective on the institutional and governance frameworks. Case studies offer fresh perspectives, models, or ideas that can direct further investigation, as they are assessed according to experience with comparable cases and the full phenomenon in its setting, guaranteeing that their contribution is accepted (Martinsuo & Huemann, 2021).

This study aimed to evaluate the contributions made by the resilience tactics of the supply chains of the cocoa industries in Ghana and Cote d'Ivoire to the financial health of all stakeholders, farmer income, and the impacts of global disruptions on the two countries. Ghana and Cote d'Ivoire were picked for this analysis because they are the biggest cocoa producers in the world and as such, are pivotal in the global chocolate value chain. Both countries have also dealt with unrelenting challenges such as global trade imbalances, climate change, price volatility, and infrastructural deficits, all of which impinge upon the resilience and sustainability of their cocoa supply chain. Within this, the study population, relates to and includes all relevant and accessible industry documents, scholarly writings and publicly available organizational writings on the operations of the cocoa supply chains in Ghana and Cote d'Ivoire.

The sample of the study included the credible media pieces published in both regional and global domains, policy and trade documents, as well as annual reports published by Ghana Cocoa Board (COCOBOD) and Le Conseil du Café-Cacao. The types of data collected included both qualitative and quantitative secondary data. These referred to information concerning international trade, industrial activity, approaches to the evaluation of supply chain management, self-sufficient policy adjustments, and illustrative surveys of the resilience strategies employed during global disruptions. The selected documents went through careful scrutiny and evaluation to find appropriate assessments on their relevancy, accuracy, and truthfulness. Ethical issues involving the protection of human participants were restricted. There was no use of personal or confidential information, and all information was accessible to the general public. Therefore, this research was able to avoid issues related to respondent authorship, concealment, and personal data protection.

IV. Results and Discussion

Case of Ghana

Ghana has strived for a more resilient cocoa industry by providing incentives for farmers to engage in reliable off-farm employment and practice agroforestry by planting shade trees to enhance cocoa yield, soil conservation, ecosystem restoration, and microclimate creation. To formulate these strategies, farmers are given agency and local knowledge to address climate change and economic issues. They are in conflict with the socio-economic realities of the drought-affected areas. Farmers risk facing the economic uncertainty of declining cocoa yield Monoculture practices. Poor management due to lack of knowledge and practices like soil erosion, loss of soil fertility, drought, and soil pollution worsen the situation. The socio-economic conditions in the area are dire.

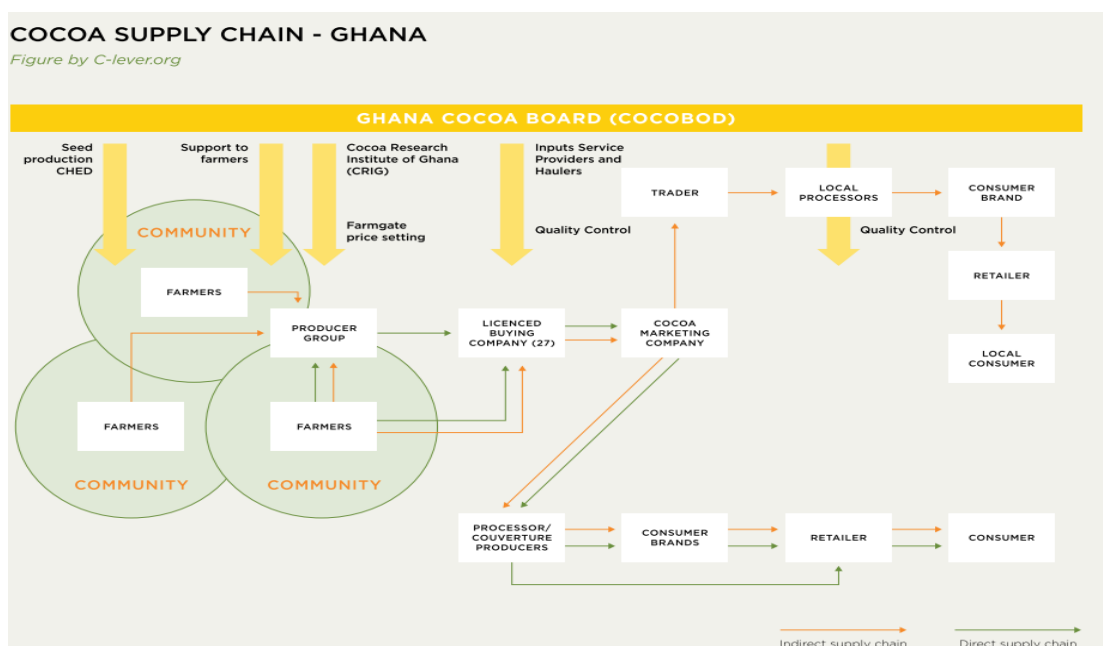
Farmer Cooperatives and Associations

Ghana has the highest proportion of smallholder farmers in Africa and these farmers remain at the frontline of climate change with high exposure and vulnerability with low adaptation capacity(Opoku Mensah et al.,

2025). Studies say there is an urgent need to support communities that are directly dependent on agriculture. The purpose is to enhance the ecosystem to lower their vulnerability. A shift to ecosystem-based communities is critical. Therefore, adaptation to climate change has been recognized as a top priority in Ghana. In Ghana, the agricultural sector has been the focus of several adaptation strategies aimed at increasing communities' adaptive capacity (Adu et al., 2018; Daz'e and Echeverría, 2016). These strategies provide assistance to smallholder farmers in adapting to the effects of climate change (EPA, 2020, 2021; Opoku Mensah et al., 2023; Abunyewah et al., 2024). The findings demonstrated that the majority of cocoa farmers do not use climate change adaptation technology, and the main innovation for those who do use some technologies is the diversification of revenue streams. Adoption of climate change adaptation technologies was also found to be significantly influenced by eight factors: respondent age, gender, participation in other economic activities, farm size, farmer association membership, access to extension services, credit availability, and annual income from cocoa production. Lastly, compared to those who did not employ these technology, cocoa farmers who did so reported far higher farm productivity and revenues. To increase resilience, cocoa farmers are urged to become members of farmer-based organizations, and extension agents should be given the tools they need to contact farmers and inform them about climate change resilience solutions.

Digital Traceability Systems

Digital solutions such as the Cocoa Management System (CMS) manage products from farm to market, improving transparency and guaranteeing adherence to international sustainability requirements (Stoop et al., 2021). These processes are being put into place by projects like the Ghana Tree Crop Diversification Project in an effort to modernize the cocoa industry, enhance farmer livelihoods, and satisfy consumer demand for cocoa that is sourced responsibly. Better data gathering, improved market accessibility, and more effective tracking of sustainability objectives in the cocoa supply chain are all made possible by these tools. Ghana's cocoa supply chain is comparable to that of Côte d'Ivoire. Smallholders sell their cocoa to 27 recognized Licence Buying Companies (LBCs) and the Produce Buying Company (PBC), which is the primary distinction. Following purchase, the cocoa must be transported by the LBCs and PBC to the Cocoa Marketing Company (CMC) facilities in Tema, Takoradi, and Kumasi. Because the LBCs are only permitted to sell through the CMC, a state-owned corporation, it is the biggest single seller and exporter of Ghanaian cocoa worldwide. Ghana's cocoa is marketed, sold, and delivered by the CMC to both domestic and foreign traders and processors.



Sustainability Certification

Ghanaian farmers are increasingly embracing sustainability certifications such as Rainforest Alliance and Fairtrade in order to reach premium markets with higher prices and as a way to protect themselves from price volatility by establishing more reliable and lucrative trading connections (Thompson et al., 2022). In the end, these programs can boost farm incomes and livelihoods by increasing access to training and services, improving management methods, and increasing production. They also require adherence to social and environmental norms. According to ITC (2019), Ghana's certified cocoa area is distributed as follows: 19% UTZ, 14% Fairtrade, 8% RA, and less than 1% organic. Since 2007, Suhum, a town and district 60 kilometers north of Accra, along with the nearby districts of Fanteakwa South and Abuakwa North, have become a hub for the production of UTZ and organic cocoa in Ghana. The adoption of organic cultivation in the area has been accelerated by a private sector cocoa buying firm with a license that specializes in organic cocoa. This company has organized farmer group creation, certified audits, and the use of organic inputs. There are more than 2750 certified organic producers in the area as of 2019. Over 800 farmers in these districts have earned UTZ certification, which was also sparked by this hub. The Western Region, which includes the town of Juabeso in Juabeso District, is the focus for RA certification (Figure 1). RA has been certifying farmers in the Juabeso District since 2010. Some of the first farmers to receive training on the Sustainable Agriculture Network Standard's climate module were these farmers (SAN, 2011). In the region, RA has spearheaded a landscape strategy by establishing community cocoa growing groups and landscape management boards. In the district, more than 3000 farms are currently certified.

Risk-sharing and Extension Services

Ghana enhances agricultural output and lessens the impact of market volatility and climate change on livelihoods by using public-private partnerships (PPPs) to give farmers subsidized agricultural inputs and extension services. By connecting farmers with innovative methods, technology, and market access, these partnerships combine resources and experience to provide improved extension services that promote food security and rural development. This strategy contributes to a more sustainable agriculture sector by boosting productivity and safeguarding revenues, strengthening farmer resilience. Agricultural extension public-private partnerships (PPPs) are cooperative agreements between public or government agencies and private sector organizations with the goal of providing farmers and rural communities with agricultural extension services and support. Agricultural extension, which involves sharing information, knowledge, and technology to improve farmers' productivity, income, and general well-being, is essential to rural development (Kaur et al., 2024). By combining resources, knowledge, and skills from the public and private sectors, PPPs in extension provide a practical way to increase the scope and influence of extension services. Enhancing the efficacy and efficiency of agricultural extension services is a common goal of PPPs in extension. Increasing farmers' access to modern farming methods, equipment, and inputs, enhancing market ties, promoting sustainable farming methods, and eventually advancing rural development and food security are all examples of this. Every participant in a PPP extension contributes unique resources and strengths to the partnership. Infrastructure, legal frameworks, and policy support are typically provided by public sector organizations, whilst partners in the private sector may offer technical know-how, funding, market access, and creative solutions. The partnership agreement specifies each party's obligations in detail. Diverse financial arrangements can be found in PPPs. Government finances or donations from donor groups may provide funding for the public sector, while partners in the private sector may contribute funds and resources to the partnership. The implementation of cost-sharing agreements is sometimes used to fairly divide financial commitments. Public-private partnerships allow for the sharing and transfer of risks between the two sectors through the distribution of resources and labor. The possibility of fruitful partnerships is increased by this shared risk strategy.

Case of Côte d'Ivoire

Price Stabilization Mechanism

In Cote d'Ivoire, the CCC sets the producer price annually through administrative decisions, considering political objectives and consultations with value chain actors. Through administrative choices that take into account political goals and value chain actors' input, the CCC in Cote d'Ivoire determines the producer price every year (TRUSTAFRICA, 2024). The CCC (Conseil qu Café-Cacao) in Côte d'Ivoire determines the producer price every year by administrative decisions that take governmental goals and value chain actors' input into account. The average cost at which projected contracts are sold serves as the primary basis for this price. The present criterion, which is at least 60% of the CIF (Cost, Insurance, and Freight) price, serves as the foundation for discussions with actors to determine the farm price. Nonetheless, the average cost of selling early contracts is used as the foundation for determining this price.

The Ivorian cocoa industry was governed by the Caisse de stabilisation (CAISTAB) prior to the 1990s. This organization-maintained producer prices consistent throughout the seasons and collected the difference between producer and export prices as government revenue (Benjamin/Deaton 1993; McIntyre 2001). Declining worldwide cocoa prices forced the discontinuation of inter-seasonal price stabilization in 1990. The SAPs witnessed a gradual liberalization of the system in the 1990s, which resulted in the elimination of CAISTAB (Tröster et al., 2019). Initiatives to re-regulate the cocoa sector in the 2000s were hindered by political instability and the civil war, notwithstanding the sector's generally poor performance under the liberalized regime (Gilbert 2009). The Ivorian government finally created the CCC as a regulatory agency in 2011–12, and in 2012–13, it reinstated a system for export permit distribution and a cost structure known as *barème* that sets prices and margins for all domestic players. Like the previous CAISTAB system, CCC does not directly deal in the actual trade of cocoa beans; instead, about six dozen licensed local and foreign exporters manage this activity. These exporters primarily source cocoa beans through wholesale (*traitants*) and farm-gate (*pisteurs*) middlemen. Traders are exporting, and the top five companies—Cargill, Sucden, Touton, OLAM, and Barry Callebaut—purchased 80% of export contracts for the 2018–19 season (Aboa 2019), thereby diminishing the importance of locally owned exporters.

Therefore, the Ivorian government makes sure farmers receive at least 60% of the CIF reference price, which acts as a baseline for cocoa income. A The price paid to cocoa producers in Ghana is set by the Producer Price Review Committee (PPRC) every year, taking into account variables such as the expected Free on Board (FOB) price, crop size, and exchange rate. With industry and operating costs deducted, the government guarantees farmers at least 70% of the net FOB.

A Based on administrative authority and taking government policy directives and inflation into account, the SLPMB in Sierra Leone sets minimum guaranteed prices.

Centralized Export System

In contrast to Ghana's export system, Côte d'Ivoire uses a more centralized government control over its export industry, especially over important commodities like cocoa, to stabilize national earnings and manage the supply of goods. Better control over the export market is made possible by this strict government oversight, which is essential considering how heavily the nation depends on these essential goods for its economic stability (Seekers, 2025). Côte d'Ivoire's stability was largely attributed to its success as an exporter of coffee and cocoa, the world's largest producer, which allowed the nation to rapidly reach an impressive degree of social progress and affluence. However, Houphouët-Boigny's use of ethnicity as a means of retaining power prevented the authoritarian leadership from fostering a distinct idea of citizenship and ethnic political inclusion. According to the OECD (2006), Cote d'Ivoire is the world's top supplier of cocoa beans. In the 1990s, the nation produced about half of the cocoa that was traded internationally (Losch 2002: 206). A complex web of foreign investments, immigration, and land colonization accompanied Cote d'Ivoire's cocoa production and export, which was driven by a combination of public and private initiatives

(Toungara 2001; Woods 2003). The first elected and long-serving president of the nation (1960–93) was Félix Houphouët-Boigny, who led the African cocoa growers in uniting in 1944 to form the trade union of African cocoa farmers (Marrone, 2013).

State-led Sustainability Programs

To increase resilience and lessen the effects of climate change, state-led sustainability projects with funding from foreign donors employ strategies including climate-smart agriculture (CSA) and forest replanting. While replanting initiatives tackle land degradation and environmental restoration, CSA seeks to more sustainably boost agricultural output, improve food security, and adjust to changing conditions (Bhatnagar et al., 2024). These cooperative endeavors are crucial to accomplishing national development objectives concerning food security and climate resilience. Agroforestry has drawn a lot of attention as a very advantageous strategy for both sustainable agriculture (Hanif et al., 2015; Kep-rate et al., 2024) and addressing the problems associated with a changing climate (Riyadh et al., 2021; Sharma et al., 2023). The integration of trees with crops and/or livestock is known as agroforestry. It includes a wide range of activities that work together to reduce the effects of climate change, adapt to them, and increase productivity (Abbas et al., 2017; Partey et al., 2017). Because it acts as a sink for carbon dioxide and methane, agroforestry has shown promise as a means of reducing the accumulation of greenhouse gases (Singh et al., 2024; Panwar et al., 2022). Rapid changes in product ecologies brought about by climate change need for quick innovations and the replacement of better crop varieties in agricultural landscapes in order to boost yield and quality. Breeding climate-smart features including disease resistance, preharvest aflatoxin contamination, and heat and drought tolerance can be more effective with the use of modern genomics technology. The quality and productivity of crops have significantly grown thanks to improved crop genetics, which has also successfully met the dietary and nutritional needs of the growing world population (Gangurde et al., 2019). The integration of soil fertility and pest management measures, as well as advancements in planting techniques and agricultural management practices, are particularly promising technologies in the field of pulse production.

Infrastructure Investment

With current initiatives targeted at boosting cargo capacity, enhancing connectivity, and lowering trade costs, Côte d'Ivoire has placed a great deal of emphasis on updating and extending its port and transportation infrastructure in order to improve logistics and boost trade efficiency. Economic growth, especially for its major exports like coffee and cocoa, and establishing the Port of Abidjan as a critical entry point for sub-Saharan trade depend on these initiatives. The nation hopes to increase its resilience to trade interruptions and promote prosperity for both itself and the larger area by fortifying its logistics network. In the mid-2000s, Côte d'Ivoire spent about \$0.75 billion on infrastructure, which is less than 5% of GDP and almost half of what several of its neighboring West African nations had been spending. Almost all of the expenditures have been allocated to operations and maintenance in the power industry, with little remaining for construction expenditures (Report, 2010). Infrastructure spending by the public sector has been very low, with the majority of recent investments coming from households (on-site sanitation) or the business sector (ICT). As of 2006, the gasoline levy, which supports the Road Fund, was fixed at \$0.05 per liter. The estimated \$0.15 per liter required to completely restore and maintain the nation's network of categorized roads is significantly less than this. The road sector spending in Côte d'Ivoire, like in other adjacent West African republics, is therefore significantly below what is required to make up for the recent neglect and to sustain the network once it has been restored to good condition (figure 4). Côte d'Ivoire must spend roughly \$48 million year to finance appropriate maintenance projects, based on simulations. In addition to physical road infrastructure, Côte d'Ivoire's road freight transport services encounter certain non-physical obstacles. Any upgrades to the infrastructure of the road network won't yield the full economic benefits unless these problems are fixed. First, police officers extort large sums of money from motorists on the country's highways. The overall yearly worth of these payments is estimated by recent research to be between \$200

million and \$290 million, with roughly 25% of that amount coming from freight traffic and the remaining 75% from passenger travel. Because of the high rate of bribery in Côte d'Ivoire, some regional transit traffic is redirected to other gates (such Tema and Lomé).

Comparative Insights

The comparative analysis reveals key differences and complementarities

1. Approach: Ghana emphasizes bottom-up resilience by encouraging farmer-led adoption of tactics like crop rotation and technology and empowering farmers through institutions like the Ghana Agricultural Associations Business and Information Centre (GAABIC). The state controls and implements agricultural policies and methods for a more centralized agricultural system in Côte d'Ivoire, on the other hand, using a top-down approach.

2. Strengths: Ghana is promoting a resilient cocoa industry by encouraging farmers to engage in off-farm employment and practice agroforestry to improve cocoa yield, soil conservation, ecosystem restoration, and microclimate creation. However, these strategies conflict with socio-economic realities in drought-affected areas, where poor management and climate change-related issues worsen. A shift to ecosystem-based communities is crucial to support communities directly dependent on agriculture.

3. Shared Challenges: Ghana and Côte d'Ivoire face challenges in cocoa production and export, including climate change, child labor, poverty, and limited education opportunities. The balance of payment dependence on cocoa presents a major challenge for farmers, countries, and governments. To address these issues, strategic cooperation is needed to minimize socio-economic pressures and maximize coco exports, ultimately minimizing economic socio-eco pressures in return.

4. Resilience Trade-offs: Ghana's cooperative and certification models offer sustainability pathways but face challenges for small-holder farmers. Ghana's cooperative subscriptions may not be accessible to all, while Côte d'Ivoire's price stabilization policy provides income security. Ivorian farmers face significant financial burdens, especially during low prices. These models highlight the importance of short-term wellbeing over long-term structural sustainability, emphasizing the need for government spending during challenging times.

Discussion

The results of these comparisons for Ghana and Cote d'Ivoire illustrate the impact of different governance systems on the supply chain resilience of the cocoa industry. While the top-down, state-led interventions of Cote d'Ivoire emphasise strength and stasis, the bottom-up, farmer-driven strategy of Ghana reflects a focus on empowerment and agility. These differences provide deep insights into the multifaceted nature of resilience. Cocoa sustainability has drawn a lot of attention lately. The social elements of workers and producers in the cocoa industry are covered by a variety of media outlets, advocacy groups, and alternative trade associations. Codes of practice for defining and auditing sustainable performance are now being developed and implemented by certification organizations. A number of food processing and manufacturing businesses are examining their sourcing policies and working to include sustainability standards into their trading practices. To share ideas on how to make the cocoa industry more sustainable, public and commercial partners gather at international conferences or round tables. Consuming nations gather to decide on policies that will benefit the industry, and the many smallholder producers in particular. Market-led development and poverty reduction in commodity-dependent nations are increasingly being attempted in projects funded by the intergovernmental Common Fund for Commodities (CFC). The European Commission's Commodity Action Plan focuses on poverty issues in nations that rely heavily on commodities. Governments are even debating the unique, troublesome circumstances of nations that rely heavily on commodities within the World Trade Organization. The foundation for efforts to improve cocoa's sustainability performance is established by these public and commercial initiatives. Their investments in and advancement toward sustainability, however, may be slowed or even halted by the

unpredictable and capricious economic realities of global commodities markets and, occasionally, the unequal distribution of margins across the cocoa chain.

Resilience as Adaptability (Ghana)

The case of Ghana uses approach adaptation and employs digital tools, farmer organizations, and sustainability certification and associated tools to enhance adaptability and reduce vulnerability. Ghana's farmer cooperatives have been able to improve resource access, communication among producers, and strengthen collective bargaining. Farmers can access international markets and earn higher incomes due to certification programs like Rainforest Alliance and Fairtrade, which promote the adoption of environmentally friendly practices. Farmers have been better able to cope with disturbances thanks to digital platforms like mobile payment systems. These systems provide prompt updates on weather, markets, and pests. Still, some things can be problematic. For instance, certification processes tend to favor bigger, financially equipped farmers at the expense of smaller producers (Barrientos, 2019). These issues include growing inequalities within the agriculture sector and the most vulnerable people being at higher risk of being excluded. Ghana's adaptation tactics must, therefore, be supplemented with inclusion strategies to ensure all groups of farmers regardless of social status have equal access to resources, and that these strategies improve the well-being of farmers and promote sustainability.

Resilience as Robustness (Côte d'Ivoire)

In contrast, Côte d'Ivoire has taken a resilience-by-robustness approach to focus on systems that shield farmers from the impact of sudden shocks from outside the country. Controlling the export market and stabilizing the country's cocoa prices are, of course, vital to the success of the strategy. The Ivorian government via the Conseil du Café-Cacao (CCC) ensures that farmers are shielded from the volatile world prices by guaranteeing a fixed farm-gate price at the beginning of each season. This policy is especially important for a country where millions of household's primaries earn their livelihood from cocoa. It helps farmers better manage their expenses, investments and consumption and reduce their exposure to the world prices as well as downturns in the global market. This model, however, has some weaknesses. The lack of market contact and dependance on government set prices contributes to excessive state control which reduces the independence and choices of farmers as well. Additionally, the government has to spend a lot of money on fixed price policies which can be a burden to the government budget in the event of a collapse of cocoa prices in the world market (KPMG, 2016). This draws attention to a crucial trade-off: stability through price stabilization fosters short-term security, but it also calls into question long-term financial viability and farmer autonomy.

Complementarity of Approaches

Through the lens of resilience, the complexity of strengths and weaknesses of both Ghana and Côte d'Ivoire can be understood in terms of robustness and resilience. Farmers in Ghana are strategically empowered through digital platforms, cooperatives, and certification programs which makes their farming more sustainable. On the other hand, the Côte d'Ivoire system provides farmers with uninterrupted price protection which ensures a guaranteed income over a short span of say, two to three months. A hybrid model where both strategies are incorporated can develop more comprehensive resilience frameworks for the West African cocoa value chains. For example, Ghana could implement more price stabilization measures which would act as a safety net for farmers in recessions, thus cutting down income uncertainty in a flexible manner. On the other hand, Côte d'Ivoire can do more to protect farmers by investing in amateur cooperative led certification programs and digital service expansion which would help smallholder farmers. The outcome would be increased farmer autonomy and expertise, as well as more stability, which makes the resilience measures more comprehensive by addressing current vulnerabilities and anticipation of future risks.

Theoretical Contribution

The results from Ghana and Côte d'Ivoire augment the understanding on the resilience of supply chains by empirically testing, and thereby affirming, the notion that institutional frameworks and governance, alongside economic considerations such as pricing and market access, determine resilience in agricultural value chains. This supports the claim made by Ponomarov and Holcomb (2009) that resilience should be dismantled and understood as a potential, dynamic in essence, and active at different levels of a supply chain that require orchestration. In this case, the associations of farmers, international certifying bodies, and state-driven initiatives all contribute to how resilience is understood and operationalized at the farm level. Moreover, the analysis highlights the different facets of resilience; in this case, robustness provides immediate “fire-fighting” capacity to withstand external shocks, and how well the system can learn and improve on its faults guarantees long-term adaptability and sustainability. In contrast to other studies, this study underscores the need to synthesize farmer empowerment and institutional governance, which provides a much deeper theoretical perspective to understand disruption of resilience as procedural and systemic through globalized agricultural supply chains.

V. Conclusion

This research is focused on the fate of supply chain resilience in the cocoa sector along the industry case study of the largest producers globally, Ghana and Côte d'Ivoire. The results indicate that the countries suffer from the same set of disruptions including price changes, climate shifts, pandemics, and logistical chokepoints. These disruptions, however, are countered differently. While Ghana employs farmer-centered adaptability by empowering cooperatives and offering certification schemes and digital traceability platforms, Côte d'Ivoire relies on policy-driven robustness that incorporates price stabilization, centralized export control, and state-led sustainability schemes. The comparative perspectives suggest that resilience strategies ought to consider both approaches. Empowering farmers through Ghanaian adaptability is highly beneficial in the long run, but the farmer exclusion is concerning. Côte d'Ivoire's robustness is detrimental in the long run due to its constrained farmer agency and overextension of the government's capacity. The integration of top-down bottom protection along top-down bottom empowerment yields the most favorable resilience. These approaches would enhance stability in farmer's income along with farmer's livelihood, and resource sustainability over the global supply chain of cocoa.

Practical Contributions

Polymakers: To reduce fluctuations along the world market for cocoa, Ghana and Côte d'Ivoire may use some of the policy levers discussed in the report. The coordinated, rather than the independent, efforts would reduce market fragmentation and the arbitrage that drives the price shifts. Examples include export pacing, buffer stocks, quality and grading standards, pest and climate warning systems, and resilient planting stock research. The evidence also supports cross-border social investments. Targeted cash transfers, rural infrastructure, and crop insurance subsidies ultimately protect smallholder earnings during price shocks. Finally, the integrated approach to trade and climate finance, diplomacy in the commodities forums, and joint negotiation of financial assistance for climate adaptation fosters the national resilience strategies into more stable conditions of global supply.

The practical contributions of international organizations — Foundation, donor, and global agencies continue to finance the shifts the sector needs. There is a mix of infrastructure investment priorities such as supporting extension services for women and neglected farmers, research on the development of hardy cocoa, and agroforestry and climate-smart agronomy. International Organizations can also act as facilitators of cross border trade by supporting the regional trade infrastructure and multi stakeholder platforms that bring together government, business, and civil society, as well as sustaining social risk mitigation initiatives (such as gender responsive input access, and child labor remediation). These organizations can also help incorporate resilience from integrated climate change strategies to business models of the private sector and national integrated plans by result-oriented finance and monitoring through assigned technical support.

Theoretical Contributions: This research furthers the theory of supply chain resilience by expanding the focus of governance on the determinants of resilience outcomes. The form and location of governance—for example, from vertically integrated firms and cooperative federations to multi-stakeholder public–private institutions—shapes the selective attention given to different resilience dimensions, the allocation of resources, and the dispersion of risk exposure, even though resilience in most studies is treated as a set of neutral activities (redundancy, buffers, flexibility, and so forth). Addressing specific governance configurations to each resilience dimension, such as centralised public systems which often provide robustness by creating buffers, and decentralised cooperatives which may enable adaptability through localised innovation, enhances the multidimensional framework of robustness, adaptability, and recovery capacity. This paper provides a typology to forecast resilience outcomes under different governance regimes which bridge the macro policy with the micro behaviour of farmers.

Future research directions

1. Empirical surveys with policymakers, exporters, and farmers: It will be appropriate to pay attention to primary, mixed-method data collection. Focus groups and key informant interviews with influencers can reveal policy frameworks and barriers to institutional transactions, as well as imbalances and potential overlaps in policy execution. On the other hand, household and producer surveys can estimate the adoption of resilience practices along with the income volatility and service accessibility derived from these practices, along with the geo-gender stratified farm sizes, as well as the servicing zones. Integrating experimental modules will provide the information necessary to derive the behavioral changes brought about by the different incentivized mechanisms, hence establishing causal evidence for targeted specific interventions (randomized information interventions, discrete choice experiments on contract terms).

2. Regional Trade Agreements and International Institutions: The research has raised concerns which require focused institutional and policy research on supranational resilience factors. Subsequent research should analyse the role of international institutions, ECOWAS, and the AfCFTA on the flow, tariff and standard of cocoa. Governance including the international tiers should also be analyzed on how they interface with national policy to amplify or dampen shocks and the system. Approaches to estimating how different regional cooperation frameworks might shift resilience outcomes should include comparative policy analysis, institutional mapping, econometric analysis that associates changes in trade policy and price volatility with shifts in the trade system, and scenario development.

3. Social sustainability and intersectional resilience: Social vulnerabilities like child labor, gender inequity, and feeble land tenure systems, are not peripheral; they can profoundly determine the supply chain's fragility. In demonstrating how social limitations impact the ability to adopt adaptive practices or obtain financing, future research ought to explicitly integrate social indicators into resilience frameworks employing qualitative ethnography and quantitative household-level data. More research can be done to measure the impact of social vulnerability reducing expenditures like conditional cash transfers, women's leadership programs, and legal land rights assistance on advancement and adaptation in cocoa communities in the long term.

4. Comparative analysis across sectors and nations: To draw lessons, comparative analysis should include the resilience of other African commodities, such as the cashew industry in Nigeria and the coffee industry in Ethiopia, alongside different market and governance systems. A comparative analysis would aim to determine which resilience techniques are transferable and which are specific to the commodity, due to the export market's structure, value-chain concentration, or perishability. Mixed methods, such as paired case studies, cross-country econometric analyses, and meta-synthesis of program evaluations, would give practitioners and policymakers a richer set of tailored options and show where policy transfer is likely to succeed or fail.

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