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Agri-Food Supply Chains and Rural Revitalization: Implications for Land Use and Regional Development in Ghana

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ABSTRACT

Agri-food supply chains play a critical role in shaping rural revitalization, land use, and regional development, particularly in agrarian economies where livelihoods are closely tied to land-based production systems. However, limited empirical research has examined how supply chain structures influence land use and regional development outcomes in Ghana. This study examines how agri-food supply chains support rural revitalization, shape land-use practices, and contribute to regional development in Ghana. Adopting a qualitative case study design, the study focuses on selected commodity supply chains (cocoa, maize, rice, and roots and tubers) which are central to rural livelihoods and agricultural land use across Ghana's diverse agro-ecological zones. Data were collected through semi-structured interviews with key supply chain actors and complemented with analysis of policy documents and secondary sources. Thematic analysis was employed to identify recurring patterns and relationships across the data. The findings reveal significant variation in supply chain structures and governance across commodities. Well-coordinated supply chains, particularly in the cocoa sector, enhance market access, income stability, and incentives for sustainable land management. In contrast, loosely organized food crop supply chains are characterized by price volatility, weak bargaining power for smallholders, and limited local value addition. The study further finds that agri-food supply chains

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contribute to rural employment and regional integration but are constrained by inadequate infrastructure and processing capacity, resulting in spatial disparities in development outcomes.

Keywords: Agri-Food Supply Chains; Rural Revitalization; Land Use; Regional Development; Value Chain Governance; Smallholder Agriculture; Ghana

1. Introduction

Supply chains are key factors in determining rural revitalization, the performance of the agri-food system, and regional development by organizing the transformation, distribution, and valorization of land-based resources across space [1]. Supply chains in agri-food systems connect agricultural land, rural labour, production inputs, processing plants, and markets into interlinked networks that directly affect rural incomes, food security, and territorial sustainability [2,3]. Since most rural areas are still largely dependent on agriculture as the dominant land use, the structure and organization of supply chains are closely linked to land management practices and regional development trends [4]. Agri-food supply chains are increasingly recognized as socio-technical systems embedded in specific spatial, institutional, and ecological contexts. Instead of being purely logistical arrangements, these supply chains reflect land tenure patterns, the presence of rural infrastructure, and the region's policy environment [5,6].

It has been demonstrated that well-coordinated agricultural supply chains can increase value addition for rural producers by promoting market access, reducing transaction costs, and facilitating product differentiation based on geographical origin and land-based characteristics [6,7]. In Ghana, the supply chains play a core role in rural revitalization, agri-food system performance, and regional development. Rural people have continued to depend on agriculture as a major land use and source of livelihood, providing employment, food security, and export revenue. Agricultural supply chain organization and governance, in turn, largely determine how land-based resources can be converted into economic and social value in rural and regional spaces [4,8].

The agri-food supply chains in Ghana have numerous commodities, including cereals, roots and tubers, horticultural, livestock and export crops such as cocoa. These chains connect producers (who are usually smallholders and account for the majority of agricultural production) to assemblers, processors, traders, and local and international markets [6,9]. Supply chains enable access to markets, income, and value addition in rural areas, underscoring their significance for rural development and land-use systems [7]. The revitalization efforts undertaken by rural communities in Ghana are increasingly focused on agricultural commercialization, value chain development, and agro-industrialization to improve rural livelihoods and narrow spatial gaps. The national development frameworks emphasise the importance of priority commodity value chains to enhance productivity, local processing, and job creation in rural areas [10,11]. In this context, supply chains are institutional and spatial frameworks that connect the rural land resources to the regional markets and economic networks.

Agri-food supply chains are also located within the specific regional and ecological areas of the forest belt, the savannah, and the coast in Ghana. These geographic variations define production and logistical structures, as well as patterns of market integration, highlighting the territoriality of supply chain development [4,12]. The connectivity of supply chains within the region enables the optimization of the flow of agricultural products from overproducing rural areas to consumption centres in urban areas, thus cementing rural-urban linkages and economic integration [13]. The relevance of supply chain management to the agri-food systems in Ghana is also reflected by sustainability issues. Sustainable supply chains emphasize efficient use, environmental concern, and social inclusion, which are particularly relevant in land-based rural economies [14,15]. Land conservation, livelihood resilience, and long-term regional development outcomes have been associated with initiatives promoting sustainable sourcing, traceability, and value addition in Ghana's agricultural supply chains [16].

Technological and institutional innovation have also changed the Ghanaian agri-food supply chains. It is

true that there is a shift towards digital capabilities, enhanced logistics infrastructure, and market information systems that improve coordination among supply chain actors and increase transparency at the production and distribution levels [17,18]. These trends enhance rural producers' integration into regional and national markets, underscoring the importance of supply chains as sources of rural renewal and spatial growth. The literature on agriculture and rural development in Ghana is considerable, and much attention is paid to smallholder agriculture, productivity growth, market engagement, and poverty alleviation [8,9,12]. Although these studies yield valuable information on the performance of agricultural systems, they often model supply chains in terms of segmented or linear marketing systems, as opposed to thinking of them as integrated systems within the processes of rural land use and institutional governance as well as regional development [3,6].

Simultaneously, the literature in the broader supply chain and agri-food systems more generally is starting to highlight the spatial, territorial, and governance aspects of dynamic supply chains in terms of their contribution to connecting land resources, rural livelihoods, and economic integration across regions [14,19,20]. Nevertheless, there are few empirical studies on the Ghanaian situation where such integrative approaches to the issue are applied. The current literature on Ghana leans towards policy assessment, farm-based results, or institutional alignment, without operationalizing how the agri-food supply chain framework can be aligned with rural regeneration goals, land-use trends, and regional development dynamics across ecological zones [4,7,11]. As a consequence, this lacks an empirical synthesis of how supply chain management fits within Ghana's broader rural transformation and spatial development agenda.

Although previous studies have examined agricultural value chains and rural development in Ghana, they tend to consider supply chains, land-use change, and rural development individually [21,22]. As a result, there has been little research on how agri-food supply chain organization and governance systems interact to affect rural revitalization and interregional land-use relationships. The current paper will add to the body of literature by offering a comparative analysis of several commodity supply chains: cocoa, maize, rice, and roots and tubers in Ghana's agro-ecological zones. The research draws on insights from supply chain governance, rural development, and land-use literature to show how variations in supply chain coordination and market structure outcomes influence rural livelihoods, regional development, and land-use choices in agriculture. The study thus provides a more holistic approach to comprehending the contribution of agri-food supply chains in facilitating rural regeneration and sustainable regional development in Ghana.

2. Research Framework and Methodological Approach

2.1. Supply Chain Management in Agri-Food Systems

The agricultural and terrestrial supply chain management (SCM) has developed considerably compared to the traditional linear models of production, processing, and distribution. Modern knowledge has positioned agri-food supply chains as interconnected networks rather than the linear channels of the past. Such networks consist of various interdependent participants, including farmers, cooperatives, input suppliers, processors, wholesalers, retailers, logistics providers, and end consumers, and are connected by two-way flows of information, knowledge, finance, and materials. Resilience, susceptibility to failure, and joint innovation are some emergent qualities of this networked perspective, not found in strictly sequential views [2]. To illustrate the point, an issue with one node (e.g., weather affecting the availability of raw materials) can be felt throughout the entire network, underscoring the need to optimize systems systemically, not individually. Such networks should be governed through governance, coordination, and upgrading. Governance refers to structures and power relationships that determine who makes decisions, sets the rules, and distributes values amongst the actors, and is usually influenced by lead firms, standards bodies, or government regulations. Agri-food governance can take the form of market-based (arm's-length transactions), hierarchical (vertical integration), or relational (long-term partnerships).

The distribution of incentives and the absence of uncertainties inherent in biological production processes

and perishability require coordination through contracts, traceability systems, information-sharing platforms, and joint planning [6]. Upgrading, particularly among producers in developing contexts, can be a process of moving up the value ladder, whether through process improvements (such as improved farming practices), product differentiation (such as organic certification), functional change (such as changes in processing), or inter-chain change. Global value chain (GVC) approaches concentrate on the effects of the lead firms in buyer-led chains on upgrading opportunities and value capture, which, in most cases, inhibit the access of smallholders unless some supporting interventions exist [3]. Agri-food SCM has become increasingly driven by the need to generate sustainability and value as environmental pressures, social pressure, and financial restrictions put pressure on the system.

Sustainable supply chain management (SSCM) integrates the triple bottom line of economic, environmental, and social performance and addresses issues such as resource depletion, greenhouse gas emissions, biodiversity loss, labour exploitation, food waste, and the equitable distribution of value. Life-cycle assessment, eco-efficiency, the principles of the circular economy, ethical sourcing, and collaboration with stakeholders are among the key practices. It has been pointed out in literature that SSCM can be associated with trade-offs (between short-term cost-efficiencies and long-term ecological resiliency) and in the vast majority of cases, requires dynamic capabilities in response to unstable environments, including climate changes or market changes [14,15].

2.2. Supply Chains, Rural Revitalization, and Land-Based Development

Agri-food supply chain management is not limited to efficiency and coordination; it also serves as a strategic tool for revitalizing rural areas and fostering endogenous development. Rural revitalization is an idea that focuses on the regeneration of rural economies, communities, and social fabrics through locally based mechanisms that draw on their own internal strengths rather than external reliance. The focus of endogenous development in place of top-down exogenous development is the use of local resources, knowledge, networks, and institutions to facilitate self-sustaining development. In this situation, especially shorter or alternative supply chains, agri-food supply chains serve as means of revaluing rural territories and even spur local economic cycles [19,20].

Value chains are important for increasing rural incomes and creating jobs. They facilitate value addition at the farm or community level, reduce reliance on remote middlemen, and increase the share of value retained locally by bridging the gap between producers and consumers or middlemen. Face-to-face, spatially close, or extended food supply chains and alternative food networks foster direct sales, farmer cooperatives, regional branding, and territorial products, thereby generating diversified job opportunities, smallholder livelihoods, and multiplier effects on rural economies. These chains tend to prioritize quality, authenticity, and sustainability, enabling rural producers to command higher prices and withstand global market fluctuations [7,20].

The convergence of supply chains and land use, land territories, and place-based development is emphasized by a keen interest in the territorial and spatial aspects. Geographic peculiarities, natural resources (soil, biodiversity, landscapes), cultural heritage, traditional knowledge, and territorial resources are the place-based strategies that can be mobilized in rural areas. Supply chains affect land-use patterns by setting supply chain configurations and land management practices, including sustainable intensification, agroecology, and multifunctional agriculture, which are, in turn, affected by supply chains. Place-based development strategies put forward policies and interventions to resolve spatial disparities in opportunities and challenges, but all within the context of the territory. This territorial strategy emphasizes that value chains may enhance rural-urban relationships, sustain cultural landscapes, and promote equitable land-based development [4,11,23].

2.3. Agri-Food Supply Chains in Ghana

Ghana offers a strong example of studying agri-food supply chain management in a developing economy where agriculture continues to underpin the national economy, rural livelihoods, and territorial development. The sector is marked by smallholder power, a broad range of products, and a high degree of policy attention to value chains, which makes it particularly topical to explore how

the supply chain can rejuvenate rural territories and be inherently connected to the presence of territory and land. Smallholder farmers dominate Ghanaian agriculture and most grow on plots less than 2 ha (often less than 1 ha) and produce most of the significant Ghanaian crops. They are farmers who rely on rain-fed farming, have limited access to inputs, credit, and markets, and contribute significantly to the country's food security and export revenues. The industry is very fragmented but strong in nature and smallholder production prevails in the large commodity blocks [8,9]. The Ghana agri-food environment is marked by a wide variety of commodities. The country is a global leader in cocoa and the second-largest producer, with smallholders contributing nearly all production and a controlled value chain run by a board that has facilitated production growth and increased farmers' incomes.

Cereals (maize, rice, sorghum), roots and tubers (cassava, yam, plantain, typically the largest market share commodity in the domestic market), and horticultural crops (vegetables, fruits, pineapple, mango and other vegetables) are also essential commodities in the domestic and export markets. This combination shows that there are divergent agro-ecological areas, forest-savanna borderlands where cocoa would be cultivated, and northern savanna areas where cereals and roots are grown, with production systems being particularly specific to the territory [13,16]. Ghana has seen policy frameworks geared towards value chain development as an avenue for agricultural transformation, smallholder inclusion, and economic diversification. There has been an effort to match producers and markets, increase coordination of supply chains, add value through processing and quality standards, and involve smallholders in more lucrative sectors.

One such initiative, beginning with the Planting for Food and Jobs (PFJ) program, launched in 2017, is the focus on the supply of inputs, extension services, and market connection of priority crops, and the subsequent steps incorporate the clear value chain principles to increase the involvement of the private sector and inclusivity. These policies are intended to enhance productivity, minimize post-harvest losses, create employment opportunities in rural areas, and address structural issues in supply chains [8,10]. The agri-food supply chains in Ghana, therefore, provide a compelling rationale for study, given that they comprise smallholder-dominated structures, commodity heterogeneity whose value is attached to land and territory, and policy initiatives that aim to utilize these value chains to promote inclusive growth.

2.4. Cocoa Supply Chain in Ghana

The cocoa supply chain is a process that includes farmers, buyers, transportation and trading, collection, certification, quality control, storage, processors and chocolatiers, and distributors (**Figure 1**). While the supply chain includes many private actors, the government maintains a significant presence through the Ghana Cocoa Board (COCOBOD) and its divisions, which regulate the activities of all other industry stakeholders. COCOBOD oversees the entire supply chain in Ghana, from farmers to exports. The early 1990s have seen a move to greater private sector involvement in internal marketing, but COCOBOD still plays a major role in the cocoa supply chain through, inter alia, providing a wide range of support to farmers, including seeds, subsidized fertilizer, and phytosanitary measures, and regulating the marketing of Ghanaian cocoa on international markets. COCOBOD retains a portion of the export price to cover operating expenses and to provide farmer bonuses, educational scholarships, input supply subsidies, research, and road network improvements [24]. COCOBOD's regulation of the supply chain and support for farmers are implemented through its specialized divisions and programmes. The Cocoa Health and Extension Division 4 (CHED) is responsible for controlling cocoa swollen shoot virus disease, rehabilitating old and unproductive cocoa farms, and providing extension services. The Seed Production Unit (SPU) works to multiply and distribute improved cocoa planting materials to farmers. The National Cocoa Diseases and Pest Control (CODAPEC) program assists cocoa farmers in combating cocoa mirids (capsids) and black pod diseases. The Cocoa Research Institute of Ghana (CRIG) undertakes research into challenges relating to the production, processing and utilization of cocoa and other tree species.

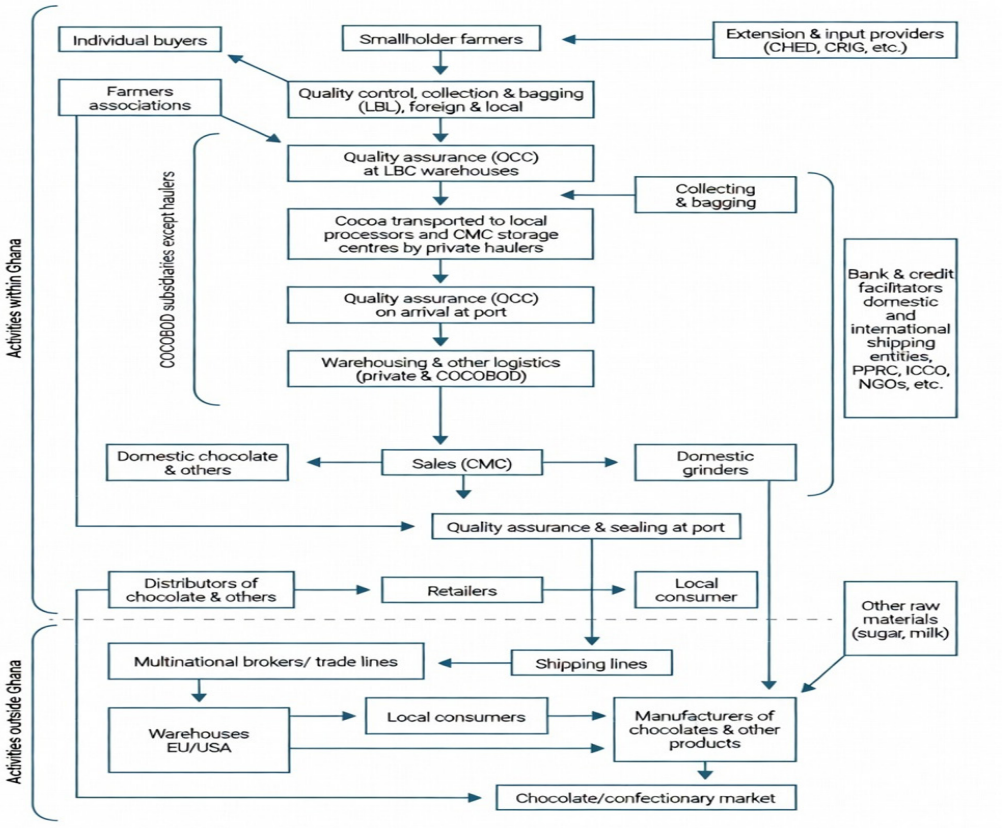

Figure 1. Cocoa Supply Chain in Ghana.
Source: Ghana Commercial Bank (GCB) Cocoa Sector Report (2022).

2.5. Research Gap

The dynamics between agri-food value chains and rural development and land use in Ghana are the subject of an expanding body of literature. The impact of the commercialization of agriculture, market integration, and involvement in the value chain on smallholder farmers' incomes, food security, and rural livelihoods has also been studied [21,22,25]. Other scholarship explores land-use alterations in relation to agricultural growth, urbanization, and infrastructure development. Although these studies offer essential information on the connection between agricultural transformation and rural development, several gaps remain regarding how agri-food supply chains relate to land-use patterns and rural revitalization processes in Ghana. A major gap is the insufficient integration of supply chain analysis into the broader concept of rural revitalization. Current studies on agricultural value chains in Ghana primarily focus on enhancing productivity, market competitiveness, and the inclusion of smallholders in international and regional markets, especially for products such as cocoa, maize, and horticultural products [21,25,26]. Despite the fact that these studies show that when value chains are involved, the farmers will get a higher income and have better access to markets, they seldom relate the process of supply chain upgrading to larger territorial processes related to rural revitalization, such as stabilization of demographics, better rural services and better rural-urban connections [27,28]. Consequently, the contribution of agri-food supply chains to long-term rural transformation remains poorly studied.

The second knowledge gap concerns the study of land-use transformation in relation to changes in the agri-food supply chain. Studies on land-use dynamics in Ghana have revealed that the expansion of commercial agriculture and cash crops can significantly transform land use and the rural landscape. In particular, one can cite the impact of the expansion of tree crops such as cocoa and rubber on land use and on potential consequences for food crops and the local food supply in the community. The loss of

agricultural land in urban and peri-urban areas due to infrastructure development, real estate, and urban growth has been documented in other work [29]. Nevertheless, such land-use transformations are commonly viewed in agrarian or spatial-planning terms, without sufficient connection to the structural processes of a particular agri-food supply chain. As a result, little is known about how changes in supply-chain organization, market demand, and the values of commodity specialization stimulated these land-use transitions.

The third constraint can be linked to the use of rural development models that are not tied to tangible supply-chain arrangements. Rural diversification and local institutional networks in Ghanaian rural areas, as well as development indicators, have been examined through the prism of concepts such as the rural web and sustainable rural development. Similarly, research on periodic markets and local food systems has highlighted the significance of shorter food supply chains for rural livelihoods. However, these strategies seldom relate particular supply-chain models, including global commodity chains, regional value chains or localized short supply chains, to quantifiable land-use results or localized geographical patterns of rural renewal. This lapse prevents the identification of the impacts of various supply-chain arrangements on rural development paths.

3. Materials and Methods

3.1. Research Area

The study was conducted in Ghana, a country whose agricultural production is strongly shaped by distinct agro-ecological zones. These zones influence the types of crops grown, the structure of commodity supply chains, and the nature of market interactions across regions. Ghana is typically divided into several major agro-ecological belts, including the Coastal Savanna, Forest, Transitional, Guinea Savanna, and Sudan Savanna zones. Each zone has unique rainfall patterns, soil characteristics, and vegetation types that make it suitable for specific agricultural commodities. Understanding these ecological variations is essential for analysing how supply chains operate and how they contribute to rural revitalization [29]. The Map of Ghana Showing Agro-Ecological Zones (**Figure 2**) illustrates these spatial patterns, highlighting where each key commodity is produced. This map enhances understanding of the supply chains investigated in this study by illustrating how ecological factors create regional differences in agricultural potential and in supply chain organisation [30,31]. By situating the analysis within these spatial and ecological contexts, the study examines how supply chains contribute to rural livelihoods, employment, land-use decisions, and the broader process of rural revitalization across varied geographic settings. **Figure 2** shows a map of Ghana highlighting the agro-ecological zones relevant to each supply chain.

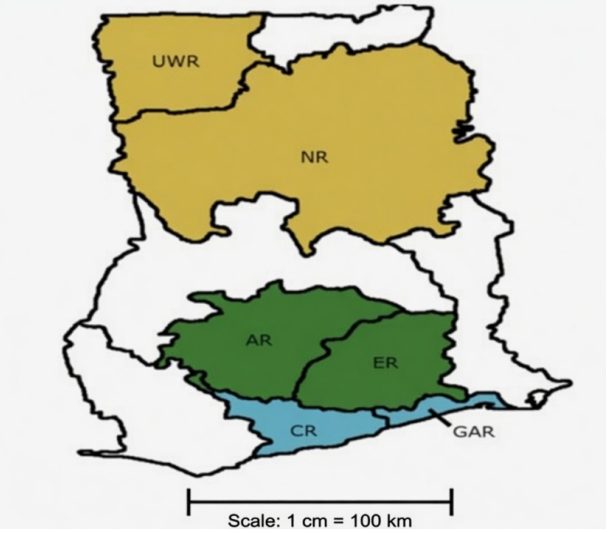

Figure 2. Map of Ghana Showing Agro-Ecological Zones.
Note: UWR = Upper West Region; NR = Northern Region; AR = Ashanti Region; ER = Eastern Region; CR = Central Region; GAR = Greater Accra Region.
Source: Adopted from Osei-Amponsah et al. (2017).

3.2. Research Design

The study used a qualitative case study design to examine the role of agri-food supply chains in enhancing rural revitalization, land use and regional development in Ghana. The case study methodology was particularly well-suited to analyzing complex, context-specific phenomena when the boundaries between the phenomenon and its context are not clearly defined [32]. Ghana is a good place to conduct the study because it has diverse agroecological regions, a high proportion of smallholder farms, and a national policy focused on agricultural commercialization and rural transformation [9,16]. The three major criteria led to the choice of the commodity supply chains (cocoa, maize, rice and roots and tubers). To begin with, these

commodities are part of the most significant agricultural production systems in Ghana, in terms of the land area under cultivation, the number of people employed, and their role in rural livelihoods. Second, the chosen commodities represent various forms of agri-food supply chains, such as export-oriented (cocoa) and domestically oriented staple food supply chains (maize, rice, and roots and tubers). Third, these products are grown in various agro-ecological regions, providing the study with an opportunity to investigate differences in land-use patterns, market integration, and supply chain governance across different regions. Such a choice can thus be used to compare the effects of various supply-chain structures on the outcomes of rural revitalization and regional development. The country of study was chosen because Ghana is an agrarian, rural economy with many active production systems and orientations towards value chain development and rural transformation [8,10]. It focuses on the chosen commodity supply chains that contribute to rural livelihoods and regional development and these include cocoa, maize, rice and roots/tubers. These products are significant land-based production systems within Ghana's ecological zones and provide insights into the role of supply chain structure in land use, market integration, and rural socio-economic performance [13,16]. This approach to the methodology allowed the research to explore the interaction between supply chain structures and supply chain governance mechanisms and rural land utilization and regional development in Ghana [33].

3.3. Data Sources and Sampling Approach

The information employed in the study was collected from various sources to increase triangulation and strengthen the analytical results. Semi-structured interviews with key participants in the agri-food supply chain, including smallholder farmers, traders, processors, transport operators, and government officials, were used as primary data collection methods [34,35]. Semi-structured interviews offered us the flexibility to understand participants' experiences and perceptions whilst maintaining consistency across all interviews [36]. Purposive sampling was employed to select participants, as it is a common qualitative research methodology for identifying individuals with pertinent knowledge and experience [37]. The selection criteria were that the participants must be directly engaged in the production, processing, distribution, or governance of the selected commodity supply chains. Moreover, snowball sampling was used to identify additional respondents through referrals, especially key actors such as traders and processors, who could not be readily obtained from formal records. Overall, 30 respondents were interviewed in the various parts of the supply chain: 15 smallholder farmers who were involved in the production of cocoa, maize, rice and roots and tubers; 6 traders and aggregators who connected the producers to markets; 4 processors who were involved in the value addition; 3 transport operators who were used in the movement of the commodity; and 2 government or institutional body representatives who were This sample is a representation of about 25% of the projected target population of 120 stakeholders and has varied views at different levels of the supply chain.

The research was grounded on a qualitative case study design to understand how agri-food supply chains can be used to revitalize rural areas, land use, and regional development in Ghana. This method is especially applicable to the analysis of context-specific and complex phenomena in which the boundaries between these phenomena and their contexts are not well-defined [37]. Ghana is an appropriate context in that it has a variety of agroecological zones, high rates of smallholder farming, and a policy emphasis on commercialization and rural transformation in agriculture [9,16]. Three criteria were used to select the commodity supply chains which include cocoa, maize, rice, and roots and tubers. To start with, commodities are central to Ghana's agricultural production, particularly for land utilization, jobs, and livelihoods in rural areas. Second, they are export-based (cocoa) as well as domestically based staple food systems (maize, rice, and roots and tubers). Third, they are grown in various agroecological areas, which allows for comparing land-use patterns, market integration, and supply chain governance. There was a methodical thematic analysis of data [36]. First, data familiarization was conducted by repeatedly reading interview transcripts, field notes, and policy documents, and initial observations were documented. Preliminary coding was then conducted using both manual methods and spreadsheet-based categorization, yielding descriptive codes for meaningful segments related to supply chain governance, land use, market behaviour, rural livelihoods, and regional

development. Next, the codes were clustered into broader conceptual themes to uncover recurring patterns through constant comparison across data sources.

The themes were subsequently discussed and narrowed to ensure they were coherent, relevant, and unique. Where needed, themes were combined, divided, or redefined to more effectively represent the underlying data. The ultimate themes were supply chain coordination and governance, rural livelihood improvement, value addition and employment, land use and sustainability, and regional integration and spatial development. These themes were then organized in the last phase into an analytical narrative, which was consistent with the conceptual framework of the study. This made it possible to interpret the effects of supply chain structures on rural revitalization, land use patterns, and regional development. The methodological rigor, transparency, and credibility of the study's findings were ensured through a systematic analytical process.

4. Results

4.1. Supply Chain Structure, Organization and Market Coordination

These findings indicate that the agri-food supply chains in Ghana are highly diverse in their structure and coordination across commodities and regions. The cocoa supply chain is the most institutionalized, with centrally determined prices, uniform quality control, and coordinated input and extension delivery systems. The cocoa farmers in the supply chain always reported regular market availability, a constant source of revenue and less susceptibility to market changes. These conditions enable long-term planning and encourage long-term investment in land management practices such as replanting, soil fertility management, and the integration of shade trees. Conversely, the maize, rice, and roots and tubers supply chains are highly decentralized and market-driven and there is minimal institutional coordination. Such supply chains are reliant on private traders and informal intermediaries and therefore fragmented market structures and poor vertical integration. Farmers with these chains complained of poor access to market information, volatile prices, and high transaction costs, particularly in remote rural areas. The absence of formal contracting arrangements increases uncertainty and reduces farmers' bargaining power. These findings are consistent with the existing literature on staple-crop value chains in Sub-Saharan Africa, which emphasizes the role of coordination failure in constraining smallholder commercialization [8,12].

4.2. Contribution of Supply Chains to Rural Livelihoods and Income Stability

The research concludes that the agricultural food supply chain is the main source of revenue and livelihoods for rural families. The rural communities of all case study commodities and the supply chain in rural areas are mainly agricultural, connecting land-based production systems to local, regional, and national markets. Consistent with the evidence presented in the interview, more organized supply chains will stabilize incomes and reduce the vulnerability of livelihoods, especially in cocoa and rice supply chains [38,39]. The comparatively well-organized chains enhanced farmers' access to inputs, extension services, and output markets, leading to increased productivity and returns to land. Part of the gains enabled households to invest in other sources of livelihoods like petty trading or livestock keeping to augment their sources of income. These findings reinforce the other studies that have found value chain engagement to be a channel of enhancing livelihoods in rural areas and promoting inclusive development [40,41]. But the results also highlight thorny livelihood challenges for food-crop farmers, particularly those producing maize, roots, and tubers. Income generation is still hampered by limited access to credit, lack of adequate storage facilities, and post-harvest losses. The situation was common: farmers would sell the produce as soon as it was harvested to generate instant cash, and in most cases, the price was unfavorable. These constraints reduce supply chains' capacity to deliver sustained improvements in livelihoods and reinforce cycles of rural poverty, consistent with earlier empirical evidence from Ghana and comparable contexts [41,42].

4.3. Employment Creation and Rural Economic Diversification

Even after including the effects of agri-food supply chains on household incomes, the results indicate that agri-food supply chains create a high level of employment op-

portunities in rural economies. Jobs are created not just at the farm scale but also along the upstream and downstream supply chain, including aggregation, transportation, processing, storage, and trade. Smaller agro-processing firms, including cassava processing plants and community-based rice mills, were found to be particularly significant in providing jobs for women and young people [43]. Even with this possibility in mind, the research concludes that supply chain integration creates structural limitations on employment. Poor processing facilities in most rural areas compel agricultural products to be taken to cities for processing into value. This leads to low domestic employment and high-value outflows from rural economies. The lack of a dependable electricity supply, finance, and up-to-date processing equipment was evident as a key issue hampering the growth of agro-industries in rural areas [44]. These results align with the literature on rural development, which states that localized value addition is crucial to maximizing employment multipliers and encouraging economic diversification in rural regions [45].

4.4. Supply Chains, Land Use Decisions, and Environmental Sustainability

The discussion indicates a strong interaction between supply chain dynamics and land-use practices among smallholder farmers. Farmers are more motivated to adopt improved land management practices when supply chains use quality standards, certification schemes, or sustainability requirements. Market-based incentives for land stewardship among cocoa farmers were also reflected in increased awareness of long-term soil fertility, shade management, and responsible agrochemical use, driven by farmers' participation in sustainability programs [45,46]. Conversely, farmers who are currently involved in less-synchronized food-crop supply chains face intense short-term income pressure, which, in most cases, pushes them towards unsustainable land-use practices [47]. These include non-fallow farming, inefficient replenishment of soil nutrients and exploitation of marginal lands. According to farmers, the low and fluctuating prices are not a good incentive to invest in soil improvement and conservation, which undermines the long-term land productivity. The findings are consistent with the general literature indicating that agrarian economies are based on market structures and incentive systems that determine land-use outcomes [47,48].

4.5. Regional Integration, Infrastructure, and Spatial Development Outcomes

The findings also highlight the significance of agri-food supply chains in characterizing the region's development and spatial integration. Excess production of farm products in rural areas is moved to urban and peri-urban markets, enhancing economic links between rural and urban areas and national food security. Improved supply chain efficiency and reduced losses during harvesting were facilitated by better road networks, market infrastructure, and logistics services [49]. Nevertheless, regional inequalities are still high. Northern regions have inferior infrastructure, are farther from major markets, and incur higher transportation costs, thereby limiting their access to national supply chains. These spatial constraints limit the realization of markets and reduce the role of agriculture in the balanced development of regions. These results are consistent with the literature on spatial development and regional economics, which asserts that infrastructure and connectivity become central determinants of territorial cohesion and regional growth [47]. Collectively, the findings position agri-food supply chains as spatial structures that can bridge land-based rural production to wider regional and national development.

5. Discussion

The paper has discussed the role of agri-food supply chains in Ghana, in this case cocoa, maize, rice, and roots and tubers, in revitalizing rural areas, land-use choices, and area development. The results not only support the previous literature on agricultural value chains in developing economies but also offer some context-relevant information on how governance structures, institutional arrangements, and geographic environment influence the nature of development. Overall, the paper provides evidence that supply chain organization and coordination strongly affect the stability of income, land management, employment, and territorial integration [50,51].

One key result is that better-governed supply chains, such as the cocoa industry, deliver more predictable and equitable development outcomes than the more fragment-

ed maize, rice, and roots-and-tubers chains. This aligns with previous research findings that show that organized governance minimizes transaction costs, improves quality assurance, and increases farmers' bargaining power [51–53]. COCOBOD influences price determination, extension regulations, and quality control, aligning with global value chain scholarship highlighting how powerful institutional players significantly shape upgrading opportunities and value allocation [54]. On the contrary, farmers in staple food chains face low coordination, limited market information, and high price volatility, consistent with reports by some researchers that inefficiencies in the informal agricultural market in Sub-Saharan Africa [42,51].

The study also establishes that supply chains are vital to enhancing the livelihoods of rural people. Involvement in value chains helps diversify incomes, enhance productivity, and build resilience, which is why [48,51] are mentioned. In this study, cocoa and rice farmers reported increased income stability through greater access to inputs, extension services, and organized, reliable markets, consistent with observations that coordinated chains mitigate vulnerability and enable long-term planning [54]. Nevertheless, for maize and root and tuber crops, overarching factors such as limited access to credit, poor storage facilities, and post-harvest losses make it difficult to achieve stable income. The results are consistent with previous evidence that impediments to development, in the form of infrastructural and institutional limitations, dilute the developmental prospects of staple crop chains [51].

Another significant input of supply chains was employment creation. The research studies established that the farm not only creates employment but also supports aggregation, transportation, processing, and retailing. This is consistent with past studies that demonstrate the potential of agricultural value chains to promote non-farm rural labor and broaden economic opportunities, especially for women and youth [54]. The lack of rural processing capacity inhibits value addition and reduces employment multipliers [50]. This has prevented rural areas from industrializing and slowed territorial growth, as the bulk of raw produce is sent to urban processing facilities. The results also show that the supply chains have a great impact on land-use decision-making. More coordinated chains, such as cocoa, certification schemes, environmental standards, and quality requirements, promote sustainable land management practices [55]. The trend aligns with findings that market incentives may encourage soil fertility management, the adoption of agroforestry, and the responsible use of agrochemicals [51]. Conversely, manufacturers in weakly integrated staple crop chains are also prone to short-term income constraints that deter investment in soil conditioning or climate-smart production. This compares with findings from Gorgan and Hartvigsen [42], who suggest that market instability increases the likelihood of smallholders adopting unsustainable land-use practices.

The other key drivers of value chain performance and regional development were also spatial connectivity and regional infrastructure. Effective supply chains enhance rural-urban interconnections by facilitating the transport of produce from surplus regions to high-consumption areas. Nevertheless, unequal access to roads, storage, and markets has hindered farmers' access across the northern regions and the country's interiors. These results align with the general literature on regional development, which highlights that infrastructure and spatial integration are key to territorial cohesion and balanced growth [48].

6. Conclusions

This paper aimed to analyze the role of agri-food supply chains in rural revitalization, land use and regional development within the Ghanaian context, based on the qualitative case study method of major commodity supply chains vested in cocoa, maize, rice and roots and tubers. The study offers a subtle insight into how agri-food systems contribute to rural development outcomes in an agrarian economy by situating supply chains within their socio-economic, institutional, and spatial relations. The results indicate that the agri-food supply chains in Ghana are the key processes through which land-based resources are converted into economic and social value. Well-coordinated supply chains, especially those that were well-governed and institutionalised, were observed to increase access to markets, enhance income stability, and strengthen the resilience of rural livelihoods. Conversely, loosely structured, market-driven supply chains were associated with price fluctuations, low bargaining power among smallholders, and a lack of motivation to engage in sustainable land

management. These disparities highlight the role of governance and coordination in shaping supply chain performance and development outcomes.

The paper also concludes that agri-food supply chains are vital for the provision of rural jobs and economic diversification. In addition to the main production, other supply chain activities, such as aggregation, transportation, processing, and trading, create off-farm jobs, especially for women and young people. Nevertheless, value addition in the rural environment is inhibited by the lack of local processing facilities, and thus, the raw agricultural products are exported to towns, and the multiplier impact on the rural economies is lost. With regard to land use, supply chain incentives play an important role in shaping farmers' land management. In systems where suppliers are incentivized by changes in supply chains to achieve quality, sustainability, or adherence to standards, farmers will be motivated to adopt better land-use practices that increase long-term productivity and environmental stewardship. On the other hand, short-term supply chains, which prioritize price competition, tend to promote unsustainable land-use practices such as extensification and continuous cropping, jeopardizing ecological sustainability and future living conditions.

At the regional level, the results emphasize the role of forged agri-food supply chains in intensifying rural-urban interconnections and promoting regional incorporation. Effective supply chains facilitate the transportation of agricultural produce from surplus rural areas to urban markets, thereby supporting food security and economic integration within the region. Nevertheless, the contribution of agriculture to the balanced development of regions, especially in the northern and remote areas of Ghana, has been hindered by persistent inequality in infrastructure and access to markets, especially for farmers. Overall, this paper has shown that agri-food supply chains are not logistical systems but are important institutional and spatial structures that intersect land use, rural livelihoods and the regional development. Enhancing supply chain integration, an investment in rural infrastructure and value addition and integrating sustainability concerns into value chain governance are key to ensuring that agri-food systems contribute to their fullest potential to rural revitalization in Ghana. The knowledge created in this research paper can be added to the overall body of information on supply chain management and rural development, and achieves evidence-based policy and practice towards a vision of inclusive, sustainable, and territory-based agricultural change.

Author Contributions

Conceptualization, H.O.-Y. and M.O.; methodology, H.O.-Y.; validation, M.O., D.A., and E.D.N.; formal analysis, H.O.-Y.; investigation, H.O.-Y.; resources, J.E.; data curation, H.O.-Y.; writing—original draft preparation, H.O.-Y.; writing—review and editing, M.O. The publishable version of the manuscript has been read and accepted by all the authors.

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Institutional Review Board Statement

This research did not require ethical review or approval because it consisted of interviews with adult participants on non-sensitive, work-related subjects, and posed no danger to the respondents. The research complied with the host organization's ethical standards.

Informed Consent Statement

Not applicable.

Data Availability Statement

The information that led to the conclusions of this research can be obtained by the relevant author when requested reasonably. The transcripts of the interviews and field notes could not be made accessible due to confidentiality concerns. Ministry of Food and Agriculture, FAO, NDPC and Ghana Statistical Service contain policy documents, secondary datasets and reports.

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Conflicts of Interest

The authors do not claim any conflict of interest. The funders did not participate in the design of the study, the collection, analysis or interpretation of data, writing of the manuscript or in the selection of publication of the results.

AI Use Statement

During the preparation of this work, the authors used DeepSeek to improve the clarity and coherence of certain sections of the manuscript. The authors subsequently reviewed and edited the content as necessary and take full responsibility for the final content of the published article.

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