

Review

Agricultural Production Networks and Upgrading from a Global–Local Perspective: A Review

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Abstract: The COVID-19 pandemic, extreme temperatures and the Russia–Ukraine conflict have exposed deficiencies in global agricultural production capacity and governance systems, which left low-income countries and regions to face more severe food insecurity. Thus, there is an urgent need for agricultural upgrading and the establishment of a more sustainable agricultural system. Although there is a large body of literature with rich theoretical and empirical case studies, there is still a lack of systematic analysis of these studies, and the summary of global agricultural production networks and the agricultural upgrading process is not sufficient. This article will first set up an organisational framework of global agricultural production networks and explore the implications of governance and agricultural upgrading within this framework. It will then summarise the local agricultural upgrading processes on global, national and local scales based on a review of the existing literature. The article argues that agricultural upgrading in the context of global linkages is mainly driven by private-sector standards while the state also plays multiple roles. Moreover, in the embedding process of global agricultural production networks into local areas, local actors can promote agricultural upgrading through capacity building and organisational innovation. This review has implications for the economic, social and environmental sustainability of agriculture in developing countries, and provides a reference for future research.



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1. Introduction

Food is the foundation of human existence, and ensuring food security is an important goal of the UN 2030 SDGs [1,2]. The progress of modern science and globalisation promotes the supply of agricultural products. However, this entails environmental problems and food security risks [3,4].

The COVID-19 pandemic broke out worldwide in the spring of 2020 and is still prevalent. Government-imposed social distancing policies have impacted seasonal labour supplies to harvest crops [5]. Moreover, there is reasonably solid evidence that food affordability has been severely impacted by declines in purchasing power of most households in low- and middle-income countries [6]. Since 2022, the world's major grain-producing regions such as China, India and Africa have been experiencing extreme temperatures and periods of drought. The annual harvest is also expected to hit a record low [7]. The adverse effects of climate change have become increasingly apparent. The conflict between Russia and Ukraine has worsened the global food security situation. Both countries are considered 'global breadbaskets', supplying 34.1% of wheat, 26.8% of barley, 17.4% of corn and 72.7% of sunflower oil in global trade [8]. The war has directly affected Ukraine's spring planting and grain exports this year [9], while Russia's supply of grain and fertiliser has also been limited [10]. Since the beginning of the war, many countries have imposed export restrictions to ensure local food supplies and ease inflation [11], further exacerbating the global

food panic. The global food price index reached 159.3 in March 2022, which is a significant increase to its highest level since the index was established in 1990 [12]. The price indices of various agricultural products such as grains, vegetable oils, meat and dairy products have increased significantly. Nearly 250 million people are on the brink of starvation [13]. A series of crises has exposed potential rigidities, vulnerabilities and inefficiencies in the global food system, as well as deficiencies in the global agricultural production capacity and governance systems. Therefore, there is an urgent need to build more resilient and sustainable global agricultural systems to manage complex and increasing internal and external risks and to safeguard global food security.

In addition to food security, the sustainability of agriculture is reflected in multiple dimensions, such as environmental well-being and farmers' income. Regarding the environment, agriculture is the most closely related to the natural environment. Inappropriate agricultural production methods may lead to climate change, ecosystem degradation and biodiversity loss among other environmental problems [14]. From a socioeconomic perspective, agriculture is one of the most important activities in rural areas and may even be the only source of livelihood for hundreds of millions of smallholders. In recent years, agricultural inputs, especially pesticides and synthetic fertilisers, have increased steadily; however, farm prices for most agricultural products have been falling. This has put farmers, especially in developing countries, in a severe price squeeze that undermines their livelihoods and the profitability of their agricultural businesses [15]. In recent years, the agricultural sector has undergone remarkable changes, highlighted by increasing globalisation and the emergence of complex network structures and commodity flows. Global agricultural production requires significant capital investment. Many multinational food producers, retailers and agricultural technology giants have emerged. These multinational companies have great power and can create and coordinate 'complex and dynamic economic networks made up of inter-firm and intra-firm relationship(s)' [16]—known as 'global production network'. This new paradigm of spatial organisation of agricultural production leads to the global migration of agriculture, influences the formulation of national and regional agriculture-related policies, and determines the economic and social development of regions (especially developing countries). Simultaneously, the risks associated with agriculture and agricultural products spread globally through agricultural practices, transportation, processing and the consumption of agricultural products. These changes impose new challenges, including the management of global agricultural production networks from a global perspective and the improvement of sustainability of agricultural production and the supply of agricultural products.

In contrast to other industries, such as manufacturing and services, a large body of theoretical and empirical research addresses various issues related to multinational corporations (MNCs). However, research on global production networks in agriculture is still limited. Many studies examine foreign direct investment (FDI), outsourcing and non-equity production patterns of agricultural MNCs in developing countries [17,18], with emphasis on the motivations behind these investments [19] and the benefits they bring [20,21]. However, as Buckley and Strange [22] argue, there is a need for further research to understand global factory governance. In the early 1990s, Gereffi and other economists propose the theoretical framework of the global commodity chain (GCC), which was later optimised into the theory of the global value chain (GVC) [16] and became a tool to guide the practice of industrial development in later developing countries. Economic geographers break through the firm-centred limitations of GVC and emphasise the relationship networks within, between and outside the firm, as well as the organisational and geographical structure of these networks [23,24]. They further propose the analysis framework of GPN 1.0 and GPN 2.0 successively. The global agricultural production network is an important channel for agricultural development and knowledge acquisition, especially for developing countries. It helps promote value-added activities to 'move up the value chain' [25]—referred to as 'upgrading' in the GVC/GPN literature. Following increasing concern about the adverse effects of globalisation on developing countries, the concept of upgrading has been

extended to social and environmental dimensions [26], namely social and environmental upgrading. Agricultural research no longer simply emphasises ‘productive forces’, but seeks unity between economic production, the ecological environment and social equity. However, it is difficult to achieve a comprehensive upgrading goal for agriculture. It is necessary to strike a balance between the interests of various actors and shape a more perfect governance mechanism.

This study addresses these challenges by systematically reviewing the literature on global agricultural production networks and their upgrading processes. These studies are mainly based on the GVC and GPN research frameworks. Such efforts are particularly important, given that existing research on upgrading focuses mainly on manufacturing [27]. This paper proceeds as follows. Section 2 conceptualises the global agricultural production network, distilling the characteristics of the agricultural industry under current globalisation, the organisational structure of the network and its global impact. Section 3 discusses the governance of global production networks under the framework of GVC and GPN and explores the rich connotation of current local agricultural upgrading based on this. Section 4 summarises the local agricultural upgrading process on global, national and local scales based on a review of the existing literature. The conclusion provides a summary and prospects for future research directions.

2. Global Agricultural Production Network

Over the past three decades, agricultural/agri-food systems have undergone a clear process of globalisation, transforming from a loosely coordinated local relationship between producers and consumers to a globalised network of formally regulated trade, which links socially and spatially distant sites of production and consumption [28]. Although agricultural production in many countries is still dominated by a ‘small-peasant economy’, the forces of globalisation are making agriculture more similar to manufacturing in one key respect: although production is fragmented and spatially dispersed, it is integrated and coordinated by a handful of agri-food transnationals [29].

Following the continuous progress in international logistics and information technology, the degree of market integration has significantly improved. Apparently, the home markets of agribusinesses in developed countries can no longer meet their demand for profits; therefore, they are actively investing abroad and competing for resources and markets globally to generate higher yields and profits [30]. The production and consumption of agriculture are controlled by agritech giants (e.g., Bayer, Leverkusen, Germany; Syngenta, Basel, Germany), diversified food producers (e.g., Nestle, Vevey, Switzerland; Pepsi, New York, NY, USA) and large retailers (e.g., Walmart, Bentonville, AR, USA; Sam, Bentonville, AR, USA). As shown in Figure 1. These agricultural MNCs span different production sectors and fully integrate all links from seeds, fertilisers and pesticides to non-staple food processing and marketing, ultimately manipulating the entire agricultural industry chain [31,32]. Through this global-local connection and interaction, agricultural MNCs gradually build a global agricultural production network for the production, processing, circulation and consumption of agricultural products in various countries. According to other literature, the definition of the global agricultural production network can be understood as a global organisational arrangement, including agricultural MNCs to coordinate related economic and non-economic participants (such as the national government, companies, civil society organisations, farmers and consumers), and in more than one location for global market production and agricultural products [33,34]. It exists within the ‘transnational space’, which is constituted and structured by transnational elites, institutions and ideologies [35].

The global agricultural production network profoundly changes the international division of agricultural labour and trade patterns. However, agricultural MNCs’ global strategies are closely linked to their national strategies. Faced with the complex situation of international agricultural competition and trade protectionism, agricultural MNCs have dual effects on the agricultural and regional development of host countries. On the one hand, agricultural MNCs have connected smallholders in the south and retailers in the

north. Through global agricultural production networks, retailers in North America and Europe have access to year-round supplies of fresh vegetables and fruits, while farmers and exporters in Asia, Africa and Latin America have access to agricultural development capital, technology and management expertise, as well as greater market space, from globalised agriculture. These have become catalysts for upgrading the agricultural export sectors in developing countries [36,37]. On the other hand, some agricultural MNCs may negatively affect the fairness of international agricultural trade through unfair competition [38] or cause the host country to lose the ability of independent agricultural development through monopolistic operations [39,40], even squeezing national sovereignty through market restructuring. If these negative effects are not prevented, they may significantly affect and challenge the economy and society of the host country.

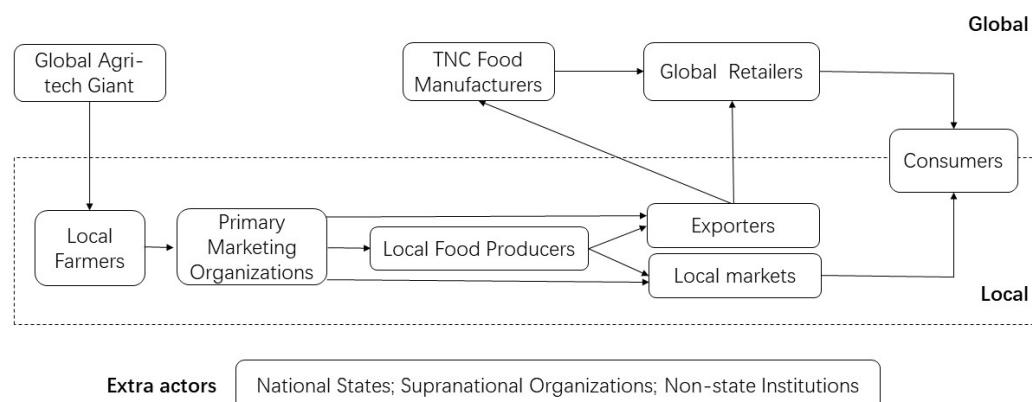


Figure 1. Global agricultural production networks.

3. Governance of Global Agricultural Production Networks and Agricultural Upgrading

The core of the global agricultural production network is the nexus of interconnected functions, operations and transactions [24]. The interconnected nodes and links in the network form complex interdependent relations in space, giving rise to network governance and power relations problems.

The GCC and GVC literature examines lead firms and how they organise their supply chains on a global scale in terms of the linear/vertical dimensions of production networks. Initially distinguishing between producer-driven and buyer-driven commodity chains [41], much attention was paid to international agricultural sourcing networks established by global retailers and brand marketers. Gereffi et al. then examined more complex and dynamic production networks, proposing a 5-fold typology of governance relationships: market, modular, relational, captive and hierarchy [42,43]. The analysis of the supply chain of fresh fruits and vegetables shows that it is changing from market coordination to more complex coordination. This governance framework succinctly explains the power relationship between lead firms and suppliers and shows how global leaders exercise power to influence the distribution of profits and risks in the industry and how this changes the industrial outlook for corporate upgrading [44]. However, each link in global production networks is embedded in broader nonlinear/horizontal relationships, with infinitely complex power asymmetries, contingent and variable over time [45].

On this basis, the GPN framework incorporates multidimensionality into the analysis, attempting to capture the complex network relationships within, between, and outside firms that underpin the global production system, and how these network relationships arise and are embedded in different institutional contexts [46,47]. The original formulation of the GPN framework (GPN1.0) focused on spatial relationality and the way economic production was embedded territorially, societally and within networks [48]. In 2015, Yeung and Coe proposed the GPN 2.0 framework and argued that the competitive dynamics and overall risk environment of production networks are the drivers of the uneven outcomes of the global economy, with development as the ‘ultimate dependent variable’ [34,49].

The GPN 2.0 framework asserts that regional development trajectories are defined by the arrangements in which regional assets are incorporated into (extra-territorial) GPNs via processes of strategic coupling with lead firms [47,50]. The processes of strategic coupling are intentional and active, and require the intervention of region-specific institutions and lead firms.

In the analysis of global production networks, the concept of upgrading usually refers to the strategy adopted by countries, regions, enterprises and other stakeholders to maintain or improve their positions in the global economy [42]. This aspect of research mainly occurs along the linear upgrade trajectory proposed by Humphrey and Schmitz [46]. In other words, the company can adopt more efficient processes of production (process upgrading), a change in the type of product (product upgrading), a change in the mix of activities performed by a firm (functional upgrading) or a move to a more technologically advanced chain (chain upgrading) [46]. This theory has important guiding significance for upstream smallholders who are in a weak position in global agricultural production networks. They are often considered victims or beneficiaries of the negotiation process between leading companies, governments, NGOs, and civil society organisations [50], playing a passive role in an agricultural production structure, that is, rife with power asymmetry and dependency. Guided by this upgrade path, local smallholders can achieve higher value capture by upgrading their assets and capabilities. Following increasing concerns about the adverse effects of globalisation on developing economies and the sustainability of production, the concept of upgrading has been extended to cover both social and environmental aspects [26]. Social upgrading is defined as ‘the improvements in labour and living conditions and overall social well-being of workers and actors’ [51,52]. The concept is broader than corporate social responsibility (CSR) [53] and focuses not only on global companies’ efforts to improve local labour conditions but also on other non-corporate initiatives initiated by NGOs and governments [54]. The current literature on upgrading, which ‘focuses on developing higher efficiencies at the expense of meeting environmental standards’ [55] is too narrow compared to the actual concept of environmental upgrading, which emphasises that ‘economic actors move towards a production system that avoids or reduces environmental damage from their products, processes, or managerial systems’ [56]. In summary, agricultural upgrading under global production networks is the outcome of regional development, including regional economic, social and environmental development, resulting from strategic coupling. Regional development is an evolutionary process with periods of coupling, decoupling and re-coupling [57]. Similarly, agricultural upgrading is an irregular process, where the potential for learning and growth in regions is not always realised. Upgrades often go hand-in-hand with downgrades. Moreover, there are trade-offs between economic, social and environmental upgrades.

4. Discussion

In the context of economic globalisation, the world is integrated and interactive. Industrial upgrading is no longer a local practice of that of one country but connects different countries through global production networks to jointly promote industrial upgrading. Therefore, local agricultural upgrading under the global production network is influenced by the three forces of global, national and local organisations. Moreover, the existing research is also conducted based on these three aspects, as shown in Table 1.

Table 1. Agricultural upgrading process from a global-local perspective.

Scale	Main Actors	Characteristics	Practices
Global	Lead firm, international organisations, et al.	Upgrading strategies driven by private standards	Procurement requirements, certification, et al.
National	National state	Multiple roles	Facilitator, regulator, producer and buyer
Local	Local governments, farmer cooperatives, local intermediaries, et al.	Capacity building and organisational innovation	civil society movements, MSIs, et al.

4.1. Global Connectivity: Upgrading Strategies Driven by Private Standards

In agriculture, private standards play an important role in the governance of global production networks and industrial upgrading, particularly for primary commodities in developing countries [58]. Private standards are defined as voluntary standards, certifications and measures established by NGOs or large companies to regulate the quality of products to further meet their own quality requirements [59,60]. Most private standards claim to support sustainable production and reduce the negative environmental and social effects of the global food trade by involving producers and consumers in governing supply chains [61,62].

Similar to other labour-intensive industries, agriculture is often characterised by buyer-driven monopoly governance [63]. Lead firms in global agricultural production networks, typically food manufacturers and global retailers, maintain a high degree of influence over farmers and other actors by creating strict private standards that specify when, where and how the items they sell are produced. Although this practice is primarily aimed at improving the economic performance of the company, it may also involve social and environmental dimensions, such as product quality and safety standards, environmental protection and labour protection standards [54]. Lead firms often implement the internal governance of standards through intra-firm coordination, inter-firm control and inter-firm partnership strategies [50]. Based on this ‘relational regulation’ [64], the economic, social and environmental upgrading of agriculture was promoted. There are case studies that describe how global retailers are modernising their purchasing systems through stringent quality/safety control standards to optimise their local supply chains [65,66]. In addition to guiding supplier upgrades through procurement requirements, lead firms can embed knowledge of food safety standards directly in farmer groups [67], establish new connections with certified farmer groups [68], and innovate governance systems for standards in agricultural cooperatives [69,70]. While optimising production, lead firms also face corporate social responsibility and consumer pressure with social and environmental expectations, forcing companies to establish internal sustainability programmes. Gibson examined a resource-sensitive acoustic guitar GPN [71]. In response to raw material scarcity and regulatory risks, manufacturing companies have turned to renewable wood, small-batch production and limited-edition customisation to meet musicians’ desire to demonstrate green citizenship. It is important to note that agricultural companies that set standards may not reap the expected benefits, especially in terms of social and environmental upgrades. Many consumers do not strongly care about labour and environmental issues [72,73].

However, there is a gap between the goals and effects of private standards. Enterprise standards bring upgrading opportunities such as improving the income of certified farmers [74], enhancing organisational capabilities [75] and improving environmental quality [76]. In fact, lead firms may exploit asymmetric information and power to abuse their dominant market position, resulting in highly unbalanced and unfair development in producing countries and regions [77]. This also means a decline in the social well-being of a large portion of the population there [78]. In this context, external actors in the GPN, such as international organisations, industry sectors, farmers’ organisations and labour unions,

increasingly influence the content and implementation of standards and conduct extra-firm bargaining with lead firms [50]. Thus, international and sector-specific standards are established to guide and supervise the upgrading of local agriculture. Ouma analysed the effect of private collective standards on the supply chain organisation of fresh vegetables in the Kenyan horticulture industry from the perspective of global GAP standards [79]. He stressed that upgrades can be achieved through this market-based self-regulation model. Ruysschaert et al. [80] and Oosterveer et al. [61] demonstrated the positive effect of the roundtable on sustainable palm oil (RSPO) production. Piao et al. found that voluntary sustainability standards (VSSs) have induced farmers to improve the coffee production process as well as to control management activities within the production unit [81]. However, there are still many smallholders excluded from lucrative markets based on alleged ‘compliance’ requirements owing to differences in the expectations of various actors regarding sustainability standards. Only by matching standards with capacity building of smallholders can the livelihood aspirations of all participants be improved [60].

4.2. National Power: Multiple Roles in Upgrading

Many countries have implemented state-led development strategies in their rural and agricultural sectors [82]. Earlier studies stated that the government plays a passive role, with national policies limited to providing an appealing business environment for MNCs and local suppliers seeking to integrate into the GPN [83]. However, in recent studies, the state, as a key participant in the GPN, plays multiple roles in industrial upgrading. Moreover, all the elements in the GPN are regulated in the political structure with the nation-state as the basic unit [84,85]. The state is not only a part of the background institutional environment, but also acts as an active ‘inter-scalar mediator’ to exercise governance within the global production network and create the local assets needed for strategic coupling [86–88].

The coffee industry occupies a strategic position in many developing countries and has gone through three stages of governance, from colonial times to liberalisation and reintegration [89]. Therefore, this industry is most often selected for analysing the dynamic evolution of power in the coffee GPN over 40 years, Grabs and Ponte found that power inequality between northern buyers and southern producers still exists. However, governments can mitigate this inequality in bargaining power by stepping up unilateral and multilateral efforts to support small-scale producers [89]. Additionally, agriculture is riddled with certification systems related to health, product quality and environmental and labour standards. Moreover, the coordination required to maintain these processes is far beyond the capabilities of most companies in developing countries [90]. In this sense, state support is crucial, as it can play an active role in price control, environmental and cultural protection and the promotion of agricultural modernisation [91]. On the contrary, if the state fails to provide sufficient policy, legislation and capacity-building support, it will not be able to achieve effective industrial upgrading and may even yield negative results [92,93].

Recent work has attempted to generalise the role of the state and governance model in the GPN [94,95]. Horner concluded that the state has four roles, including as facilitator, regulator, producer and buyer [96]. Behuria combined these functions with a political settlement framework, showing the state’s efforts to shape the path of coffee upgrading in Rwanda [97]. On the one hand, the Rwandan government closely directs the product and process upgrading (facilitators) for farmers and cooperatives by establishing coffee washing stations for farmers to help them create differentiated value chains. On the other hand, the state participates in the design and implementation of labour and environmental standards, and mandates that coffee growers and processors comply with various international and domestic certification schemes (regulators) to ensure that their producers have access to professional markets. Additionally, the state has invested in coffee roasters, processing plants and retail outlets (producers) to support functional upgrades. Few studies have examined the role of the state as a purchaser in the GPNs. However, the state can support local agricultural upgrading through public procurement, which can play a key role in

enhancing the competitiveness of local farms, especially when they have not yet met the standards required to supply products for foreign markets [98].

The importance of public-private governance has been increasingly recognised after the emergence of various hybrid governance arrangements involving national, transnational and non-governmental organisations (e.g., standards schemes and multi-stakeholder initiatives). States need to shape and influence global production and governance outcomes through national policies and engagement with state, private and civil society actors across scales, considering both regime interests and the appeals of various actors [99–101]. Other studies emphasise the need to further reveal the non-economic functions of the state, such as strategically selecting, mediating and coordinating local capabilities, financial resources and societal objectives [102]. This requires additional capacity building by the state to consciously link economic upgrades to social and environmental development goals [103]. Alford and Phillips provided a useful complement to the study of fruit GPN in South Africa. He proposes the distributional function of the state, which can use tax and regional development policies to mitigate social and spatial inequalities resulting from participating in GPNs [104].

4.3. Local Embedding: Capacity Building and Organisational Innovation

Agricultural enterprises in agricultural GPN are easily affected by the natural environment, resulting in production instability. Therefore, they rely more on embedded local networks to obtain external resources and information to spread risks. Local governments, farmer cooperatives, civil society organisations (unions and NGOs) and local intermediaries play an increasingly important role in influencing procurement by leading firms and shaping regulatory outcomes at local production sites [99].

As mentioned above, MNCs set a range of standards for production. However, they are not always willing to transfer technology in favour of local agricultural upgrading, hence requiring local actors to take on greater responsibility for upgrading. Franz et al. noted that the development of agricultural clusters is closely related to the 'historical process of embedding' local participants [105]. This process is referred to as 'territorial embeddedness' and 'societal embeddedness' [45] in the GPN literature. Following the increasing influence of social, economic and technological factors, the influence of natural conditions such as climate, land and rain is weakening. The role of local embeddedness is becoming increasingly important, and it continues to shape agricultural enterprises. Hughes et al. demonstrated that social and territorial embeddedness play a key role in shaping the ethical trading strategies of lead firms, such as civil society movements, media and consumer campaigns that have forced UK and US retailers to be more socially responsible [106,107]. To be embedded in the GPN and local governance arrangements, local service providers and intermediaries must increasingly take on the role of improving vertical and horizontal coordination [108,109]. These include acting as an intermediary for knowledge transfer [110], helping local actors optimise the institutional environment [109] and facilitating smallholders to adopt new organisations and participate in technological innovation [111].

Some practices revolve around the goal of collaboration, transparency and inclusion, with local stakeholders forming coalitions of organisations or launching joint initiatives. These organisational innovations are often conducive to engaging marginalised smallholders in the GPN while having a strong impact on agricultural upgrading. Multi-stakeholder initiatives (MSIs) consist of stakeholders who wish to jointly address social and/or environmental issues in the production process. Members work together to develop cooperative goals and codes of conduct [112,113] and are subsequently implemented and tested across the GPN. MSIs incorporate civic expectations regarding participation and equality [72]. Its cross-sectoral objectives align with many SDGs' objectives, such as poverty alleviation, environmental impact reduction and food security [114], and are therefore considered best practices for local support for sustainable development [115]. Other organisational innovations include coffee producer associations in Mexico, which integrate the features

of traditional indigenous community governance and modern capitalist corporations. It adopts creative ways to reduce women's labour burden and time poverty, which can promote comprehensive organisational participation [116]. KUBE, an Indonesian farmer's organisation, reinforces its bargaining power by integrating existing micro-enterprises into larger ones. Additionally, it has always maintained contact with individual farmers through farmer groups, thereby improving farmers' welfare. Compared to highly structured GPNs controlled by MNCs, these organisations creatively consider the needs of their members and are therefore more likely to develop 'inclusive governance' of smallholders [117].

5. Conclusions

Following the growth of globalisation, agricultural production and consumption have undergone major changes. The SDGs require a more comprehensive economic, social and environmental upgrade of agriculture. The global agricultural production network connects smallholders in the south to the markets in the north. Promoting the export of the agricultural sector in the south may result in the plundering of resources and production exploitation in the region. Therefore, it is necessary to further clarify the process of local agricultural upgrading and to establish a better regulatory and governance system. Accordingly, we conduct a systematic review of the literature on the governance of global agricultural production networks and local agricultural upgrading processes. The results show that local agricultural upgrading is influenced by global, national and local forces. Therefore, it is important not only to discuss the private standards established by MNCs and international organisations in the context of global linkages but also to examine the multiple roles of national actors. Moreover, more attention should be paid to regional and social embeddedness, including the collective building capacity of local actors and organisational innovation.

MNCs guide the sustainable production of smallholders through strict private standards, and international organisations, industry bodies, farmers' organisations and labour unions increasingly influence the content and implementation of standards. However, the implementation of these standards has been contradictory. On the one hand, sustainability criteria involve upgrading opportunities; on the other hand, the benefits to smallholders may be limited. Therefore, it is necessary to study the imbalance of standards further and explore the optimal form of standard governance.

State forces, including supportive industrial policies, regulations and direct involvement in production activities, play a decisive role in global agricultural production networks. However, despite a large number of empirical case studies demonstrating its multiple roles in local agricultural upgrading, this institutional capacity is still not adequately theorised in the GVC or GPN framework. As actors, how the actions of the state lead to the formation and change of network relations and the influencing mechanism of regional strategic coupling need to be examined further.

Vertical and horizontal linkages between local actors directly affect the outcome of agricultural upgrading and achieve sustainable governance of agricultural GPN through social and territorial embeddedness. Local service providers and intermediaries are increasingly taking on the role of improving vertical and horizontal coordination to help build local capacity. A series of organisational innovations, such as stakeholder alliances and joint initiatives, promotes the extensive participation of marginalised smallholders, which is conducive to solving the problem of unbalanced development in the coupling process. However, local actors often involve complex networks of partnerships, and the goals and values of individual organisations are not always compatible. More perspectives are needed to analyse the effect of cooperation and conflict at the local level.

Therefore, future research should clarify the complex interrelationships among different upgrading objectives (economic, social and environmental) to understand the diversity, complexity and nonlinearity of agricultural upgrading paths or trajectories. Additionally, future research should incorporate a multiscale perspective and use GVC, GPN or other analytical frameworks to reveal how governance structures at different scales jointly affect

local agricultural upgrading mechanisms. It also enriches the existing theories on global agricultural production networks.

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