CLIMATE SMART AGRIBUSINESS FINANCING (CSAF) FORESTRY AND WASTE MANAGEMENT

GLOBAL ISSUES & LOCAL PERSPECTIVES

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TABLE OF CONTENTS

CLIMATE SMART AGRIBUSINESS FINANCING (CSAF) FORESTRY AND WASTE MANAGEMENT --- ISBN 978-978-60709-1-7

Part one: CLIMATE SMART AGRIBUSINESS FINANCING (CSAF)

Chapter 1:

Sources and Constraints to Agroforestry Financing in Nigeria

[1]Edoka, M. H. and [2]Edoka, Edebo L.

Chapter 2:

Climate- Smart Agricultural Waste Management: The Circular Economy Perspective

*Okwor, Uchechi Mercy [1] and Okwor, Kelechi C.[2]

Chapter 3:

Farmers Perception on the Effect of Climate Change on Soybean Production and the Adoption of Coping Strategies

Paul, A. H. (B. Sc. M. Sc, Ph. D.,) and Oyigbenu A. O. (B. Sc. MSc)

Chapter 4: **Resource-Efficient Waste Management and Financing in Climate-Smart Agribusiness**

Dr. Ijeoma Rose Ezebuike

Chapter 5:

Social Capital as an Evolving Framework for Shaping Livelihood and Farming System Resilience amidst Climate Adaptation

Sesugh Uker [1], and Muhammad B. Bello [2]

CLIMATE SMART AGRIBUSINESS FINANCING (CSAF) FORESTRY AND WASTE MANAGEMENT --- ISBN 978-978-60709-1-7

Part two: FORESTRY AND WASTE MANAGEMENT

Chapter 6:

Influence of Climate Change Adaptation Strategies and Information Communication Technology (ICTS) Utilization by Soybean Farmers in North East Nigeria

Paul, A. H. (BSc., MSc., PhD) and Gadu, H. O., (BSc, MSc)

Chapter 7:

The Impact of Climate Change on Animal Health and Productivity

Oyeleye, O. O.

Chapter 8:

Advances in Remote Sensing for Biodiversity: Theory, Methods, Applications, and Validation

[1]Salami, K. D. and [2]Falade, L. O.

1

Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It is eschews pedantry and lays bars the issues in such clarity that conduces to learning. The book elaborates on contemporaneous **Climate Smart Agribusiness Financing (CSAF) Forestry and Waste Management** issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which **Climate Smart Agribusiness Financing (CSAF) Forestry and Waste Management** issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue **Climate Smart Agribusiness Financing (CSAF) Forestry and Waste Management** necessary in policy making process that will stimulate increase in food production and environmental sustainability. **Climate Smart Agribusiness Financing (CSAF) Forestry and Waste Management : *Global Issues & Local Perspectives*** is organized in two parts. Part One deals with The Concept of **Climate Smart Agribusiness Financing (CSAF)**, Part Two is concerned with The Concept of **Forestry and Waste Management**

Eteyen Nyong; August 2026

Chapter Five

Social Capital as an Evolving Framework for Shaping Livelihood and Farming System Resilience amidst Climate Adaptation

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Table of Content

CLIMATE SMART AGRIBUSINESS FINANCING (CSAF) FORESTRY AND WASTE MANAGEMENT --- ISBN 978-978-60709-1-7

Introduction

Resilience in the face of undesired changes is embedded and manifested in more diversified resources and secured livelihoods, social institutions and networks, and cultural values and attitudes. Indigenous language could comprise a more vital component of global knowledge on development issues, contributing to problem-solving strategies for local, and especially economically disadvantaged, communities (Son *et al*., 2019). Further, Co´rdoba *et al*., (2020) opines that resilience is birthed from complex interactions among ecosystems, economic, social and cultural systems and cannot be analysed through a fragmented consideration of each component when presented in isolation from the whole. Multiple interlocking capitals which have been researched to enable coping and adaptation to mitigate loss and withstand damage has received criticism for extending individualism, driving capital accumulation, and consolidating power dynamics rather than building anti-capitalist ethics, networks, and relationships that protect individuals where asset holdings and distributions might fail or be inadequate (Shah *et al*., 2017). Critical scholarship on the intersection of development pathways and climate change responses draw out the roles of power, agency, social difference, intersecting inequalities, and social justice in shaping people's resilience in a rapidly transforming world (Tschakert *et al*., 2023). Similar to resilience, social networks have attracted great interest in recent years. Social networks refer to both formal (e.g., membership in organizations or associations) and informal (e.g., relations to kin, friends, and neighbours) connections developed among community members through exchanges in information, labour, money, and materials (Wang *et al*., 2021).

Resilience builds on a rather complex conceptual framework due to the complexity ruling the norms and other conditions describing the functionality of economic systems (Sdrolias *et al*., 2022). These norms form the bedrock to which a society can be united under a common interest to build their resilience and foster developmental outcomes. In addition, while household resilience is partly driven by the availability of physical assets and infrastructure, much of it relates to 'soft' elements. These intangible processes or soft elements as the case may be such as community cohesion or social capital are difficult to see or measure (Jones and d'Errico 2019, Zugravu-Soilita *et al.*, 2021). Social resilience as closely knitted with social capital is defined as ''the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change'' (Stotten *et al.*, 2021, Quandt, 2018).

Social resilience is said to be increased through improvements in communications, risk awareness, the development and implementation of disaster plans, the purchase of insurance, and sharing of information. The qualities of social resilience intertwine with those of social capital. Marshall *et al*., (2023) infers that relationship and network forming are important attributes of social capital which is basically built on trust and reciprocity. Livelihood resilience applies a broader set of indicators to resilience measurement, such as natural and human assets, while indicators of social resilience can be more narrowly focused, and in many cases is similar to social capital within the sustainable livelihoods framework (Quandt 2018).

Social capital has its origin in cultural evolution. Notably, a society improves its social network and thus develops its social capital when its members share a common cultural life (through celebrations, rites). In other words, social capital stems from cultural capital with its important attribute focused on trust and reciprocity (Nichols *et al.*, 2022, Zugravu-Soilita *et al*., 2021). The concept of social capital can be described as the quantity and quality of social resources (e.g., networks, membership in groups, social relations, and access to wider institutions in the society) upon which people draw in pursuit of livelihoods (Marshall *et al*., 2023; Smith and Frankenberger 2018). Similarly, for households or individuals or a society to effectively utilize natural, physical, and financial capitals, minimum levels of human and social capital are necessary as inferred by Quandt (2018).

Livelihoods resilience in agrarian societies entwines with agriculture, therefore, if the purchasing power of farmers is further constrained, it would affect market-driven agricultural transitions (Ritzema *et al*., 2019). The compounding issues may also affect resource poor farmers and conspicuously expose them to risk of poor development and falling deeper into the poverty trap. This is largely due to low incomes and pensions, work seasonality, dual production, poor structure, reduced access to information and low bargaining power which may increase transaction costs and hinder their access to markets (Gava *et al.*, 2021). Considering that this has direct implication on their structural social capital, it could isolate them and reduce their influence for resource mobilization to foster development. As the community continues to suffer from the absence of formal and informal networks, their ability to connect to external resources also become diminished thus leading to their inability to also mobilize for collective action to solve problems even at the local level.

According to Marshall *et al.*, (2023), whilst social capital is associated with the relationships and networks within the community, community competence is related to problem solving strategies, collective action and decision-making capabilities which could affect economic development. However, economic development is associated with equitable distribution of resources within a community. Finally, information and communication flows within a community become vital in emergencies, and are an essential component of disaster preparedness, response, and recovery processes. For instance, Nakamura *et al*., (2020) infers that, the provision of access to all-weather feeder roads, or rural roads, is expected to raise living standards in poor rural areas by reducing transport costs between villages and markets; thereby generating market activity, affecting input and output prices, and enhancing agricultural production through the increased use of modern technologies and the changes in crop choice. The combination of these factors will have significant influence in the household decision making process which could also affect the wider community. However, the concept of social capital is devoid of a generally acceptable definition and operationalization in climate resilience. This has created a hole in understanding how interactions in different social settings and networks could develop trust and shared norms to drive anticipatory resilience discourse. In addition, most contemporary views ignore mutual benefits of social capital and fail to link local governance structure with formal public disaster plans. To help solve this challenge, there

is need to study evolving social capital frameworks that shape livelihoods and farming systems adaptation amidst climate challenges.

Methodology

The study was conducted through a comprehensive literature review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Thorough examinations of 217 agricultural resilience research articles were undertaken, with specific attention to social capital for assessing resilience. Findings were synthesized from peer-reviewed journal publications, and a literature matrix was devised to streamline the selection process using key terms such as agricultural resilience, social capital, climate resilience, covariate shocks, agricultural risk, farmers' livelihood, farming systems, vulnerability, and adaptation.

After rigorous screening, 53 articles were chosen for further analysis. To operationalize the study, an overview of agricultural resilience in respect to social capital was provided, and an analytical framework consisting of five criteria uncertainties, covariate shocks, scalar relationships, social capital, and temporal dynamics were applied. These criteria were based on Guedegbe *et al*., (2023) view on definition of resilience, which considers the economic unit, nature of shock, and development outcome as key aspects of resilience discourse.

Research Overview

Farming Household as a Basic Unit of Social Capital in Resilience Discourse

Specifically, the farm household is the basic unit of livelihood decisions in rural areas. Their livelihoods are a connector between social and natural systems through the management of resources (Wang *et al.*, 2021). The social domain is crucial for resilience because it mediates the relationship between economic, cultural and environmental components of a community (Wilson *et al*., 2018). Constructivists are recasting vulnerability and natural hazards debates by stressing the role of human agency in shaping risk exposure; however, due to the prevalence of nominalism within the tradition, they have been unable to effectively analyse the dynamics of this structure (McCordic *et al.*, 2022). Behavioural economics offers a better explanation for understanding human decision-making, especially in the context of climate change uncertainty, by introducing psychological concepts to explain decisions that differ from the optimal choices suggested by traditional economics (He *et al*., 2022).

The influence of farmers' cognitive traits which are behavioural or psychological in nature and relate to learning and reasoning such as perception of costs and risks has been undermined in agricultural resilience research (Andatia *et al*., 2022). These cognitive traits are often referred as the cognitive social capital as it systematically governs the decision making process of the individual. In addition, social aspects of resilience are weakly developed, especially with regards to empowerment which includes notions of collective community agency as important to resilience, but they do not propose measurement instruments (Co´rdoba *et al.*, 2020). Resilience has a high potential to help food and or farming systems manage with shocks,

complexity and uncertainty by including ideas such as continuous learning, adaptability and back-up capacity.

The structural form of social capital enters directly into all the determinants of the economic performance of agriculture. This form of capital is concerned with facilitating collective action and information sharing that would lower transaction costs and mitigate risks. Intangible cultural capital should affect economic performance only indirectly, through its impact on structural social capital, by predisposing individuals to cooperation and collective decisions (Zugravu-Soilita *et al.*, 2021). Economic services including price bargaining in markets, collective bulking of production, providing access to credit, and price negotiations for agricultural inputs, among others may standout in this context. Social services include, facilitating the access to public support measures, knowledge transfer for improved production, providing targeted education and training opportunities for specific agricultural products and social groups (e.g. women), building social capital and social cohesion through networking, as well as improving the access to other livelihood services (e.g. healthcare) (Gava *et al*., 2021).

Government interventions are able to target the root causes of vulnerability faced by households while maintaining a high degree of synergy with households' adaptive behaviours, thus effectively improving their adaptation outcomes. (He *et al.,* 2022). Little research has been carried out on the interconnected nature of hazards and how this is currently captured in resilience measurement approaches or how resilience approaches are supporting decision-making and resilience implementation (Lauriena *et al*., 2022). Further, Clark-Ginsberg *et al.,* (2020) infers that, there is currently no standard of practice for measuring community resilience that addresses issues related to validity, reliability, sensitivity, utility, and cost effectiveness and ease of use. If these gaps must be filled effectively, the households become the starting point for measurement as they are characterised or equipped with the right information that researchers could use to analyse resilience at a more localized level.

Households as Basic Unit for Resilience Measurement in Social Capital Context

Over the years, many different approaches to evaluate resilience have been offered by international organisation including the United Nations' Food and Agriculture Organization (Mondal *et al*., 2023) but the measurement of social resilience which is embedded in social capital still remain elusive. For instance, Son *et al.,* (2019) infers that, if local knowledge were better incorporated into adaptation planning by policy makers, its conservation and application would enhance resiliency to climate change in indigenous communities. Farmers' abilities to persist in a difficult economic environment may undermine the resilience of the wider region, while decisions that enhance farmers' resilience in the short term may lock them onto a path that weakens their future resilience (Ashkenazy *et al*., 2018).

More importantly, household unit is an important point for measuring resilience. Indeed, many of the assets, capabilities and functions commonly assumed to support resilience in social systems are derived from, and are dictated by, household-level dynamics (Jones and d'Errico 2019). Communities with weak social capital allow practices that enhance vulnerability,

collective concerns are more likely to be overridden by powerful stakeholders which may cause community interests to become fragmented (Wilson *et al*., 2018). Taking a step back, the ‘‘social turn” has elaborated those cultural systems, and political and power structures that profoundly shape decision-making and resilience-based strategies in socio-ecological systems (Shah *et al*., 2017).

While not mutually exclusive, livelihood resilience applies a broader set of indicators to resilience measurement, such as natural and human assets, while indicators of social resilience can be more narrowly focused, and in many cases is similar to social capital within the sustainable livelihoods framework; Community disaster resilience stems from four sets of adaptive capacities: social capital, community competence, information and communication, and economic development (Marshall *et al*., 2023). Measuring social capital should be a difficult task because this concept is broad and still debated. The variables used in the literature to measure social capital have often been outcome-based (Zugravu-Soilita *et al.*, 2021).

Measurement tools can be qualitative or quantitative, participatory or expert led, inductive or deductive, expert driven and top-down or bottom-up and participatory, and use primary or secondary data. According to Co´rdoba *et al*., (2020) Eight (8) dimensions of community resilience with metrics that have not been applied in practice and that are centred on the capacity to adapt to change have been presented. Scholars have employed official statistics to propose an index of rural diversity, considering natural economic and social capital, under the premise that diversity increases resilience. Other authors include, in addition to ecological variables, factors such as food security, income, access to services and support networks. According to Zugravu-Soilita *et al*., (2021), from an economic perspective, social capital is an input of the production function whose effects are modelled in such a manner as to reduce transaction or production costs. However, the intangible dimension of cultural capital includes activities and practices outside the economic sphere; therefore, it refers to the non-market dimension of cultural capital which captures everything that increases the productivity of an economy or farming system, such as knowledge, institutions, and governance; and more broadly contributes to well-being such as social relationships and cultural values, which are beliefs that define the lifestyle of individuals/social groups, in which the latter have an emotional investment.

The cultural domain, meanwhile, encompasses rites, ideologies, societal norms, traditions and conventions. Cultural factors are important as they include complex processes of human activities passed down not by genetic inheritance or environmental pressure but by teaching, imitation and conformism (Wilson *et al*., 2018). The elements of indigenous knowledge, for example, participation, flexibility, inclusion, and autonomy are a function of climate governance. Son *et al*., (2019) infers that, users of indigenous knowledge are often flexible to actively choose available coping and adaptive options for climate proofing in response to climatic events such as floods and drought. Such adaptation strategies based on local knowledge have been identified by various authors for predicting hydro-meteorological and catastrophic threats through environmental observations.

Community Resilience as an Intricate of Social Capital

Community resilience, which brings together indicators in social-ecological governance and material capitals, in addition to a range of underappreciated social and psychological indicators that exist at local and granular scales (e.g., social networks, people-place relationships, values and beliefs, and positive outlooks). (Shah *et al.*, 2017). To demonstrate resilience at the community level, it is crucial to understand the complex interplay of economic, social, cultural, political, and natural capitals, or "domains" (Stotten *et al*, 2021). The notion of community resilience is gaining increasing importance in contemporary society, especially as many communities around the world appear to be gradually losing resilience in the face of challenges such as climate change, out-migration of young people and socio-economic ruptures (Wilson *et al.*, 2018).

Low adoption of climate smart agricultural technologies within a community has been linked to several factors, including socioeconomic status, farm characteristics, gender-specific factors, access to resources, access to agricultural and climate information services, institutional characteristics, and other cognitive characteristics of farmers, such as risk-taking behaviour (Andatia *et al*., 2022). These attributes point to the intrinsic and sensitive nature of social capital on livelihood and farming systems adaptation that has also been demonstrated in the core of resilience building. Scholars used the interrelated concepts of social embeddedness, moral economy, and social capital as opined by Nichols *et al*., (2022) to understand the logics of participating in local and regional food systems (LRFS), where pure economic rationalities for self-interest maximization are tempered to varying degrees by values that emphasize community engagement, trust, reciprocity, and, in some cases, shared risk.

Ostensibly, rural contexts may be characterized by increasingly urban-oriented lifestyles and consumption patterns (Eakin *et al*., 2015). Rural households lead a more sedentary life and typically practice some form of seasonal or permanent crop production alongside animal production and therefore interface more with food markets more regularly (Hussein *et al*., 2021). A focus on households also allows for distinctions to be drawn between psychological resilience associated with the ability of an individual's psyche to deal with shock or trauma and the resilience of the individual or household overall. This point is particularly relevant when assigning modules on subjectively-measured resilience (Jones and d'Errico 2019). Evidence are recently mounting in Sub Saharan Africa as reported by Kehindea *et al*., (2021) in Nigeria that social capital as an endogenous input, has a positive effect on different economic outcomes. This can be seen in the conservative attitudes towards extension services, and market forces that are disincentives, soil quality and terrain/relief, low capital base of farmers, pests and diseases, field operations, timing of planting, and super imposed on these is a fluctuating climate regime and weather elements as currently witnessed in the case of Nigeria (Ujoha *et al.*, 2019).

The erratic seasonal fluctuations of temperature, rainfall, and humidity often lead to adverse impacts on human health as the increase in the occurrence of disease and natural disasters stress food production and food security (Son *et al*., 2019). The last decade (2011–2020) has been the hottest decade on record (He *et al*., 2022) inferring production constrain for farmers. In the context of climate and disaster resilience, it can be broadly defined as the "ability of a system,

community or society to pursue its social, ecological and economic development objectives, while managing its disaster risks over time in a mutually reinforcing way" (Lauriena *et al.*, 2022). When resilience is explored in this way, holistic links between the physical, financial, human, social, and natural capitals become more accessible. This approach takes into account the multiple climatic and socioeconomic factors that contribute to individual and collective resilience, such as managed and unmanaged landscapes, financial resources, social networks, communications, governance, and different worldviews (Lauriena *et al*., 2022). As inferred by Quandt (2018), a household is assumed to need a balance of the five capitals articulated in the sustainable livelihood approach in order to maintain adaptive capacity and well-being.

Microeconomic Aspect of Social Capital in Farming Systems Resilience Discourse

At the microeconomic level, cooperative development involves addressing the market failures that inhibit farmers' participation in the market economy, while trying to improve their social capital, by facilitating coordinated production and aggregation (Gava *et al*., 2021). Interest in agriculture as a vehicle for both economic and sustainable development has regained ground in policy circles and academic investigation (Eakin *et al.*, 2015); but there is still paucity of studies addressing the issue of farm productivity and food security within the context of social capital, despite its potential to mitigating shortfalls in households' income and food supplies, especially in times of crises (Kehindea *et al.,* 2021). Community resilience will be strongest where the different domains (social, cultural, natural, economic and political/institutional/governance) intersect, provided these domains are well developed (Wilson *et al*., 2018).

The establishment of agricultural cooperatives had proven to be effective in alleviating rural poverty as they can increase the efficiency and productivity of processes on farm by procuring inputs and shared machinery; they can improve farmers' bargaining power and facilitate their access to wider markets; they can link farmers' with supply chain actors and mitigate gender issues and they can support knowledge building and the creation of the social capital locally (Gava *et al*., 2021). Social capital is a 'by-product of religion, tradition, shared historical experience and other types of cultural norms', thus reinforcing cooperation between members of society. Trust and cultural norms (Nichols *et al*., 2022, Zugravu-Soilita *et al*., 2021), shared expectations and rules that guide individuals' behaviour within social groups appear to be mechanisms by which exogenous factors can affect participation in social networks (Zugravu-Soilita *et al*., 2021).

Social Elements Consistent with Social Capital in Livelihood and Farming System Resilience

In particular, social networks enable information and resource exchanges that facilitate social supports and can be transferred to other forms of capitals (such as financial, human, physical, and natural capitals) that promotes livelihood security and enhance adaptive capacity through livelihood diversification and new farming technology (Wang *et al*., 2021). Resilience is generally understood as the ability of a system, community or society exposed to slow or fast-onset shocks/disturbances to resist, absorb, accommodate and recover from shocks/disturbances

including through the preservation and restoration of its essential basic structures and functions (Wilson *et al*., 2018, Stotten *et al*., 2021). Those who suffer from various forms of marginalization based on age, gender or ethnicity are the least resilient, resulting in among other things, more precarious tenure of productive assets and more limited access to financial risk management tools (Shah *et al*., 2017).

Differences in gender, age, and ethnicity may inform the use of natural resources, bringing to the fore cultural and social dimensions of conflict (Bogale *et al*., 2006). More so, these dimensions may bring about competition for resources thus aggravating existing challenges. The presence of competition from other local producers creates a process that erodes logic of social solidarity and moves local food towards conventional capitalist markets where producers set prices that do not adequately compensate the social and ecological costs of production, but instead focus on securing market share (Nichols *et al*., 2022). Furthermore, food insecurity is negatively associated with social capital, remittances, and off-farm income (Bhalla *et al*., 2018). Hence it is important to mention that the level of household food security is based on the level of household social capital within and outside their environs.

Agricultural resilience and sustained escapes from poverty require a new approach that recognises the changing realities of any rural economy. Whilst asset accumulation and an increase in productivity form essential aspects of development through agriculture, they are also becoming difficult to reach for people living in or near poverty. The following structures according to Eichsteller *et al.*, (2022) are relevant when discoursing social capital in agricultural resilience: Environmental structures, such as provisions of public goods and infrastructure and regulation of the availability of key productive assets, such as land and access to water; social structures - including gender norms and family networks that regulate social norms directly contributing towards profitability and economic well-being of households, such as divorce practices and family money lending; and, personal services structures that include individual capacities to engage in agriculture, such as nutrition, health, education and transferable skills over time.

Forms of Social Capital

Two forms of social capital have been distinguished: *structural social capital* and *cognitive social capital*

● **Structural social capital**, according to Zugravu-Soilita *et al*., (2021) is an objective form of social capital that refers to social networks and social structures (e.g. sports clubs, neighbourhood associations). Scholars over the years have differentiates between two forms of structural social capital which include: *Bonding social capital: which* reflects the social relationships between individuals in the same social group (family members and friends) and; *bridging social capital:* which refers to social relations between heterogeneous social groups.

● **Cognitive social capital**, a subjective form of social capital that refers to the norms, values, attitudes, beliefs, and trust shared by members of a group, a network, or a society. These features are also attributes that define intangible cultural capital. Two components of cognitive social

capital have been distinguished: The first refers to *cultural values and norms*. These values and norms pass from one generation to another and represent the intangible cultural capital defined as the set of norms, values, and customs of a society. The second component of cognitive social capital relates to *the individual characteristics of every person* (personality, mentality, intelligence, way of thinking and seeing things) and, therefore, a subjective element specific to each person. Complemented by more or less objective skills acquired by the individual during his or her existence (knowledge, education, expertise), these elements extends to form *human capital* (Zugravu-Soilita *et al.*, 2021).

Further Classification and Utilization of Social Capital

Smith and Frankenberger (2018) further classify social capital with their practical utilization to include the following forms: (i) Bonding social capital is seen in the bonds between community members. It involves principles and norms such as trust, reciprocity, and cooperation, and is often drawn on in the disaster context, where survivours work closely to help each other to cope and recover. (ii) Bridging social capital connects members of one community or group to other communities/groups. It often crosses ethnic/racial lines, geographic boundaries and language groups, and can facilitate links to external assets in that those with social ties outside their immediate community can draw on these links when local resources are insufficient or unavailable. (iii) Linking social capital is seen in trusted social networks between individuals and groups interacting across explicit, institutionalized, and formal boundaries in society. Linked networks are particularly important for economic development and resilience because they provide resources and information that are otherwise unavailable. This type of social capital is often conceived of as a vertical link between a network and some form of authority or power in the social sphere.

Result and Discussion

Influence of Social Capital on Livelihood and Farming Systems Resilience

Social capital in their various forms has influence on the livelihood choices or farming systems adopted by farming households. It governs the social dimensions of farming systems by absorbing indigenous knowledge into farming systems innovations. Furthermore, it can be employed for resource mobilization to enhance farming systems and households resilience during shock events or farm expansions. Cognitive antecedents or cognitive social capital influencing herders' intention and behaviour regarding rangeland rent-in as researched by Qian *et al.*, (2022). Reasonably, social values or norms govern the behaviours and attitudes of individuals on the choices they make. Limited understanding of factors influencing heterogeneous responses in rangeland rental services were also inferred by Qian *et al.*, (2022). To a header protecting their herd for years to attain maturity, there is a bias they could have attached to their herds; the same way humans in other chosen endeavours protect their livelihood as such, they won't want any harm come to them because their livelihood and economic wellbeing largely depends on it. Understanding cognitive antecedents can inform policy interventions for more prosperous rangeland transfer systems in pastoral regions. Mburu

et al., (2016) analyses patterns of livelihood sources and poverty among pastoralists in Northern Kenya. They suggested that keeping livestock remains the main source of livelihood, with increasing livelihood diversification. Their research shows the prevalence of income and livestock poverty, suggesting a need for more appropriate measures of asset poverty.

Examining the barriers and success factors related to effective crop and livestock enterprise diversification in northern Namibia and its effect on food security outcomes, Mulwa and Visser (2020) revealed that past exposure to climate shocks influences current diversification levels. Access to climate information is a key success factor. How farmers or households get access to climate information is largely determined by structural social capital through social networks and sometimes through lateral communication channels. Overall diversification in both livestock and crop enterprises contributes to higher food security outcomes and economic wellbeing for farming households. Livelihood or farming systems diversification becomes a critical tool employed in social capital discourse to enhance the resilience of households against climatic shocks in this context. This is because emphasizing the importance of climate information and considering both livestock and crop diversification enhances farmers' capability during shocks and consequently improves their livelihood. There is need for further investigation into the motivations and barriers for farming systems adopting genomics technology linked to social capital.

Predictors of maize land use and livelihood outcomes for smallholder farmers in three regions of Mexico were identified by Eakin *et al.,* (2015). Their result shows that regional and inter-regional heterogeneity in farmers' responses underscores the importance of regionally specific policy interventions. The significance of regionally specific policies in understanding and addressing diverse livelihood outcomes is emphasized. Kalkuhl *et al*., (2020) investigates the impact of climate conditions on the prevalence of sharecropping as a form of traditional land tenure. They found that sharecropping acts as a form of insurance in areas with low precipitation. This form of farming could accommodate different farming systems when communities are experiencing any form of weather or economic stressors to cushion immediate devastating outcomes. It provides a form of cover that ensures livelihood capabilities and community cohesion.

The role of sharecropping in reducing the need for costly risk management strategies where formal insurance is unavailable has been identified. Where insurance policies and government incentives are lacking, livelihoods or farming systems become exposed to risk. At the point where this becomes the challenge of farming households, it could be inferred that social capital is lacking as such new measures must be taken to ensure resource mobilization to enhance livelihood and farming systems resilience. Equitable resilience in western Nepal, has been studied by Forsyth *et al*., (2022) emphasizing the influence of equity framings on resilience efforts. They point out the limitations of state-led efforts that may not reflect local experiences of risk, particularly social exclusion. There is need for a more critical understanding of normative framings of equity in resilience interventions. Quandt (2018) introduces the Household Livelihood Resilience Approach (HLRA) to measure livelihood resilience. The

research identified the importance of practical methods, subjective measures, household-scale focus, and human agency in measuring and building resilience. If these items are properly captured, social capital could become the bridge for resilience discourse that holistically involves local farming households and other stakeholders in the process.

Resilience of agricultural and food systems was analysed by Ashkenazy (2018) emphasizing social-ecological resilience and its diverse interpretations at farm and regional levels. They found that strategies to enhance short-term farm resilience may conflict with long-term regional resilience. Empirical evidence from 14 countries demonstrates the impact of spatial and temporal factors on outcomes. The research points to the need for a more comprehensive understanding of resilience, considering social-ecological aspects, and addresses the potential conflicts arising from divergent strategies. Eichsteller *et al.,* (2022) investigates the changing role of agriculture and farming practices in contributing to sustained escapes from poverty in rural Kenya in the context of climate change. Their findings reveal that links between accumulation of assets and poverty escapes are ambiguous, and climate change shocks exacerbate difficulties in conversion processes. The challenges in conversion structures and processes reveal social capital challenges. The need for interventions to improve existing structures for sustainable poverty reduction could become an important strategy. However, the role of social capital in sustaining poverty escapes and compensating for adverse social norms has not been adequately investigated in scientific research. Some studies have collectively contribute to understanding resilience in different contexts, including agriculture, social dynamics, livelihoods, and climate change responses. The various studies reveal the need for detailed oriented approaches, considering both tangible and intangible dimensions of resilience, and the importance of equity, agency, and social justice in building resilience to climate-related stressors to forge a path for development discourse.

Development Pathways Influencing Farming Systems and Livelihoods Resilience

The significance of diverse interventions, adaptive strategies, and transformative actions for enhancing climate resilience at various levels has been drawn out from farming systems to community livelihoods. The intersections of development pathways, climate change responses, and resilience have been researched by Tschakert *et al*., (2023) emphasizing power, agency, and social justice. They revealed the transformative role of alliances, resistance, shared learning, and inclusive approaches in building political capabilities for just climate action and farming systems sustenance. Shah *et al*., (2017) examines the resilience of agricultural livelihoods, emphasizing the intangible and non-material dimensions of resilience. They challenge the central focus on tangible capitals and advocates for a more nuanced understanding of emotional and affective indicators of resilience which are key attributes of social capital. Steinke *et al.,* (2023) on their part **a**nalysed the effects of a multi-sectoral intervention program on food and nutrition security in rural households. They found that each additional intervention increases the probability of positive food and nutrition security outcome. This indicates the effective utilization of linking social capital for resilience building. Investments in diversified

intervention programs for stronger food and nutrition security benefits become appropriate recommendations for livelihood and farming systems resilience enhancement approach.

How long-term development pathways affect community resilience in two villages in the Austrian Alps was investigated by Stotten *et al.,* (2021). They posit different development pathways lead to economic, structural, and political lock-ins, reinforcing path dependencies. They found potential challenges and reinforcing effects of specific development trajectories that interplays economic, social, cultural, political, and natural domains in community resilience. Nakamura *et al*., (2020) analyses the linkage between rural road development and household welfare, resilience, and economic conditions in Ethiopia. They found that, rural road development is associated with increased household welfare and resilience during severe droughts. Connectivity to markets also supports welfare and resilience. Enhancing developmental pathways associated with rural roads in connecting communities to markets, supporting welfare, and enhancing resilience in shock-prone areas could be structural forms of social capital that could become resilience building blocks in local communities.

Determinants of household choice among alternative land property right regimes in Eastern Ethiopia were identified by Bogale *et al.,* (2006) to mitigate land-related conflicts and reduce vulnerability. Findings suggests dependency ratio and education level of the household head were key factors predicting preferences for common property resource regimes. Livestock holding, household size, and area of cultivated land lost were relevant for resettlement preferences. The study addresses the role of property rights in managing conflicts and vulnerability. Whilst this study emphasizes the importance of cognitive social capitals in shaping decision making, it also reflects the place of intangible capital factors related to household learning composition, skills and education in shaping household resilience. Furthermore, bonding social capital is expressed in terms of household relationships whilst linking social capital is expressed in terms of financial resources or assets ownership. Where household possess large assets holdings, they could become a node for resource mobilization during shocks or stressors thus providing immediate support for related family members as well as community members' resettlement. Sarkhel (2015) analyses complementarities between land productivity and conservation investments in the context of river embankment maintenance in the Indian Sundarbans. The research reveals that aquaculture households invest more in embankment maintenance, and there is evidence of free riding in canal-based aquaculture. There is interplay between land productivity, conservation investments, and social networks, revealing the role of private efforts and potential crowding out by public intervention.

Disaggregated indicators could have dire implication on the overall wellbeing of households, affecting their community resettlement plans following shocks. Reasonable, this could holistically affect even their food security and health. The research by Young (2021) used disaggregated indicators to focus on water-related indicators and their impact on human well-being. The Individual and Household Water Insecurity Experiences Scales offer potential for transformative insights. The importance of measuring water insecurity globally and regularly, drawing parallels with the intrinsic value of water and its critical role in achieving various

development goals has drawn attention. Wilson *et al*., (2018) assess the resilience of Hu village (Sichuan, China) in the face of multiple disturbances, including globalization and modernization. Their result shows moderate resilience in one of the villages investigated (Hu village) with tendencies for further weakening, especially in natural and political domains. Though, the impact of industrialization, deagrarianization, and changing stakeholder expectations on community resilience could improve household capabilities; there are still indications that realigning government policies for strengthening developmental pathways could be also beneficial.

The Assets Capabilities approaches posit that wellbeing is described in terms of assets, community support networks, and capabilities adapted to rural life as researched by Jaye *et al*., (2022) in their bid to explore the health wellbeing of rural communities. Furthermore, Steinert *et al*., (2018) through a meta-analysis of randomized controlled trials. They found that small but significant effects on poverty reduction, including increased household expenditures, incomes, higher returns from family businesses, and improved food security. Their study drew out the relevance of saving promotion schemes in reducing poverty, suggesting that future efforts should focus on gender-sensitive programmes and expanding banking services to improve social welfare of households. Whilst the wellbeing of farming households is important, how seamless their strategies for enhancing them could be influenced by their level of social capital. Sometimes, households use their assets as collateral to attract immediate funding from financial enterprises to expand their farming systems or livelihood opportunities; and this could be influenced by vertical communication channels with organisations that have the capacities to ensure that there are no challenges whatsoever in the process, connoting the place of linking or bridging social capital depending on organisational type. Where family members have business, bonding social capital becomes a tool in the hands of households to leverage on for diversification of livelihoods if proper mechanisms are put in place to avoid complacency. However, the intertwining effects of the various forms of social capital in a single model have not been explicitly investigated.

Empirically, Zugravu-Soilita *et al.*, (2021) investigates the effects of structural social capital and cultural values (intangible cultural capital) on tribal agricultural production in New Caledonia. Findings suggest agriculture and social capital are interlinked, and cultural values affect tribal social relations, indirectly influencing economic performance. There is complementarity between different forms of capital and the essential role of this complementarity in sustaining tribal agriculture and social ties. Limited research of the role of specific social capital components (trust, networks) in decision-making processes related to land property rights and conservation investments is seen as new dimension for research focus. However, the institutional domain may be relevant to explicitly address the intersection of social capital and climate change in the context of resilience, indicating a need for more comprehensive investigations. The intertwining effect of this would support the development of context specific programme packages that would sustain livelihoods and farming systems during and after shock or even averting shocks before they could happen.

Development Programmes Associated with Livelihood and Farming systems Capabilities in Social Capital Discourse

Social safety programmes facilitated by the government or non-governmental organisations or through Public-Private Partnership are considered intrinsic aspects of social capital. These types of relationships for developmental causes drawn from linking social capital become basis for developing trust and reciprocity. Bhalla *et al*., (2018) studies the impact of the Zimbabwe Harmonized Social Cash Transfer (HSCT) on household food security after 12 months. Findings suggest labour constraints significantly affect food security but not food consumption. The program has effects on food security and diet diversity scores but shows null to low effects on food consumption. Sabates-Wheeler and Devereux (2010) addresses the debate on the efficacy of cash transfers versus food aid, drawing on empirical evidence from Ethiopia's Productive Safety Net Programme. They identified that "Cash plus food" packages are superior to cash transfers alone, enabling higher income growth, livestock accumulation, and self-reported food security, especially during periods of high inflation. Brugh *et al.,* (2018) found positive effects on diet quantity during the lean season, but limited improvement in diet quality and economic vulnerability after one year of unconditional cash transfer program exposure of food and nutrition security among the ultra-poor and vulnerable households in Malawi. These safety net programmes may prove to be beneficial in the meantime, but if they are not presented in a package such that one compliments the other, they may not be able to earn long term dividends. In situations where food interventions are sold by beneficiaries for immediate monetary gratification justifies the need for this complementarity.

The research by Sabates-Wheeler and Devereux (2010) raises implications for social transfer program design, emphasizing the benefits of combined cash and food assistance, particularly in the context of inflation and ensuring predictable support. Brugh *et al.*, (2018) in their study highlights the importance of the purchasing power of cash transfers and the need for integrated social protection initiatives to address multiple dimensions of food and nutrition security. Young (2021) on their part posits assessing water security through experiences of access and use, similar to the shift in measuring food insecurity in their result. Bhalla *et al*., (2018) emphasizing the importance of addressing vulnerability criteria like labour constraints towards improving food security.

Limited attention has been given to the impact of changing socio-political contexts on community resilience and social capital. Inadequate exploration of the potential trade-offs and synergies between different forms of capital (social, cultural, economic) in influencing agricultural practices and resilience outcomes. Inadequate attention to the intersection of social-ecological resilience and social capital has hindered a comprehensive understanding of how social factors influence resilience outcomes. Few studies explicitly investigate the long-term impact of interventions on multiple dimensions of resilience and well-being.

Indian Self-Help Groups (SHGs) enable households to withstand rainfall shocks in Jharkand, East India as researched by Demont (2022). They found that, SHGs operate well under large covariate shocks, providing counter-cyclical credit access during droughts. Credit access and

peer networks contribute to increased food security and migration as risk management strategies. Jaye *et al.*, (2022) on the other hand reported that, high value on rural assets mitigates disadvantages of distance to local communities' wellbeing including health services. However, Kihiu (2016) found that increased basic capabilities reduce cooperation levels in collective management of farm resources. If increased capabilities reduce cooperation among social networks, it means that transitional networks could be formed to facilitate bonding or encourage group affiliation even when individuals feel they have outgrown a group or social class within their community. On the other hand, this could become a form of motivation for individuals to diversify their farming system enterprises, improve their capabilities to become part of higher affiliate groups.

Lack of attention to the social events sustaining social capital and their implications for debt and migration has been identified. Steinert *et al*., (2018) also reported supply-based programs are more effective than demand-enhancing ones. If the effectiveness of the programme is not need specific to farmers' livelihood and sustenance, over time, individuals could lose interest in the programme. Sometimes, these programmes are gender bias and region specific without capturing the peculiarities of those communities because they are supply-based in their forms. Furthermore, they do not involve the entire communities when being propagated. Steinert *et al*., (2018) found that, there is reduced effectiveness for women in the saving promotion intervention in Sub Saharan Africa. Kihiu (2016) infers social capital, neighbourhood social influences, resource system characteristics, socioeconomic factors, and institutional factors are key determinants of basic capabilities on households' decision in farmers' programme participation to draw mutual benefits. Further, the research by Jaye *et al*., (2022) pointed out the importance of rural-specific capabilities and assets in mediating the effects of distance on health services, providing a positive framework for understanding wellbeing of households. Credit access affects recipient groups differently, with positive effects on non-farm income but no effect on farm income as found by Luan and Bauer (2016). Effects vary based on economic conditions, ethnicity, and credit volumes received.

The role of local self-help and financial associations in helping farmers cope with climatic shocks was demonstrated by Demont (2022) emphasizing the importance of credit access and peer networks. The research by Luan and Bauer (2016) on the other hand emphasized the heterogeneity in the effects of credit access on different household groups and the importance of economic conditions in benefiting from rural credit. The contribution of social capital to sustained poverty escapes in Ethiopia has been studied by Woldehanna *et al*., (2022). They examined the role of material wealth, human, political, and social capital, and the impact of adverse social norms. The research shows that better-off households possess a combination of capital underpinned by an enabling environment. Social events sustaining social capital can be a double-edged sword, leading to debt and migration. They suggest that social capital helps families during shocks but also reveal challenges, providing policy suggestions such as promoting public discussion and group-based insurance. It is important to note that there have been limited studies on the role of social capital in the effectiveness of saving promotion interventions.

Societal efforts as an intrinsic aspect of social capital need to be implemented effectively so that there is mutual benefit. Kihiu (2016) encourages strategies to build social capital and facilitate the adoption of improved range management technologies, emphasizing the role of an enabling environment and policy implications. Smallholder export crop cultivation leads to higher incomes and greater public investment. Luan and Bauer (2016) examines the heterogeneous impacts of credit on households in Vietnam based on factors such as relative poverty, loan volumes, access to agricultural extension services, and ethnicity. Papaioannou and De Haas (2017) investigate the impact of climatic variability on social distress in British Colonial Africa, addressing the debate on the effects of agricultural commercialization on rural communities' ability to cope with shocks. They found that weather anomalies are associated with increased social distress, and cultivating export crops partially mitigates the impact.

Adaptive factors such as cultivating export crops and the urgency of understanding and identifying mitigating factors in the context of global climate change have been inferred by Papaioannou and De Haas (2017). Assessing the interactions between participation in Malawi's public works program (MASAF) and climate-smart agriculture (CSA) practices have been by Scognamillo and Sitko (2021). Their study drew out the synergy between social protection and agricultural interventions and found that, MASAF participation increases the adoption of CSA practices, contributing to sustained adoption. The joint effect enhances households' productivity and welfare, reducing sensitivity to low precipitation. The synergistic benefits of integrating social protection interventions with the promotion of CSA practices, demonstrating the potential for skill transfer from public works to farmers' fields. If these come at a minimal cost to farming households either in their production output or failures to meet their commitment, they may be inclined to adapt such models to enhance their resilience.

The impact of risk preferences and peer effects on adoption time frames has been examined by Gao *et al*., (2022). They found that risk-averse farmers are more likely to delay adoption. Social network status does not affect adoption time frames, but closely related farmers' time frames are positively correlated. Clay and King (2019) investigate how development transitions, such as the adoption of 'green revolution' agricultural policies in sub-Saharan Africa; intersect with cross-scale social-environmental processes to shape smallholders' adaptive capacities and pathways. They found that, adaptive capacities vary across livelihood groups due to evolving environmental, social, and political-economic processes. Social institutions play key roles in shaping differential adaptation pathways by enabling or constraining opportunities for especially smallholders.

Lack of attention to the intersectionality of social and environmental processes in shaping adaptive pathways for smallholders has been identified. The study by Gao *et al*., (2022) show the influence of risk preferences and peer effects on technology adoption, offering implications for local governments and companies promoting new technologies. Clay and King (2019) posit that, Rwanda's Crop Intensification Program enables wealthier households to adapt through commercial agriculture, while deactivation of local risk management institutions reduces options for most households. Access to capitals (land, labour, nonfarm income) is crucial for

negotiating new institutions and pursuing alternate livelihood practices. The research pointed to the dynamic and context-specific nature of adaptive capacity, illustrating how social institutions and power structures influence smallholders' capacities to adapt to climate shocks.

The sustainability of cocoa farmers has been studied by Tennhardt *et al*., (2022) in Ecuador and Uganda, considering environmental, social, and economic dimensions and identifying co-benefits and trade-offs. The research found lowest sustainability performance in the social and governance dimension. Co-benefits of environmentally-friendly cocoa production, such as human health benefits and resource conservation, with trade-offs in farm investments and profitability were identified. Recognition of the importance of tailored interventions considering gender, economic conditions, and cultural factors could contribute to the understanding and mitigation of the impact of climatic shocks on vulnerable populations. The potential for synergies between social protection programs and agricultural interventions in enhancing resilience and well-being is inevitable towards maintaining a sustainable livelihood.

Insufficient attention has also been identified in the social and governance dimension in farming systems sustainability research. The need for further investigation into the long-term impacts of resilience-building interventions is required. Béné *et al*., (2017) develops a resilience impact assessment framework for development interventions. They illustrated the approach through the case of the enhancing resilience program implemented by the World Food Programme in Bangladesh. The research pointed to the need for practical resilience measurement frameworks in resource-constrained situations. They utilized an ex-post treatment verses control approach to assess the impact of resilience interventions. They suggest a framework for assessing the impact of resilience-building interventions, acknowledging the importance of practicality in measurement frameworks for practitioners.

Food Aid, Food Security and Social Capital as a Tool for Livelihood Sustenance

The relationship between farm production diversity and household dietary diversity has been studied by Jones *et al*., (2014) in Malawi, considering gender, wealth, and control of household decisions. While Sitko *et al*., (2021) examines the relationships between food aid and the adoption of climate-adaptive agricultural practices (CAPs) in smallholder households in Ethiopia and Malawi. Jones *et al*., (2014) found that, increased farm diversity is positively associated with dietary diversity, especially in women-headed households and wealthier households which affirms the findings by Woldehanna *et al*., (2022) that households which are better of have a better environment to thrive as well as combination of different capitals that enhances their collaboration. Sitko *et al*., (2021) revealed that food aid increases the adoption of resource-intensive practices (soil and water conservation, livestock holdings) by easing capital and labour constraints and enabling greater risk-taking initiatives by farming households. The relationship is complex and influenced by various factors. These researches reveal the intertwining effect of gender and interventions in ensuring that households are able to cushion the effect of food insecurity when experiencing challenges pointing a focal lens to women empowerments, adoption of livelihood and farming systems sustenance strategies that could be achieved through linking social capital. However, most intervention programmes have

been revealed to be gender bias as peculiarities of women are not adequately captured most of the time. When programmes are designed to accommodate women or women headed households especially in the area of food security, there is usually more hope for household sustenance during the period of food insufficiency or lack.

The study by Jones *et al.*, (2014) suggests that diverse production systems contribute to diverse household diets, affirming the role of gender, wealth, and household decisions in this relationship. For less risky practices (organic fertilizer use, legume intercropping), food aid has negative effects indicating a substitution effect triggered by food aid (Sitko *et al.*, 2021). Heterogeneous impacts based on transfer values and levels of low rainfall risk exposure draws out the value of leveraging existing social assistance interventions for climate adaptation. The research recognizes the role of food aid in influencing CAP adoption choices, acknowledging the potential of social assistance interventions to contribute to climate adaptation objectives. Limited investigations of the social and policy dimensions of climate adaptation in the context of food aid and development transitions need further research especially when gender dynamics are involved. Further, the dynamics of adaptive capacity, especially in relation to social institutions and power structures could become beneficial hotspots for livelihood and farming system resilience.

Conclusion and Recommendation

Conclusion

Emphasis on the multifaceted nature of resilience, incorporating economic, social, cultural, political, and natural dimensions recognises the interconnectedness of social capital, cultural values, and economic performance in shaping resilience outcomes to drive its enormous benefits in building household and livelihood amidst climate challenges. Minimum levels of human and social capital are necessary to effectively make use of natural, physical, and financial capital. The social domain is crucial for resilience because it mediates the relationship between economic, cultural and environmental components of a community.

Social aspects of resilience are weakly developed, especially with regards to empowerments that include notions of collective community agency which are important to resilience. The structural form of social capital enters directly into all the determinants of the economic performance of agriculture. This form of capital is concerned with facilitating collective action and information sharing that would lower transaction costs and mitigate risks. Intangible cultural capital should affect economic performance only indirectly, through its effects on structural social capital, by predisposing individuals to cooperation and collective decisions making.

The Assets Capabilities approaches posit that wellbeing is described in terms of assets, community support networks, and capabilities adapted to rural life. There is complementarity between different forms of capital and the essential role of this complementarity in sustaining tribal agriculture and social ties. Self-Help Groups (SHGs) enable households to withstand shocks as they operate well under large covariate shocks, providing counter-cyclical credit

access during shocks. Credit access and peer networks contribute to increased food security and migration as risk management strategies. Supply-based programs are more effective than demand-enhancing ones.

Agricultural policies intersect with cross-scale social-environmental processes to shape smallholders' adaptive capacities and pathways in sub-Saharan Africa. However, adaptive capacities vary across livelihood groups due to evolving environmental, social, and political-economic processes. Social institutions play key roles in shaping differential adaptation pathways by enabling or constraining opportunities for smallholders.

Recommendation

Regionally specific policies and interventions to address the heterogeneity of responses and challenges in different contexts as applied to farming system resilience and social capital is recommended. Concerns about the potential crowding out effects of public interventions and the importance of understanding local dynamics for effective policy design is necessary.

There is need for disaggregated indicators and experiences to understand the complexities of developmental pathways on agricultural resilience, and food and nutrition security. Recognition of potential conflicts between short-term and long-term resilience goals draws out the importance of considering temporal and spatial factors in policy and intervention design. The role of social institutions and power structures in shaping differential adaptation pathways for smallholders is recommended.

The importance of integrated approaches, combining financial support, social protection, and climate information, to enhance resilience and well-being in diverse systems shows the intertwining influence of social capital in faming systems and livelihood resilience. Acknowledgment of the need for equitable and climate-resilient agricultural development policies that consider the dynamic and context-specific nature of adaptive capacity will be beneficial to farming households positing dual benefits to both the government and farmers.

Emphasis on the role of an enabling environment, connectivity, and rural-specific capabilities in supporting resilience and wellbeing is also important. Recognition of the multidimensional nature of factors influencing decisions and outcomes, including basic capabilities, social capital, and economic conditions could be beneficial when addressing the complex relationships in resilience discourse as it affects farming systems, households and the general communities.

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