

Compatibility of Agriculture Development Policy of Nepal to Sustainable Agriculture Development Principles

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Abstract

The agricultural sector, on which the majority of Nepal's population depends, faces significant challenges due to global warming, climate change, and rising global food insecurity. This underscores the need for a carefully designed agricultural development policy focused on sustainable practices. This study aims to assess the compatibility of key policy interventions in agricultural development of Nepal with sustainable agriculture principles. These policies prioritize the conservation, promotion, and utilization of natural resources, environmental protection, and biological diversity to encompass economic, social, and environmental attributes of sustainable agriculture development in Nepal. This paper scrutinizes various aspects of Nepal's agricultural development policy, including governance systems, bureaucratic and institutional structures, supportive policies and programs, and regulatory frameworks, to evaluate their compatibility with sustainable agriculture principles. The findings indicate a strong orientation of Nepal's agricultural development policy towards sustainability. Legislative, policy, and governance provisions serve as a foundation for steering the agricultural sector towards sustainable practices. However, despite these positive aspects, significant challenges remain, including the prevalence of traditional agricultural systems and constraints such as limited financial resources, technical expertise, and knowledge among farmers and smallholders. Overcoming these obstacles will require considerable efforts to achieve the desired outcomes in sustainable agriculture.

Keywords: Sustainable Agriculture Principles, Agriculture Development Policy, Policy Intervention, Sustainable Practices, Food Security, Agriculture Commercialization

1. Introduction

The advancement of agriculture in recent decades has played a pivotal role in ensuring food security, propelling economic growth, fostering overall economic development, countering climate change, and mitigating environmental degradation, ultimately contributing to the reduction of poverty in numerous developing countries. Research suggests that the implementation of well-considered policy measures is instrumental in addressing sustainable agriculture practices and enhancing commercial farming. This can be achieved through improvements in the value chain and trade linkages at local, national, and international levels. Governments worldwide have initiated diverse policy interventions aimed at promoting sustainable agricultural practices and uplifting the livelihoods of farmers. Typically, these interventions involve a comprehensive examination of various government policies and their impact on agricultural growth, sustainability, food security, rural development, and measures to alleviate poverty (OECD, 2020; UN, 2021).

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The agricultural development in developed countries from the 1960s to the 1990s demonstrated that the Malthusian theory of population became obsolete. During this period, the Green Revolution led to agricultural growth rates exceeding population growth rates (except in Sub-Saharan Africa and South Asia), driven by innovation and technological advancements (Brodt et al., 2011; Rose et al., 2021). Agricultural product prices remained stable, even declining, for nearly four decades post the Green Revolution in the 1960s (Meijerink & Roza, 2007). However, the liberalization trend in the 1990s, along with an increasingly interconnected global market and rapid technological advancements, led to a scenario where agricultural product prices dropped faster than yields increased. Consequently, the agriculture sector appeared less prioritized due to diminished profitability and the adverse impacts of the Green Revolution in Asia, marked by pesticide overuse, biodiversity losses, and subsequent pollution. During this period, many foreign investors redirected their investments from agriculture to more lucrative sectors, and donor organizations shifted focus from supporting agriculture to promoting pro-poor well-being and social infrastructure development, considering agriculture no longer the primary driver of economic growth (Meijerink & Roza, 2007; Djokoto et al., 2022). Once again, the drawbacks of the Green Revolution, coupled with challenges such as climate change, persistent global poverty, an escalating global food crisis, and increasing environmental issues, have brought the agenda of agriculture development back to the forefront since the beginning of the 21st century (CFS, 2022). Notably, both the United Nations (UN) and the World Bank (WB) acknowledged in a 2008 report that the agriculture sector plays a pivotal role, surpassing other economic sectors, in addressing challenges related to rural poverty reduction, global food crises, and environmental degradation.

The global food and agriculture system intricately intersects with the financial and energy markets. Excessive utilization of natural resources, including fossil fuels, forest resources, and water, has precipitated rapid environmental challenges and scarcities in ecosystems worldwide. The repercussions are particularly harsh for impoverished farmers in developing nations. Climate change has significantly altered farmers' calendars, and the substantial cost of living, closely entwined with food, fuel, health, climate, inequalities, and various practical threats, is a burden borne by the global community (CFS, 2022). In this context, the global community, recognizing the imperative to intervene for sustainability in the agriculture sector to achieve Sustainable Development Goals (SDGs) by 2030, is more crucial than ever. Nepal, a least developed country where agriculture forms the backbone of the economy and livelihoods constituting 60% of employment opportunities and contributing a significant 24% to the national economy (Neupane et al., 2023), has been identified as highly vulnerable to climate impact in the Himalayan region, emphasizing the necessity of embracing sustainable agriculture principles in the formulation of agriculture development policies.

Policy intervention in agriculture development in recent decades typically involves a thorough examination of various government policies and their impact on ensuring food security, propelling economic growth, fostering overall economic development, addressing sustainability concerns, promoting rural development, and reducing poverty in many developing countries. In the specific context of Nepal, the agriculture development policy emerges as the most effective tool to realize these goals. Supported by numerous policies and programs, Nepal's agriculture development policy

is dedicated to cultivating a sustainable commercial farming culture, fortifying supply-side capacity, addressing food crises, promoting social inclusion, and eradicating poverty by commercializing neglected and underutilized crop species available in the country (Joshi et al., 2020).

The prevailing global consensus emphasizes that the global food system falls short of providing adequate nutrition for everyone, primarily due to environmental degradation, biodiversity losses, climate change, limitations of conventional agricultural systems, and persistent issues of malnutrition and rural poverty (Wezel et al., 2020). The significance of sustainable agriculture has grown in recent decades, spurred by a multitude of serious global challenges. In Nepal, these global issues manifest in agricultural impacts such as soil degradation, water scarcity, increasing desertification, and resistance of weeds and insects to pesticides. Environmental consequences include a decline in pollinators, biodiversity losses, extreme weather events, climate change, nitrate pollution, emissions, and deforestation. Social ramifications encompass few incentives for farm work, insufficient food, and rising inequality. Economic outcomes involve yield gaps, agricultural productivity deficiencies, and inadequate livelihoods for local farmers and smallholders (Kolkowska, 2023).

Scientific, agricultural, and political discussions underscore the necessity of transforming the agriculture system to address existing challenges through the adoption of sustainable agriculture policies and practices. In this context, this paper aims to examine the extent of alignment of Nepal's Agriculture Development Policy with Sustainable Agriculture Development Principles. The scope of this study is confined to evaluating the alignment of Nepal's Agriculture Development Policy with principles of sustainable agriculture development practices. This assessment will be conducted by analyzing pertinent literature and examining policy documents that have been formulated and endorsed by Nepal.

2. Theoretical Framework

Theoretical frameworks guiding agricultural development are critical in addressing the challenges posed by sustainable agriculture development ideologies and practices. In the context of developing countries, the convergence of the United Nations Sustainable Development Goals, the donor community, and domestic agricultural policies plays a pivotal role in steering progress. The agriculture revolution of the 1960s, marked by technological innovations, increased fertilizer usage, mass production specialization, and supportive governmental policies, propelled global agriculture production. However, this achievement came at a cost, manifesting in multidimensional economic, social, and environmental consequences such as a decline in family farms, economic concentration, monoculture, social and gender inequalities, rural community disintegration, indigenous breeds and seeds losses, adverse impacts on biodiversity, and soil health degradation.

Addressing these local to global threats necessitates the adoption of sustainable agriculture practices that integrate three core components: economic gains, social equity, and environmental quality within agroecosystems and food systems (Thomas & Kevan, 1993). This integrated approach seeks to counterbalance the unintended consequences of past agricultural practices and aligns with the broader global agenda set by the publication of the 'Our Common Future' report, known as the Brundtland

Report, in 1987. The Brundtland Report highlighted contemporary global issues, including global warming, ozone layer threats, desertification, biodiversity loss, and socioeconomic complexities. The report underscored the interconnectedness of environmental problems in developed countries with survival challenges in developing nations, revealing global social, economic, and environmental challenges. This seminal report laid the foundation for sustainable agriculture principles as a major component of sustainable development, emphasizing the ability of people to build a prosperous, just, and secure future without compromising the needs of future generations (Our Common Future, 1987).

Wesley et al. (2000) emphasized the significant correlation between government policy intervention, factor endowments, agricultural development, trade patterns, and environmental policies. Agriculture, as outlined by Meijerink & Roza (2007), plays both traditional and modern roles. The traditional role involves direct market-mediated contributions such as providing food, creating jobs, earning export income, generating savings and funds for investment, and producing primary commodities for industrialization. In contrast, the modern role encompasses indirect non-commodities contributions like environmental services, poverty reduction, food security, social safety nets, crisis buffers, and social viability, requiring alignment with sustainable agriculture principles-oriented policies.

Siebrecht (2020) categorized obstacles to sustainable agriculture into theoretical, methodological, personal, and practical challenges. Overcoming these hurdles involves actions such as institutionalization, system development, education, and capacity building, and social and political support. Institutionalization through coordination and organization, support through economic, political, social, and environmental frameworks, education and capacity building for advisory services, and the development of assessments and tools are key strategies to overcome these challenges. Kharel et al. (2022) recommended Good Agriculture Practice (GAP) to materialize sustainability ideas, offering the potential to increase crop yields, reduce agrochemical use, enhance soil organic matter, and boost farmers' income. Five pathways for GAP policy intervention in Nepal were identified, focusing on technical capacity development, awareness building, soil fertility management strategies, extension programs, and market development for institutionalization.

The Organization for Economic Co-operation and Development (OECD, 2020) highlighted three primary categories of policy intervention to stimulate entrepreneurship development: improving institutional conditions, providing direct support to entrepreneurs, and fostering entrepreneurial ecosystems. Joshi (2023) cautioned against formal modernized commercial agriculture systems, advocating for policies supportive of genetic diversity, inclusion of marginalized groups, self-production systems, spices and microorganism-friendly practices, self-breeding/seeding systems, and ecosystem-friendly agriculture. Enhancing sustainability involves equipping smallholders and local farmers through training, financial support, appropriate technology, machinery use, and farming skills (Sikandar et al., 2021). Rose et al. (2021) highlighted the fourth generation in agriculture development, integrating new technology for social, economic, and environmental sustainability. Development assistance positively associates with sustainable agriculture practices, agriculture production, and poverty reduction (Sikandar et al., 2022). Bergquist et al. (2022) sought to scale

up policy interventions, ensuring food security and fighting global poverty through the provision of modern inputs, information, training, subsidies, and technology.

Ogutu et al. (2020) stressed the importance of enhancing market access for rural economic growth and nutrition-sensitive agriculture smallholders. Diversification in products offered for the market emerges as a strategy for alternative income sources. Khanal et al. (2023) examined the relationship between food safety, food security, sustainable food systems, awareness, and food policies in Nepal, highlighting the role of women and marginalized social groups. Recognizing the interconnectedness of global food security and the agriculture system, development cooperation becomes pivotal (CFS, 2022). Addressing ongoing food crises requires attention to multifaceted threats, including food, fuel, health, climate, inequalities, financial and energy markets. Development cooperation and donor attention should be directed towards sustainable agriculture development to mitigate the impacts of these challenges. Advancing sustainable agriculture development requires a holistic and collaborative approach. Theoretical frameworks, aligned with global agendas, effective government initiatives, and innovative practices, can address existing challenges faced by Nepal and foster economic gains, social equity, and environmental quality in the country. Through comprehensive and cooperative efforts, the evolving landscape of agriculture policy can be navigated to implement a sustainable agriculture practice for the social, economic, and environmental prosperity of the country.

3. Research Methodology

This study employs a qualitative method to assess the agriculture development policies of Nepal, focusing on governance systems, supporting policies, programs, and regulatory frameworks for sustainable agriculture development. Drawing on research theories, goals, and insights from literature reviews, the study utilizes the Mechanism Experiments and Policy Evaluation method (Congdon et al., 2016) to explore causal mechanisms (M) linking policies (P) to socioeconomic and environmental outcomes (Y) that the research adopts a three-step process: i) listing principles and reviewing policies, ii) developing policy frameworks, and iii) assessing their implementation. Sustainable agriculture principles are identified through literature searches, policy documents related to agriculture development in Nepal are collected, and the compatibility of these documents with sustainable agriculture principles is evaluated.

To list sustainable agriculture principles, relevant literature, and documents are searched using search engines and platforms like 'Google,' 'Google Scholar,' and 'Scopus.' Search terms include 'Sustainable Agriculture,' 'Sustainable Farming,' 'Organic Agriculture,' 'Agroecology,' 'Ecological Farming,' and 'Sustainable Agriculture Principles.' The search results yield 579 documents in Scopus with English language publications, covering various aspects of sustainable agriculture. For policy documents, the study acknowledges 54 Federal policies, strategies, and visions, 28 legislations/acts, 11 regulations, 39 directives/orders, 3 guidelines, and 44 procedures (compiled by Timsina et al., 2023). However, the paper focuses on analyzing 20 legislation provisions and 33 policy provisions. The key outcome variables encompass economic, social, and environmental attributes of sustainable agriculture development in Nepal. To capture these attributes, the analysis includes agricultural production and productivity, diversification, technology adoption, infrastructure development,

local capacity-building, subsidies, price support programs, environmental and climate-resilient initiatives, extension services, natural resource management, livelihood improvement, and gender and social inclusion. The study also discusses the existing framework for cross-cutting issues and overall policy provisions, employing descriptive analysis.

4. Results

4.1 Sustainable Agriculture Principles

The definition and principles of sustainable agriculture do not constitute a singular, rigid statement or set of statements. Instead, they represent a dynamic and continuously evolving multidisciplinary understanding and practical guidelines driven by contemporary issues, values, perspectives, and practices aimed at enhancing economic, social, and environmental components. These principles stem from the concept of sustainability, which emphasizes a balance among economic prosperity, social equity, and environmental protection, commonly referred to as sustainable development.

Examining the literature, sustainable development is characterized by its focus on the interdependence and interconnectedness of social, economic, and environmental systems. It warns against overconsumption, resource depletion, and the imbalance between economic growth and environmental degradation. The advocacy for preserving natural capital, maintaining automated ecosystems, and ensuring benefits for future generations is prominent. The shift towards a green economy, integrating high environmental quality into economic decision-making, is encouraged. Furthermore, a preference is expressed for a more equitable and ecologically sustainable society over the scale and intensity of production and consumption. The emphasis is on limiting the use of non-renewable resources and energies, promoting efficient use, and achieving sustainability through rationality, innovations, and the application of science and technology while caring for the future with a focus on maintaining a healthy ecosystem. Addressing these aspects involves institutional concerns, governance secured by the political system, and collective efforts across various systems, including the international, political, administrative, economic, social, environmental, production, and technological systems. The core theme of sustainable agriculture reflects holistic transformative practices based on scholarly contributions (Thomas & Kevan, 1993; Lichtfouse, et al., 2009; Kolkowska, 2023) which can be outlined:

- Agroecology: which fosters resilient farming systems and prioritizes biodiversity, nutrient recycling, and natural pest management;
- Empowering agroforestry: integrating trees, crops, and livestock to meet food demands and support soil health, fertility, water management, and habitat for beneficial organisms;
- Precision Farming: merging rational agricultural practices with innovative technology to minimize waste, improve resource efficiency, and enhance environmental quality;
- Permaculture: designing agriculture and food production systems in harmony with nature to encourage resilience, diversity, and self-sufficiency in natural ecosystems;
- Community Empowerment: promoting sustainable farming practices to empower local

communities with access to nutritious foods, economic opportunities, and inclusive production and food systems;

- **Economic Viability:** offering opportunities for cost savings, reducing dependence on expensive external inputs, and balancing profitability with long-term sustainability;
- **Institutional Actions and Governance:** encompassing collaborative initiatives from the global to local level, policy interventions, institutional support, political commitments, research and innovation, training and education, cross-sector collaboration, financial and credit facilities, transparency, traceability, regenerative practices, and nature-based solutions.

With the extensive review of the literature (Geng, et al., 1990; Caporal & Onnis, 1992; Thomas & Kevan, 1993; Saifi & Drake, 2008; Borello, et Al., 2016; Therond, et al., 2017; Wezel, et.al., 2020; Kolkowska, 2023), policy documents, and reports of FAO (FAO, 2018), the principles for transforming to sustainable agriculture and food systems are constructed as below:

Table 1: Sustainable Agriculture Principles

S.N.	Principles	Components
1.	Diversification	Conserving, protecting, and enhancing the natural resources such as water, soil, and air quality and biodiversity (both flora and fauna) to ensure food security and nutrition.
2.	Cocreation and sharing of Knowledge	Innovative research, education, training, and knowledge-sharing of agriculture innovations through a participatory approach to cope the local and practical issues or challenges.
3.	Synergy building	Functional interconnection between agriculture production supports, food systems, and multiple ecosystem services that lead to greater resource use efficiency and resilience.
4.	Resource-use efficiency	Produce more using fewer external resources through improvement in innovative agroecological practices and enhancement in natural biological processes.
5.	Recycling within systems	More agricultural products and health gain with fewer economic and environmental costs by using renewable resources and recycling of nutrients, biomass, and water within the production system.
6.	Resilience within ecosystem	Enhancing resilience of people, communities, and ecosystems by maintenance of diversified agroecological systems for sustainable food and agriculture.
7.	Respect human and social values	Protection and improvement of rural livelihoods, social and gender inclusiveness, socioeconomic equity, and social well-being for agriculture workers, farmers, and smallholders.
8.	Food and nutrition security	Consumption of culturally appropriate food and diet by maintaining the health of the ecosystem and supporting healthy, diversified, and traditional foods.
9.	Responsible governance	Responsible and efficient institutional and governance mechanisms at different levels from local to global scale with scientific, political, administrative, professional, and practical commitments.

S.N.	Principles	Components
10	Circular economy	Innovative economic, social, and environmental solidarity with foundational solutions of all other principles including the value chain from producers to consumers for ensuring sustainable food and agriculture systems.

The sustainable principles can be applied varyingly depending on issues, preferential, spatial and country context.

4.2 Agriculture policy of Nepal

Agricultural development policy of Nepal encompasses a range of related measures, including policies, acts, strategies, visions, programs, directives, procedures, and regulations designed to support and promote agriculture development in the country. Agriculture policy intervention involves the several policy, legislative, and governance provisions for the agriculture development including increasing agriculture production and productivity, agriculture diversification and commercialization, agriculture markets and value chain development, poverty reduction, food and nutritional security, social and gender inclusion, resolving conflicts between agriculture and natural environment, efficient governance, climate change resilience, and biodiversity and ecosystem friendly agriculture and food systems.

The policy framework consists of three main components (Khanal, et al., 2020; Timsina, 2023): (1) legislations: acts, regulations, and rules; (2) Policies: plans, policies, directives, visions, strategies, guidelines, programs, procedures, government decisions, and similar documents; and (3) governance provisions: institutional and governance arrangements.

Following agriculture development related legislations are outlined

Table 2: Agriculture Development Related Legislations in Nepal

S.N.	Legislations	Codes
1	Constitution of Nepal 2015	L1
2	Animal Health and Livestock Service Act 1998 and Regulation 1999	L2
3	Chemical Fertilizer Control Order 1999	L3
4	Competition Promotion and Market Protection Act 2007	L4
5	Contract Act 2000	L5
6	Cooperative Act 1992(Amended 2000)	L6
7	Food Act 1967 and National Food Corporation Regulation 1997	L7
8	Forest Act 1993 (amended 1999) and Regulation 1995	L8
9	Land Acquisition Act 1977 (amended 2010)	L9
10	Land Survey and Measurement Act 1963 (10th amendment 2010) and regulation 2001,	L10
11	Land Act and Regulation 1964 (Amended 2015)	L11
12	Land Revenue Act 1978 (amended 1998) and regulation 1979	L12
13	Local Government Operation Act 2017	L13
14	Nepal Standard (certification mark) Act 1980	L14

S.N.	Legislations	Codes
15	Pesticide Act 1991 and Regulation 1993	L15
16	Plant Protection Act 2007	L16
17	Seed Act 1988 and Regulation 1997	L17
18	Soil and Watershed Conservation Act 1982 (amended 2010)	L18
19	Water Resource Act 1992 and Irrigation Regulation 2000	L19
20	Value Added Tax Act 1995 and Regulation 1996	L20

The following agriculture development-related policy provisions are outlined

Table 3: Agriculture Development-related Policies in Nepal

S.N.	Policies	Codes
1	Agri-Business Promotion Policy 2006	P1
2	Agricultural Biodiversity Policy 2007	P2
3	Agriculture Commercialization Policy 2007	P3
4	Agriculture Development Strategy 2015-2035	P4
5	Agriculture Extension Strategy 2006	P5
6	Agriculture Mechanization Promotion Policy 2014	P6
7	Agriculture Perspective Plan 1995-2015	P7
8	Birds Rearing Policy 2011	P8
9	Breeding Policy 2011	P9
10	Climate Change Policy 2019	P10
11	Dairy Development Policy 2007	P11
12	Environment-Friendly Local Governance Framework 2013	P12
13	Forestry Sector Policy 2000	P13
14	Intellectual Property Policy 2017	P14
15	Irrigation Policy 2003	P15
16	Land Use Policy 2015	P16
17	Local Adaptation Plan of Action 2011	P17
18	National Adaptation Plan of Action 2010	P18
19	National Agriculture Policy 2004	P19
20	National Coffee Policy 2004	P20
21	National Cooperative Policy 2012	P21
22	National Fertilizer Policy 2002	P22
23	National Seeds Policy 2000	P23
24	National Seeds Vision 2013-2025	P24
25	National Standards of Organic Agriculture Production and Processing Policy 2007	P25
26	National Technical Standard for Organic Agriculture System 2008	P26
27	Nutrition Policy and Strategy 2008	P27

S.N.	Policies	Codes
28	Prime Minister Agriculture Modernization Project 2015-2025	P28
29	Rangeland Policy 2012	P29
30	The Fifteenth National Plan 2019-2024	P30
31	Trade Integrated Strategy 2010	P31
32	Trade Policy 2009	P32
33	Zero Hunger Challenge National Action Plan 2016-2025	P33

Under the governance provisions, the constitution of Nepal in 2015 has ensured the establishment of three tiers of government: federal, provincial, and local. Operating at various levels, entities such as the Ministry of Agriculture and Livestock Development (MOALD), Department of Agriculture (DOA), National Agriculture Research Council (NARC), Institute of Agriculture and Animal Science (IAAS), Agriculture and Forestry University (AFU), Provincial Agriculture Development Offices, Local Level Offices, and Community-Based Organizations play pivotal roles in driving agricultural development across Nepal, spanning from the central level to the local level.

4.3 Alignment of Agriculture policy of Nepal with sustainable principles

The assessment of the agricultural development policy of Nepal, which encompasses various policy, legislative, and governance provisions, reveals an alignment with the characteristics of sustainable agriculture principles.

Table 4: Alignment of Agriculture policy of Nepal with Sustainable Principles of Agriculture

S.N.	Sustainability Characteristics	Effective Legislations (L) and Policies (P)
1	Agriculture growth and food production	(L3) (L5) (L7) (L8) (L13) (L15) (L17) (L18) (L19) (P2) (P4) (P6) (P7) (P8) (P9) (P13) (P15) (P21) (P22) (P23) (P24) (P28) (P29) (P32)
2	Climate change adoption and environmental conservation	(L3) (L8) (L13) (L15) (L16) (P2) (P10) (P12) (P17) (P18) (P29)
3	Commercial production and diversification	(L2) (L5) (L6) (L14) (L16) (P1) (P3) (P4) (P7) (P8) (P9) (P11) (P23) (P24) (P19) (P20) (P21) (P25) (P28) (P29)
4	Credit, finance, and insurance	(L6) (L13) (P15) (P21)
5	Export promotion and food dependency	(L1) (L4) (L14) (L16) (L20) (P1) (P3) (P4) (P11) (P20) (P28) (P30) (P31) (P32)
6	Farm Mechanization, modernization, and commercialization	(L2) (L3) (L4) (L11) (L14) (P4) (P14) (P19) (P24) (P28) (P30)
7	Improved seeds and inputs	(L2) (L3) (L4) (L14) (L15) (L16) (L17) (P1) (P2) (P3) (P4) (P9) (P14) (P19) (P21) (P22) (P23) (P24)
8	Improving labour productivity	(L2) (P4) (P5) (P21) (P28) (P32)
9	Infrastructure development	(L13) (L19) (P1) (P7) (P4) (P14) (P15) (P28)
10	Institutions and governance	(L1) (L13) (L20) (P4) (P5) (P12) (P14) (P19) (P28) (P30)
11	Land reform, land use, soil management, and soil health	(L9) (L10) (L11) (L12) (P3) (P7) (P16) (P19)
12	Natural resource management	(L9) (L10) (L11) (L12) (P3) (P7) (P16) (P19)
13	Quality of food and nutrition	(L3) (L7) (L14) (L15) (P11) (P21) (P25) (P26) (P27) (P32)

S.N.	Sustainability Characteristics	Effective Legislations (L) and Policies (P)
14	Social and gender inclusion, and community-based stakeholders' participation	(L1) (L4) (L6) (L9) (L11) (L13) (P4) (P5) (P16) (P17) (P19) (P21) (P28) (P33)
15	Value chain and market development	(L2) (L4) (L7) (L14) (P1) (P3) (P4) (P7) (P14) (P19) (P20) (P25) (P26) (P28)

Among all these legislations and policies, Agriculture Development Strategy 2015-2035 has been taken into account as a milestone for transforming agriculture from subsistence to sustainable in Nepal. The success of its implementation relies heavily on robust political commitment and dedicated leadership. Crafted as a blueprint for policy measures, the Agriculture Development Strategy (ADS) envisions a self-reliant, sustainable, competitive, and inclusive agriculture development in Nepal, aiming for heightened economic growth, improved livelihoods, and fortified food and nutrition security.

The ADS comprehensively covers various domains, including agriculture production and growth, services for agriculture development, sustainability practices, and flagship programs. Agriculture production and growth span crops, livestock, fisheries, forestry, horticulture, and byproduct production and growth. Services for agriculture development encompass processing, storage, trade, marketing, supply chain, transportation and logistics, finance, governance, research, innovation, technology, and extension services. Sustainability practices extend beyond mere product and service considerations, encompassing organic agriculture, product diversification, climate resilience, equitable income distribution, social and gender inclusiveness, rural livelihood improvement, farmers' rights, animal rights, biodiversity, water resources, agroforestry, ecosystem, environment, and pollution, ensuring both socioeconomic and environmental sustainability. Flagship programs include initiatives targeting food and nutrition security, poverty reduction, agriculture diversification, agriculture decentralization, technological diffusion and improvement, human resource development, infrastructure development, and agro-entrepreneurship.

The government of Nepal, adopting a contemporary approach, collaborates with the donor community and the private sector to infuse innovative, sustainable, and regenerative concepts and practices into the agricultural sector. The examination of agricultural policy involves a broad spectrum of elements, including related policies, laws, and regulations addressing facets such as land use systems, agricultural commercialization, production, marketing, product/farm diversity, cooperative farming, circular agricultural economy, sustainability, and inclusiveness in agricultural practices. Key areas emphasized for the modernization of agriculture encompass research, education, and extension, covering subjects such as agri-business and entrepreneurship development, commercialization, integrated agricultural ecosystems, climate-smart and organic farming, genetic improvement of crops and livestock, technology innovation and dissemination, as well as science-based knowledge and extension practices.

The development of agriculture policy and legislative provisions incorporate crucial aspects such as land management (including classification, acquisition, and redistribution), infrastructure development (encompassing road and transport, market infrastructure, and irrigation), modern

agriculture inputs (seeds, fertilizer, and pesticides), and trade (covering supply chain, import, and export of agricultural products). Governance and institutions, including the Ministry of Agriculture and Livestock Development (MOALD), Department of Agriculture (DOA), National Agriculture Research Council (NARC), Institute of Agriculture and Animal Science (IAAS), Agriculture and Forestry University (AFU), Provincial Agriculture Development Offices, Local Level Offices, and Community-Based Organizations, play pivotal roles in achieving the overarching goals.

5. Discussion

The evolution of Nepal's agricultural development policy appears to be closely entwined with shifts in the country's political landscape (Mishra & Paudel, 2023). Prior to the 1990s, Nepal witnessed predominant state intervention and controls in its agricultural development. The advent of the multiparty system in the 1990s marked a pivotal turning point, with the agricultural policy now emphasizing economic liberalization to foster the commercial private sector and cooperative-led agriculture. This shift incorporated key considerations such as food and nutrition security, self-sufficiency, social and gender inclusion, comparative advantage, competitiveness, agrobiodiversity conservation, climate change adaptation, and sustainability. Practical achievements were hindered by political conflicts until the 2000s and also the dismantling of state control vertical coordination (VC) in agricultural chains, however, led to disruptions in the supply of inputs and credits to smallholders, resulting in marginalized farmers being ensnared in poverty (Meijerink & Roza, 2007).

The establishment of federalism and a three-tiered government system in 2015 marked a notable transformation in Nepal's agricultural policy. This shift embraced a more transformative, diversified, localized, commercialized, and sustainable approach, fostering agribusiness and promoting supply chain development for agricultural transformation. This shift was encapsulated in the launch of the Agriculture Development Strategy 2015-2035. While most policy documents emphasize boosting agricultural production and productivity, only a limited number address crucial aspects of sustainable agriculture principles such as the enhancement of climate-resilient varieties, breed advancements, technological improvements, and climate-smart innovation for modern high-tech agriculture. Often overlooked are critical concerns like nutritional security, effective natural resource management, and the impacts of climate change. The policy documents encompass maintaining seed standards, ensuring quality control in seed production, processing, storage, packaging, and distribution. Collaborative efforts involving central-level gene banks, provincial community seed banks, and seed laboratories contribute to the protection and improvement of indigenous seeds.

The agricultural development and land use policy in Nepal are closely aligned with the Sustainable Development Goals (SDGs), notably goal number two – food security (Timilsina et al., 2019). Guided by a sustainable agriculture production system, the policy aims to address the increasing food demand in the country, leveraging the comparative advantage of export-led agricultural products. Recent years have witnessed significant changes in the land use pattern for crops, driven by factors such as massive land fragmentation, rapid urbanization, increasing fallow lands, and absentee landlordism. The policy objectives focus on contributing to food security and poverty alleviation through high and sustainable economic growth, competitive agricultural systems,

increased productivity, and competitiveness in regional and global markets. Emphasizing integrated issues like irrigation, fertilizer, seeds, technology, energy, and road networks, the policy aims to foster agricultural growth, generate employment, and reduce poverty.

The policy framework should encompass the development of climate-smart technology and infrastructure, incorporating effective irrigation practices, soil health management, and the efficient distribution of seeds and fertilizers. It should also address the establishment of storage facilities, networks, transportation, and the mechanization of processes within the agricultural activities. An effective policy must provide a comprehensive outline of frameworks, governing structures, mechanisms, collaborations, inclusiveness, sustainable, and governance required to deliver agricultural services at the local levels, catering specifically to smallholders and farmers. The promotion of public-private partnerships, multi-stakeholder platforms, and necessary collaborations among different stakeholders is crucial for leveraging resources, sharing knowledge, and scaling up innovative solutions (Neupane et al., 2023).

Despite the existing agriculture development policy, the commercialization of agriculture relies on various components (Upreti, 2023). These components encompass irrigation infrastructure development, bio-based fertilizer manufacturing industries, organic farming, establishment of post-harvest storages, cold storages, and processing units, as well as the creation of marketing structures, trade networks, and supply chains. This includes the flow of agriculture products, inputs, energies, machines, and other commodities. Additionally, climate-smart technology, information technology, and the development of both virtual and physical networks, along with institutions and governance, play integral roles in the successful commercialization of the agriculture sector.

Targeted value chain interventions have proven effective in opening access to markets for smallholders, particularly local farmers. This has resulted in increased sales of their products and a subsequent rise in income from agriculture, ultimately contributing to rural poverty reduction (Kafle et al., 2022). Gender and marginalized group inclusion, along with environmental considerations, significantly impact the commercialization of the agriculture sector (Jaleta et al., 2009). Enhancing agricultural productivity, promoting sustainable practices, and reducing transaction costs among small-scale producers, particularly women and minority groups, can significantly contribute to poverty alleviation (Songsermsawas et al., 2023).

Nepal has ratified the International Treaty on Plant Genetic Resources for Food and Agriculture in 2004 and the Nagoya Convention in 2010. This endorsement supports the establishment of a foundational framework for facilitating access to agricultural plant genetic resources, conservation, sustainable utilization, and the equitable sharing of biodiversity resources. The Constitution of Nepal recognizes intellectual property rights as a fundamental right, with the Intellectual Property Policy of 2017 encompassing intellectual activities, including those related to the agriculture sector. This policy acknowledges the practices of indigenous people, safeguards traditional knowledge, geographical indications, plant variety protection, and promotes local innovation. It also underscores the importance of intellectual property audits, valuation methods, and licensing (Panthee et al., 2023).

The commercial utilization and sale of all indigenous landraces, genetic base genotypes, seeds, and breeds in Nepal necessitate testing and registration with the National Seed Board of Nepal (Joshi, 2023). In Nepal's agricultural development policy documents and legal frameworks, there is a prioritization of modernizing agriculture through exotic resources, while native landraces, technology, and knowledge, which could be globally competitive, receive less emphasis. The positive association between crop diversification and farm productivity has been established (Bhattarai et al., 2023). The principles of food security, including availability, accessibility, and affordability, are robustly incorporated into agriculture development policies and practices.

Policy documents highlight the significance of research, extension, and education for capacity building, input facilitation, enhancing agriculture productivity, and poverty alleviation (Tiwari et al., 2023). The federal (Central) government is responsible for agriculture research functions, while provincial governments oversee technical and resource management functions through directorates, laboratories, farms, and agriculture business promotion and training centers. The Constitution of Nepal entrusts judicial and executive powers to local governments, making them responsible for service delivery to the general populace, including agriculture service delivery to farmers. Local governments are in a transition phase to align institutional and legal policies, leading to improved services for beneficiaries.

Three critical areas of public (farmers') demands include infrastructure development for basic services, the provision of quality extensions from experts, and the prioritization of the agriculture sector (Jaisi et al., 2023). Recognizing local governments as immediate entities for agricultural service delivery, the study underscores the need to enhance municipal capacity to achieve intended goals. Although the institutional mechanism is currently weak, there is significant improvement underway. Local governments bear the responsibility of providing various goods and services, plans and policies, education, training, advice, and other necessary facilities to citizens (Dahal et al., 2020). The policy requires intervention to slow the process of governance, incentives to engage working-aged people and improve the supply chain from ward level to international level.

The role of cooperatives in agriculture production and marketing in Nepal holds immense value as they provide services, information, technology, and credit facilities to farmers and smallholders. Cooperatives have significantly contributed to the development of agriculture by fostering collaboration between the government, cooperatives, and cooperative members (agricultural households, communities, and farmers). This collaboration involves launching capacity-building programs, facilitating the commercialization of agribusiness, improving access to credit markets, and promoting value chain development and market access. Overall, cooperatives contribute to sustainable agriculture development (Bhattarai & Pandit, 2023). Their considerations encompass factors such as crop yields and income of farmers, cooperative-to-cooperative marketing, information dissemination, adherence to standard product pricing, access to credits, post-harvest support, development of product specialization, agriculture insurance, and entrepreneurship development.

Despite governmental efforts to foster agricultural development in Nepal since the 1960s, progress has been consistently weak. The policymaking process in the country faces numerous challenges,

including agenda manipulation, weak policy analysis, inefficiency in drafting committees due to bureaucratic shuffles, and undefined committee roles. Rent-seeking behaviours and collusion further hinder policy discussions and modifications. The development and implementation of such policies are closely tied to the ideologies of ruling governments, and political interests often curtail economic growth (Shrestha et al., 2021).

Agricultural development in Nepal is constrained by various gaps, including changing political and administrative structures, contradictory legislative provisions, low institutional capacity, weak coordination among key stakeholders, limited investment and credit facilities, low innovation and technology know-how, and restricted markets for inputs, products, and services (Khanal et al., 2020). This shift results in an abundance of these products, causing a surplus supply at lower prices and revealing a low impact on food security progress (Kafle et al., 2022).

Furthermore, poor land management practices in Nepal adversely affect soil quality, crop production, and sustainable agricultural development practices (Timilsina et al., 2019; Rai et al., 2020). Poudel and Paudel (2023) investigated the impact of microfinance institutions (MFIs) on agricultural output, emphasizing the need for improved mechanization in agriculture, its determinants on both supply and demand sides, and its overall impact on production and economic transformation in Nepal (Takeshima, 2017). Despite policy measures aimed at modernization, a significant portion of agriculture in Nepal remains traditional, leading to low productivity and economic challenges. Unemployment issues persist due to the prevalence of traditional farming methods, hindering the country's progress towards modernized agriculture and rural development goals (Shahi, 2022). Agricultural diversification is crucial for efficient resource use, minimizing wastage, fostering competition, and generating remunerative gains (Kansiime et al., 2018). Despite fewer family labor and land resources, households engaged in off-farm specialized activities exhibit higher production efficiency, resulting in spillover effects on income, input use, and skill improvement.

Moreover, external support plays a crucial role in facilitating the adoption and commercialization of locally derived, cost-effective solutions with a positive socio-economic and environmental impacts, particularly in the context of rural poverty alleviation (Yadav & Goyal, 2015). Donors exert substantial influence in shaping the policy-making landscape not only in Nepal but also in other South Asian countries, aligning policies with their priorities (Gautam and Pokhrel, 2011). UNDP Nepal and other donor community are actively involved in bolstering the technical capacities of the Ministry of Agriculture Development and other pertinent ministries for institutionalize the sustainable practices. This support aims to facilitate the seamless integration of climate change considerations into sustainable agricultural development efforts (UNDAF, 2016).

6. Conclusion

By scrutinizing existing policy documents, it becomes evident that Nepal is actively navigating transformative pathways toward sustainable agricultural development principles. Aligned closely with the Sustainable Development Goals (SDGs), Nepal's agricultural development policy places paramount importance on goal number two, emphasizing the enhancement of food security through

increased agricultural production, productivity, and diversity within agroecological systems. The primary objective is to meet the surging demand for food in the country while capitalizing on the comparative advantage of export-oriented agricultural products. The overarching framework of the agricultural development policy revolves around establishing a sustainable agriculture production system. This system emphasizes agroecology, integrating innovative technology, promoting nature-based approaches, building climate resilience, fostering circular economic practices, ensuring social justice, enhancing livelihoods, and implementing various sustainable measures. These efforts collectively aim to achieve sustainable agri-food sufficiency, safety, and sovereignty, contributing to the creation of robust agroecosystems and livelihood systems.

However, the study reveals that Nepal currently grapples with challenges such as heavy reliance on synthetic chemicals, constrained modernization of agriculture, simplistic practices, resource degradation, erosion of indigenous knowledge and biodiversity, environmental pollution, land fragmentation, disruptions in self-reliant livelihood systems, and a decline in food sovereignty. Despite policy measures geared towards modernization and significant contribution of agriculture to the national economy, a considerable portion remains stuck in traditional practices, resulting in low farm productivity and economic challenges. The study identifies major crises in the food and agriculture systems, including neglect of rural farmers and smallholders, implications of subsidy use, soil quality degradation, negative effects of chemicals, increasing pressure on forests, and desertification of agricultural lands. Emphasizing technological change and investment in human resource development as pivotal, the study underscores the need for addressing contemporary challenges such as food and nutrition security, sustainable natural resource management, climate-resilient measures, biodiversity conservation, and the maintenance of a sustainable ecosystem in the current agricultural policy landscape. This necessitates the integration of agriculture investment, innovative technology, human resource development, and robust institutional frameworks and governance.

Contribution

Kafle led the research including overall design of the study, literature survey, development of research questions and methodology, data analysis, overall drafting the manuscripts, and reviewing and finalizing the paper. Panta participated in the research including collection of policy documents, data collection, reviewing and finalizing the paper, and arrangement for research paper for publication.

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