INDUSTRIAL POLICY
A Scientific Journal Dedicated to Economic Development and Industrial Policy

OPEN ACCESS

Dissertation

www.indpol.org

DOI: 10.61192/indpol.1352332

IndPol, 2023; 3(2): 27-38

Enhancing Labor Productivity via Local Agro-Governance of Nepal

Kattel Dipesh[a]

[a]Ministry of Federal Affair and General Administration, Singhadurbar, Kathmandu, Nepal, ORCD: 0009-0003-4161-6573

Abstract

Agriculture is vital for Nepal's livelihoods and economy, contributing approximately 27% to the national gross domestic product and acting as a buffer during economic downturns. Nepalese agriculture, with a rich history, faces challenges of declining profitability, causing farming abandonment, especially among the youth, despite local policy efforts. Addressing issues of unprofitability, land degradation, input inadequacy, and low productivity requires targeted agricultural research and policy reforms. Sustainable agro-practices, resilience, and achieving socio-economic indices are current community demands. This quantitative research design includes various constructs of agro-production and local agro-governance, estimating labor productivity through multiple regression. The research results revealed the importance of agro-policies focusing on farm inputs, agriculture extension, and governance enrichment. Minimizing policy shocks and executing labor-extensive short-term and long-term strategies are crucial for comprehensive agro-development.

Article History
Received August 30, 2023
Accepted October 14, 2023

Keywords
Farm Inputs, Land-Labor Ratio, Labor Productivity, Local Agro-Governance, Sustainable Agriculture

JEL Codes
Q01, Q15, Q16, Q18, P43

1. Introduction

The Nepalese agrarian economy supports the livelihoods of 29,164,578 (males 48.9% and females 51.1%), among them approximately 18.7% are still under the poverty line (NSO, 2023). In the Himalayan foothills and rural areas, agriculture remains a key sector providing employment for approximately 65% of the population. Although agriculture is a major economic pillar, its productivity has not been enhanced yet. Stagnant and disjointed governance throughout the pre-and post-farming activities leads to diminished benefits for the people. In this instance, local governance may create an institutional bricolage among agriculture productivity, socio-economic indices of people, and environmental sustainability. Despite of rich agricultural potential, it faces numerous challenges in its pursuit of agricultural sustainability (Gurung, 2012). The poor governance, low productivity, limited access to farm inputs and resources, and global warming and changing climate, have hindered progress in this sector (MoALD, 2020).

It is evident that agro-growth is the precursor to an unprecedented reduction in poverty and a major engine of pro-poor growth (Gauchan, 2008). Agro-rural accommodating policies and successful local governance are crucial for rural development in Nepal (Chaudhary, 2018). These contexts are closely aligned with the prevailing constitutional provisions, legal frameworks, and systems in place. As the existing unitary governance transformed into three tiers (the federation, provinces, and local levels) after the promulgation of the new constitution in 2015; the restructuring of the state provided opportunities to ensure sustainable and resilient practices for improving agro-governance even from local levels (FIARCC, 2016). Thus, local governance structures have emerged as promising avenues for addressing the issues of overall agro-development.

In the realm of agricultural development, for decades, it has emphasized the formulation and implementation of agriculture policies to enhance agriculture productivity and growth (Abro et al., 2014; Mueller & Mueller, 2016), agriculture diversification and commercialization (Pradhanang et al., 2015), poverty reduction through agricultural development (World Bank, 2016; Corral et al.,

CONTACT Kattel Dipesh katteldipes@gmail.com

2017; Ivanic & Martin, 2018), agriculture development to resolve conflicts (Singh, 2012; Tanentzap et al., 2015; Milczarek Andrzejewska et al., 2018), efficient governance for agricultural development (Cumming, 2016; Saint et al., 2017; Sidibé et al., 2018), and environment-friendly and climate change-resilient agriculture (Blanco et al., 2017; Mittenzwei et al., 2017; Babu et al., 2018; Cortignani & Dono, 2018).

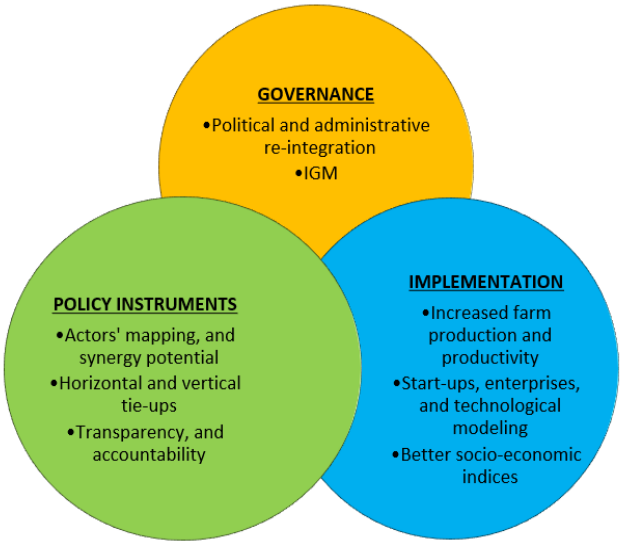
Likewise, numerous researchers have made significant contributions to the study of various perspectives on agricultural development in Nepal: Devkota and Upadhyay (2013) studied agricultural productivity and poverty reduction, and GC et al. (2019) analyzed the determinants of farm mechanization. Basnet (2010a & 2010b); Upreti (2010); Bedari et al., (2020); and Thapa et al. (2020) focused their study on multiple facets of rice production and productivity in Nepal. Likewise, Bhandari et al. (2017) reviewed the policies of paddy production, while Sigdel et al. (2022a & 2022b) analyzed the use of ICT tools and mechanization in paddy production. Khanal et al. (2020); Tamang et al. (2020); and Bishwakarma, et al. (2021) reviewed the agricultural functions, institutions, and policies in the context of sectoral restructuring. Such endeavors have proven to be notably beneficial for advancing agricultural development in Nepal.

Agriculture development is multi-dimensional and multi-sectoral (Swinnen, 2018), including production (crops, livestock, and horticulture) and value addition and trading (processing, distribution, and trading of agricultural goods) (MoALD, 2021). As agriculture plays a crucial role in national development; Nepal began planned development efforts after a democratic government was established in 1951 (Khanal et al., 2020). Nepal's policies often followed a top-down; supply-driven model: emphasizing technology's input-output linkage rather than involving local communities and stakeholders through a bottom-up approach. Thus, changes in the policy provisions (ADB, 2013), limited capacity for implementation (GoN/FAO, 2013), overlapping policies causing conflict in ownership and accountability, incomplete policy design, and supporting laws are some governance constraints.

The decentralized agricultural research and extension service, community-based Agriculture Service Center (ASC), efficient and sustainable land use (tenacity right, fragmentation, and haphazard use), expansion, and improvement of irrigation and access to improved farm inputs and labor force shortage are major issues. Due to the subsistence farming approach and involvement of farmers with small holdings, productivity is significantly low: the significant gap in the sectors compared to current and potential agro-production demands productivity enhancement, and structural reforms (MoALD, 2020). The whole agroecological mapping of the country is yet to be done (Khanal et al., 2020). Despite multi-fold efforts, the result we are getting is the stagnation of agricultural development (Devkota & Upadhyay, 2013). Although the efforts made for the overall development of agriculture seem appreciable, several facets need to be improved.

Agro-governance is a holistic approach involving economic benefits, environmental preservation, and sustainable agriculture practices; prioritized policy execution, public-private partnerships, entrepreneurship and investment climate, farm inputs, subsidies and extension services are essential for its enhancement. Similarly, sustainable agriculture gives equal weight to environmental, and socio-economic concerns (Brodt et al., 2011). The juxtaposition of agriculture development, sustainability, and agro-governance seems more challenging in Nepal. Thus, horizontal and vertical tie-up and collaboration among various agencies are inevitable. The intergovernmental management (IGM), policy instruments, and program implementation in the Nepalese milieu can be visually represented through a symbolic schema (Figure 1). This illustrates an inclusive framework for understanding how these elements interact and work together toward achieving common goals in the newly federalized context.

Figure 1. Optimal Coherence for Output



Source: Authors' depiction based on the enacted laws, and pertinent literature

The general necessity of food grains (rice, maize, wheat, millet, buckwheat, barley) per year is 181 kg per person in Nepal, but the average consumption is approximately 137 kg (MoALD, 2022). The current data also shows that rice holds a major proportion of consumption (approximately 121 kg per person per year); and, there is a significant deficit. Due to rice being the predominant staple food, its consumption deficits underscore the urgent need to enhance its productivity. The government enacted various policies that have given impetus to the promotion of paddy production and productivity (Bhandari et al., 2017). Despite the planned development

efforts in agriculture for decades, tangible achievements in paddy production and productivity have not been achieved. The rice production system has been facing serious constraints including declining yields, resource depletion, limited crop diversity, conversion of food to fuel (bio-diesel), urbanization, climate change, labor shortages, gender conflicts, institutional constraints, high food prices, reduced research and development investment, and environmental pollution. (Basnet, 2010b). Thus, studying labor productivity in the case of paddy production holds significant importance in agricultural sustainability and improving livelihoods in ecologically diverse rural mid-hills of Nepal.

However, the potential benefits of local governance in enhancing agriculture productivity are widely acknowledged, and there remains a paucity of empirical research on the new local governance structure in Nepal. This research seeks to fill this critical gap by examining the specific ways in which local governance can influence and enhance labor productivity. It employs a quantitative approach to examine the multiple facets of agro-production and local agro-governance, with a specific focus on enhancing labor productivity in paddy production. Also, assessing the perception and satisfaction levels of farmers regarding the functional delivery by the local government holds paramount significance. On the other hand, it bridges research gaps and provides pragmatic solutions for policymakers, local communities, and stakeholders in shaping the local agricultural landscape of Nepal.

To achieve these objectives, this paper is organized as follows: In the next section, materials, data collection, and research methodology are explained. Following that, a description of variables and coding details for the quantitative study is presented. In the subsequent sections, the findings are presented, and their implications are discussed. Finally, key findings are concluded with their broader implications.

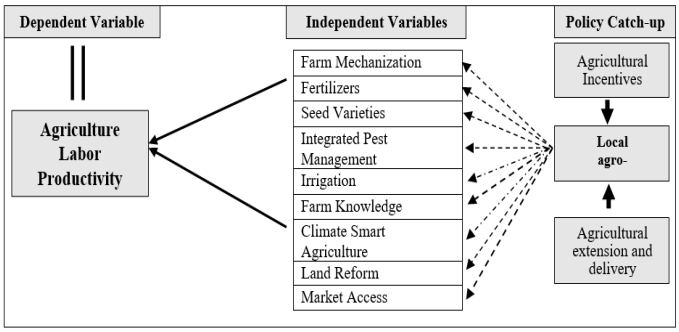
2. Materials and Methods

Tamakoshi Rural Municipality in Dolakha, a rural mid-hill region of Nepal with a temperate and humid subtropical climate, having the main occupation of subsistence farming; was selected as the study location. The primary data was collected by distributing the structured questionnaire; 285 samples were collected (20th February to 25th March 2023) with a response rate of 87.7%. The samples were selected randomly from all seven wards among the roster of farmers provided by the rural municipality. This research employs a quantitative design to investigate the impact of local governance on labor productivity in paddy production, incorporating variables related to agro-production and agro-governance in Tamakoshi Rural Municipality, Dolakha (Fiscal Year 2022/23) by multiple regression analysis.

2.1 Analytical Framework of the Study

The framework for the political economy determinants of agricultural public spending, as outlined by Mogues and Erman (2016) in the context of Africa (cited by Goyal & Nash, 2017, p. 271), with some improvisation in the Nepalese context; serves as the basis for the current study. The analytical framework consists of eleven independent variables such as farm mechanization, fertilizers, seed varieties, integrated pest management, and irrigation, farm knowledge, climate-smart agriculture, land reform, market access, agricultural incentives, and, agricultural extension and delivery; and labor productivity a dependent variable. The analytical framework of the study is presented in Figure 2.

Figure 2. Analytical Framework of Study



2.2 Variables Description

Independent variables were selected based on their expected direct and indirect impacts, following an extensive review of pertinent literature and legal provisions. Variables related to paddy production were derived from literature, while those related to local agro-governance were extracted from the Unbundling/Detailing of List of Exclusive and Concurrent Powers of the Federation, the State (Province), and the Local Level Provisioned in the Schedule-5, 6, 7, 8, and 9 of the Constitution of Nepal (FIARCC, 2016). Among various agro-constitutional rights at the local level, agriculture development was analyzed, with the livestock sector left for future studies.

2.2.1 Agriculture Productivity

Productivity is commonly defined as a ratio of a volume measure of output to a volume measure of inputs (OECD, 2001). Agricultural productivity refers to the output produced by a given level of inputs in the agricultural sector of a given economy (Amire, 2016). Abro et al. (2014) studied different policies for agricultural productivity growth and poverty reduction in rural Ethiopia and examined family income, extension services, land-labor ratio, and land/labor productivity. Kaur (2013); Awoyemi et al. (2017); and Ivanic and Martin (2018) studied the importance of agricultural productivity to the overall growth of people. Similarly,

Devkota and Upadhyay (2013) analyzed multiple dimensions of agriculture productivity and poverty reduction and identified the constraints in Nepalese contexts.

In this study, labor productivity is studied by a regression model (Abro et al., 2014; Kapri & Ghimire, 2020) and is defined as the production of paddy in Quintals divided by the total working hours on the rice farm. The cumulative working hours are constructed by using total family labor (working males and females), average working hours (per day per person), and average working days (per year) on rice farms. The smaller agricultural tasks performed by minors are excluded. A distinct gender-based division of labor is evident in wholesome agricultural activities: including the rice production cycle. Consequently, both males and females are regarded as equivalent participants in this study; acknowledging their respective roles and contributions. Thus, agriculture productivity can be explained as the ratio of the value of total farm outputs to the value of total inputs used in farm production (Sam, 2013).

2.2.2 Farm Mechanization

Farm mechanization can be defined as the application of implements, tools, and other machinery to achieve agricultural production (Houmy et al., 2013), which can be a panacea for decreasing labor scarcity (Upreti, 2010; GC et al., 2019; and Devkota & Upadhyay, 2013). Due to increasing population demand and dis-oriented land policies, the farm area is degrading gradually; there is less possibility of bringing more land into agriculture production (Basnet, 2012). Thus, the process of mechanization in farming cycles has greater significance. The National Agriculture Policy (2004) in Nepal focused on the uses of machinery such as heavy machines/tractors, mini-power tillers, threshers/seeders, motorized pumps, and sprayers as farm mechanization, which also included the mechanization in the production of major cereal crops.

2.2.3 Fertilizers

CBS (2013) classified fertilizer use patterns in Nepal as local/organic fertilizers (Farm Yard Manure (FYM), Compost) and minerals/chemical/inorganic fertilizers (Di-ammonium Phosphate (DAP), Urea, Potash). The availability of chemical fertilizers on time, whether due to unavailability or inadequacy, is a major challenge in Nepalese agriculture.

2.2.4 Irrigation

CBS (2013) defined irrigation as intentionally providing land with water, excluding natural flooding from rainfall or river overflow, but including the controlled collection and use of rainwater or uncontrolled flooding for improving pastures or crop production. The major sources of irrigation in Nepal are rivers/lakes/ponds (by gravity or by pumping), dams/reservoirs, tube wells/boring, and others (wells and springs). Mixed sources refer to the combination of two or more of the above sources, which are essential for agricultural production.

2.2.5 Seed Varieties

Seeds are a major part of farming; without them, agriculture cannot be imagined. CBS (2013) considered the seed use pattern as high-yield and/or local seeds at the time of sowing. Many literatures specified the importance of seeds; as seed varieties are central to agricultural produce (Goyal & Nash, 2017, pp. 189-191; Jones et al., 2017; Abro et al., 2014; Kaur, 2013). Rice production and productivity are influenced by seed varieties and cultivars (Bedari et al., 2020). Similarly, Basnet (2012) quotes the importance of seeds for rice production as "healthy seedlings are responsible at least for half of the yields."

2.2.6 Integrated Pest Management (IPM)

Pesticides/insecticides also include fungicides, fumigants, herbicides, rodenticides, and other materials for controlling pests and diseases (CBS, 2013). Pests and diseases directly affect and ultimately decrease the yield of agricultural produce. Thus, protecting harvests from pests, diseases, and weeds is very essential.

2.2.7 Farm Knowledge

National Agricultural Policy (2004) highlighted the importance of human resources in agricultural development in Nepal. Total years of farming experience, farming techniques, methods of increasing agricultural profits, etc. are equally important in agriculture (Abro et al., 2014; Upreti, 2010). The level of agricultural literacy of farmers is a crucial factor that impacts their ability to make decisions and carry out effective farm practices.

2.2.8 Climate-Smart Agriculture (CSA)

Climate change in the years is a risk and a multiplier that threatens water, agriculture, and food security (Basnet, 2012). Environment-resilient technology and investment in CSA must be the frontier of today's climate change regime in agriculture (Babu et al., 2018; Cortignani & Dono, 2018; Blanco et al., 2017; Basnet, 2012). Kaur (2013) argued the importance of weather insurance over crop insurance due to the dismal results of the latter across the world. As a better management tool, the government should promote weather insurance primarily due to its transparency, objectivity, and ease of administration. However, it is crucial to prioritize environmental friendliness and sustainability when pursuing increased production and productivity (Basnet, 2010a).

2.2.9 Land Reform

CBS (2013) defined agricultural holdings (Chalan gareko jagga, which means land being used) and land parcels. Choudhary et al. (2022) studied the effects of land fragmentation and the number of parcels in paddy production. Similarly, Devkota and Upadhyay (2013) found a positive output of land reform on productivity. The studies conducted by Upreti (2010) demonstrated that improving soil fertility in paddy production led to positive yield outcomes; Basnet (2012) also critically states "Grow paddy with soil fertility, wheat with fertilizers."

2.2.10 Market Access

CBS (2013) reported one-way travel time (10 min to > 3 hr) and modes of transport (on foot, bicycle/rickshaw, motorcycle/tempo, car/bus, mixed; foot and vehicle) to the nearest agriculture markets at the time of Agriculture Census in Nepal in 2011. Access to the market is essential for enhancing agriculture production and productivity and ultimately annual farm income of families.

2.2.11 Agricultural Incentives

Providing agricultural incentives to farmers is quite essential in developing countries (Kaur, 2013). Bishwakarma et al. (2021); Khanal et al. (2020); Sidibé et al., (2018), and Barkley and Barkley (2020, pp. 12-15) also highlighted the necessity of either monetary assistance or material subsidy to farmers. Mogues and Erman (2016); Jones et al. (2017); and Goyal and Nash (2017, p. 271) argued the requirement of effective public spending in agriculture. Similarly, Swinnen (2018) described the importance of a wholesome political economy of agriculture and food policies in livelihoods.

The government of Nepal also enacted numerous policies and programs to support farmers in agriculture development. According to the new constitutional jurisdiction (Schedule-8, Schedule SN. 15 & 18); agricultural incentives (monetary assistance or material subsidies) provided by state or non-state institutions are channeled through local levels. Thus, most of the agricultural incentives have significant outcomes in agriculture production and a positive impact on agro-governance.

2.2.12 Agricultural Extension and Delivery

Unbundling/Detailing of the list of exclusive and concurrent powers of the federation, the state (province), and the local level provisioned in the Schedule-5, 6, 7, 8, and 9 of the constitution of Nepal outlined agriculture extension services (outreach, training, farming techniques, awareness, and support) in the jurisdiction of local governments (FIARCC, 2016). As local levels are governments in the vicinity: they better understand the necessity and deliver effective services to the people with appropriate governance set-up. Agriculture extensions and delivery are one of the most important parts of local agro-governance in Nepal.

The definition and coding of the variables used in this study primarily adhere to the guidelines of CBS (2013) and are further mentioned by relevant literature in the field as summarized in Table 1.

Table 1. Description of Variables

Variables	Description and coding details
Socio-demographics	Ward Number, gender, marital status, age, and cast
	Second occupation other than agriculture (1: Yes, and 0: Not at all)
Dependent	
Agriculture Productivity	Labor productivity (rice production): Quantity of rice produced divided by the total working hours on the rice farm (Abro et al., 2014; Kapri & Ghimire, 2020)
Independent	
Farm Mechanization	At least a machine (Tractors, Mini-Power Tillers, Seeders, Motorized Pumps, and Others-if) used in farming (1: Yes, 0: No/Just Animal-based Power)
	Number of machines (farm capital: Abro et al., 2014) used assuming farm assets are not heterogenous among households
	Years of using at least one machine on the farm
Fertilizers	Uses of chemical fertilizers in kg (1: Yes, 0: Just FYM)
	Uses of organic and inorganic fertilizers (both) in kg (Urea: NH_2CONH_2), DAP: $(NH4)_2HPO_4$, FYM, and Others-if)
Seed Varieties	Uses of high-yield seeds (also both types) (1: Yes, 0: Local Seeds)
Integrated Pest Management (IPM)	Prioritization and implementation of IPM initiatives by RM (1: Yes, 0: Otherwise)
	Total expenditure (NPR) on pests and disease control (per year)
Irrigation	Water purposively provided other than rain (canal systems/other methods) (1: Yes, 0: Rainfed farming)
Farm Knowledge	Total years of schooling of the HoH (No schooling: 0; non-formal: 3 (Abro et al., 2014); Primary: 5; SLC/SEE: 10; and Higher Secondary and/or above: 12)
	Total farming experience (Years)
Climate-smart agriculture (CSA)	Natural calamities and climate risks (drought, heavy rainfall, flood, snowfall, hailstorm, soil erosion, and storm) that destroy the farmland and/or damage the agricultural harvest as a whole or in parts (1: Yes, 0: Not at all)

	The number of harvest/s per year (Once-1, Twice-2)
Land Reform	Land consolidation (also partial) (1: Yes, 0: Otherwise)
	Number of parcels within the cropped area
	At least an activity used to improve the soil fertility (other than tillage) (1: Yes, 0: No/Just Tillage)
Market Access	Distance of the nearest agriculture market (km)
Variables related to policy catch-up and local agro-governance	
Agricultural Incentives	Either monetary assistance or material subsidy received (provided by the local government themselves or as delivery units) (1: Yes, 0: Not at all)
Agriculture Extension (Outreach, Training, Farming techniques, Awareness, and Support) and delivery	At least a method known (Value chain, Value addition, Productivity, and others-if) to make more agriculture profits (1: Yes, 0: Not at all)
	At least an agro-service received (Outreach, Agro-technician field inspection, and others-if) (1: Yes, 0: Not at all)
	Commercial crop/s harvests (1: Yes, 0: Not at all)
	Annual budget approval by RM on stipulated time (1: Yes, 0: Otherwise)
	The perception and satisfaction level of farmers in the agro-governance and delivery at the local level (Five-point Likert scale)
	Quality of agriculture extension service received (1: *Excellent*; 2: *Good*; 3: *Rather Average*; 4: *Bad*; 5: *Very Bad*)
	Adequacy of agricultural incentives (1: *Adequate*; 2: *Good*; 3: *Rather Average*; 4: *Inadequate*; 5: *Very Less*)
	Rural Municipal willingness to institutional restructuring (actions) for integrated (co-ordination with stakeholders) agro-movements (1: *Very Satisfactory*; 2: *Satisfactory*; 3: *Rather Average*; 4: *Dis-satisfactory*; 5: *Disappointing*)
	Rural Municipal Preparedness for agricultural transformation and its Sustainability (1: *Very Satisfactory*; 2: *Satisfactory*; 3: *Rather Average*; 4: *Dis-satisfactory*; 5: *Disappointing*)
	Incorporating the findings of agro-research into policy formulation and policy revision by RM (1: *Adequate*; 2: *Good*; 3: *Rather Average*; 4: *Inadequate*; 5: *Very Less*)
	Enabling local agro-governance (1: *Excellent*; 2: *Good*; 3: *Rather Average*; 4: *Bad*; 5: *Very Bad*)
	Change in the socio-economic status of farmers (1: *Strongly Agree*; 2: *Agree*; 3: *Rather Average*; 4: *Dis-agree*; 5: *Strongly Disagree*)

3. Results

A total of 285 respondents from all the wards (1-7) consisted of 236 (83%) males and 49 (17%) females. The education level of respondents varies significantly across the communities, most of the respondents completed primary education. Farming experience varies from 5 to 35, with an average of 17.6 years. Only 18% of the respondents had a second occupation in addition to agriculture, while 82% primarily relied on agriculture as their main occupation. Most of the respondents 270 (95%) used at least a machine in farming and 15 (5%) were still using only animal-based power. Most of the farmers used high-yield seeds with local ones, also, inorganic/chemical fertilizers were mixed with organic fertilizers. Overall, 112 respondents, accounting for 39% of the total, participated in harvesting commercial crops alongside their paddy harvests. The average distance to the nearest agriculture market in the rural municipality is 6.2 km, ranging from 3 to 9 km. The average number of working days on a rice farm per year is 122.4, with a range between 115 to 130 days.

The rural municipality provided agricultural incentives to the farmers as much as possible, although they appear to be inadequate. The frequency analysis, mean (M), and standard deviation (SD) for all the five-point Likert scale questions showed that the overall rating for the quality of agriculture extension services was the lowest (M = 2.24, SD = 1.16), while respondents' perception with agro-research and policy incorporation of findings was the highest (M = 3.67, SD = 0.99).

Multiple linear regression analysis (IBM SPSS V25) was used to assess the ability of independent variables to predict the dependent variable. The preliminary analysis was conducted to ensure non-violation of the assumptions of normality, multi-collinearity, and homoscedasticity. The significant impact and prediction of the independent variables on labor productivity indicate an overall strong goodness of fit for the model, the adjusted R2 = .79 depicts that the model explains 79% of the variance in the dependent variable. The results of multiple regression analysis are presented in Table 2.

Table 2. Summary of Multiple Linear Regression Findings

Coefficients[a]							
Variables	**Beta**	***SE***	**β**	***t***	***p***	**CS**	
						T	**VIF**
(Constant)	0.126	0.104		1.209	0.228		
Mechanization Status	0.065	0.027	0.094	2.416	0.016**	0.478	2.093
No. of Tractors	0.058	0.020	0.095	2.911	0.004**	0.673	1.485
No. of Mini-Power Tillers	0.031	0.007	0.138	4.139	0.000**	0.651	1.536
No. of Motorized Pumps	0.027	0.005	0.193	4.836	0.000**	0.452	2.212
No. of Seeders	0.043	0.007	0.258	6.066	0.000**	0.400	2.501
Organic and Inorganic Fertilizers (both)	0.413	0.025	0.663	16.242	0.000**	0.221	4.532
Expenses for controlling pests/diseases (NPR)	3,82E-02	0.000	0.239	5.828	0.000**	0.429	2.334
Farming experiences (Years)	0.003	0.001	0.107	2.637	0.009**	0.441	2.266
No. of parcels within the cropped area	0.026	0.004	0.282	6.334	0.000**	0.365	2.741
Annual budget approval by the rural municipality on time	0.040	0.015	0.103	2.673	0.008**	0.482	2.074
Agro-services received	0.033	0.017	0.080	1.986	0.049*	0.405	2.469
Preparedness of rural municipality (perception)	0.012	0.006	0.094	2.032	0.043*	0.337	2.971
Varieties of seeds	0.017	0.015	0.046	1.144	0.254	0.453	2.206
Years of mechanization	0.002	0.004	0.022	0.498	0.619	0.372	2.687
Status of land consolidation	-0.002	0.015	-0.005	-0.132	0.895	0.605	1.654
Chemical fertilizers (Inorganic)	0.014	0.029	0.015	0.483	0.629	0.744	1.345
Methods for improving soil fertility	-0.004	0.020	-0.008	-0.198	0.843	0.423	2.363
IMP initiatives by RM	-0.032	0.038	-0.027	-0.842	0.401	0.690	1.449
Irrigation Method	-0.025	0.017	-0.051	-1.514	0.131	0.627	1.596
Number of harvests (Per Year)	0.075	0.075	0.029	1.005	0.316	0.887	1.127
Harvesting commercial crops	-0.004	0.010	-0.011	-0.354	0.723	0.708	1.412
Distance to nearest agriculture market (km)	0.002	0.004	0.018	0.551	0.582	0.696	1.437
Damage of crops by natural calamities or climatic chaos	-0.001	0.011	-0.004	-0.115	0.908	0.621	1.610
Destroy of land by natural calamities or climatic chaos	-0.015	0.012	-0.044	-1.308	0.192	0.630	1.588
Agricultural Incentives received	-0.010	0.016	-0.031	-0.655	0.513	0.333	3.003
Familiar with agricultural profit-making methods	-0.026	0.018	-0.065	-1.480	0.140	0.377	2.652
Quality of agriculture extension services (satisfaction)	-0.008	0.007	-0.057	-1.049	0.295	0.242	4.140
Adequacy of agricultural incentives (satisfaction)	-0.006	0.006	-0.036	-0.987	0.325	0.550	1.817
The willingness of RM to agro-development (perception)	-0.009	0.007	-0.063	-1.308	0.192	0.310	3.228
Agro-research by RM (satisfaction)	-0.003	0.006	-0.016	-0.415	0.679	0.490	2.040
Change in the socioeconomic status of farmers	0.000	0.004	0.002	0.062	0.951	0.874	1.144
a. Dependent Variable: Labor Productivity							

Note: *p < 0.05, ** < 0.01, and, ***< 0.001 (the first 12 variables were significant and explained), Unstandardized coefficients (Beta and Standard Error, SE), Standardized coefficient (β), Significance (p), Collinearity Statistics (CS), Tolerance (T), and Variance Inflation Factor (VIF).

Thus, the prediction equation can be written as follows:

Labor Productivity = 0.126 + 0.06 (Mechanization Status) + 0.05 (Tractors) + 0.03 (Mini-Power Tillers) + 0.027 (Motorized Pumps) + 0.04 (Seeders) + 16.24 (Organic and Inorganic Fertilizers) + 3.821E-05 (Expenses on pest/disease control) + 0.003 (Farming Experiences) + 0.026 (No. of Parcels) + 0.03 (Agro-services received) + 0.04 (Annual budget approval on stipulated time) + 0.01 (Rural Municipal preparedness for agricultural transformation and its sustainability).

4. Discussion

The minor engagement of women in agriculture may represent pre-specified roles (socio-cultural) and more involvement in household stuff. The level of education (formal, non-formal) briefly entails the socio-economic status of the family, also related to farming experiences, and is important for better farm decisions. Similarly, average farming experience (17.6 years) shows majority have been engaged in farming for a long. Despite favorable weather and climatic conditions harvesting paddy once a year represents crop diversification and labor shift. Timely availability and adequacy of high-yield seeds and chemical fertilizers are unresolved issues in Nepalese agriculture. Thus, fertilizers (organic and inorganic) and seeds (high-yield and local) were mixed for farming activities.

Almost all of the respondents used at least one machine in farming, while a minority are still using animal-based power. This entails the need for a policy departure through in-depth studies based on landscape and crop-specific mechanization policies. Farmers' engagement in paddy farms (average 122.4 days per year) illustrates how labor productivity and engagement in farming connect to the larger interface. In contrast, the negative relationship between market access and labor productivity in this study can be attributed to the relatively long average distance (6.2 km) to the nearest agricultural market in the study location. The absence of significant and consistent means of public transport likely encourages farmers to seek alternative marketing channels and rely on community market mechanisms.

The assessment of farmers' feedback (M and SD) on agro-services and programs delivered by the rural municipality indicates notable variations among respondents in terms of their perceptions and satisfaction levels concerning agro-services and delivery. That highlights the pressing need for significant improvements in various aspects of local agro-governance, which is crucial for meeting the needs of farmers and promoting sustainable agriculture by collaborative efforts among governments, policymakers, farmers, and stakeholders to formulate better agro-policies, thus, enhancing the institutional capacity.

In this study, various constructs of agro-production and agro-governance were designed and regressed. Conducting a comprehensive statistical analysis that encompasses various facets of agriculture development and predicts their relationship with labor productivity provides valuable insights into key production factors: policy design, resource mapping and allocation, performance evaluation, decision-making, and effective monitoring and evaluation approaches.

Mechanization contributes to increased productivity by enhancing efficiency, improving precision and quality, and reducing labor dependency. By embracing mechanization, farmers can optimize their operations, save time and resources, and achieve higher yields and profitability. Farm mechanization had significant impacts on labor productivity. The Tractors, mini-power tillers, motorized pumps, and seeders used on rice farms; all were significant in the study. These findings align with previous research exploring various aspects of farm mechanization across multiple dimensions documented in Takeshima and Liu (2018); GC et al. (2019); and Sigdel et al. (2022b).

On the other hand, adequate expenses (cost of pesticides, insecticides, traps, biological control agents, controlling weeds, or any other appropriate methods) to control pests/diseases ensure optimized uptake and utilization of nutrients by the harvests promoting healthier growth and maximizing productivity had a positive relationship. The obtained results also show acquaintance with some previous studies including those conducted by Devkota and Upadhyay (2013); and Choudhary et al. (2022).

Farming experience plays a crucial role in better crop selection, and rotation, optimizing resource management, continuous learning and innovation, appropriate farm decisions, adaptability, and resilience. The results showed that farming experience played a significant role in agriculture productivity in the study area. The result is also supported by works performed by some researchers. The perception of mechanization, use of extensions, and farm decisions are related to farming experiences, which ultimately impact production (Sigdel et al., 2022a, 2022b). Experienced farmers have an edge over fledgling farmers who may benefit from some agricultural training to catch up on efficiency (Devkota & Upadhyay, 2013).

Well-defined land parcels enable farmers' efficient farm management to optimize the use of resources such as water, fertilizers, labor forces, and machinery and to maximize productivity. The appropriate number of parcels within the cropped area had a significant impact (coefficient 0.026). This observation is further supported by previous studies by Devkota and Upadhyay (2013), and Choudhary et al. (2022). In addition, excessive fragmentation and parceling can lead to operational inefficiencies, making it more challenging to effectively apply farm inputs, ultimately resulting in a reduction of the overall agricultural output potential. Therefore, it is essential to consider a saturation point by

carefully understanding and acknowledging all the ground realities and factors at play.

The lack of timely availability of high-yield seeds for most of the farmers could explain the absence of a significant relationship on labor productivity. Similarly, limited irrigation infrastructure and insufficient knowledge of irrigation methods among the study area's respondents may not significantly impact productivity. Conversely, the study did not reveal a significant link between climate-smart agriculture and productivity in the area, possibly due to the absence of significant crop damage and farmland destruction during the fiscal year 2022/23, attributable to favorable weather and climatic conditions. Despite these favorable conditions, most farmers chose to harvest paddy once a year, potentially due to diversification into other commercial crops during the second term and the structural shift of the labor force into other occupations.

In addition to the previously most discussed variables, the study has identified some novel factors that exhibit a significant impact on labor productivity such as the organic and inorganic fertilizers, the rural municipality's annual budget approval within a specified timeframe, agro-services received and the rural municipal preparedness for agricultural transformation and its sustainability.

The timely unavailability of chemical fertilizers is a dominant perennial issue in Nepal. In the absence of adequate chemical fertilizers (Inorganic), farmers choose alternative options such as mixing organic and inorganic fertilizers and tend to rely on FYM, compost, and other fertilizers. Therefore, organic and inorganic fertilizers (both together) used on rice farms emerge as the significant factor influencing productivity outcomes (coefficient 16.24). These findings also align with prior research conducted by Timsina et al. (2012); and Devkota and Upadhyay (2013).

Appreciably, annual budget approval by the rural municipal assembly on a designated timeframe had a positive impact (coefficient 0.04) on productivity. Local Government Operation Act (2017) explicitly outlines the SOP of annual budget approval; the fruitful implementation of enacted laws and regulations drives better governance and delivery outcomes. Narrowing the gap between planned and actual spending involves numerous partners in budget management, and so will need consensual agendas to make real progress (Goyal & Nash, 2017, p. 232). The successful execution of policies and policy outcomes is primarily based on information symmetry, the assembly's timely approval of a detailed budget, and fruitful implementation of the program of action.

On the other hand, the agro-services received and the rural municipal preparedness for the agricultural transformation and its sustainability were significant; thus, had a significant impact on labor productivity. Factors affecting land productivity often require long-term investments, extensive research, large-scale interventions, and broader collaborations based on farm inputs, soil chemistry, weather and climatic conditions, and other external factors. The huge agricultural incentives for farmers, specialized targeted programs and expertise may be beyond the scope of the rural municipality alone. Alternatively, labor-intensive programs include training, capacity enhancement, access to information, improvement in farming techniques, and short-term programs yielding instant results. The influence of rural municipal agro-services may be limited on land productivity due to the focus on labor-intensive programs, the inherent characteristics of land, resource constraints, external factors, and time lag effects. Thus, the agricultural extension and agro-services received by respondents might be significant in enhancing labor productivity.

The enforcement of rules and laws designated at the national level remains a prominent institutional mechanism for ensuring effective multiscale governance (Sidibé et al., 2018). Most of the time, such blanket regulations are not only unable to meet practical needs at local levels, but they may conflict with local institutional judgment, thereby creating new challenges (Sidibé et al., 2018). In the newly federalized structure of Nepal, many laws are still to be formulated. In addition, following the promulgation of laws, there is often a significant delay in formulating supportive regulations, and directives (Bishwakarma et al., 2021).

On the other hand, the land-labor ratio calculated by dividing the total cropped area by available labor (Abro et al., 2014) is 4.01. This implies the relative abundance of land resources. However, an increase in this ratio is primarily driven by a decrease in family labor resulting from factors such as abandoning homes, marriage, changing livelihoods, migration, and others. In reality, government land use policies and the partition and inheritance of land within families contribute to a gradual scarcity of land, as the average share of land per adult diminishes. In response, it becomes crucial to focus on enhancing the productivity of production factors to make the most efficient use of the available land and other resources.

In a nutshell, the values of the Beta coefficients reveal that a one-unit increase in the independent variables corresponds to a one-unit increase in productivity, assuming other factors remain constant. Moreover, the presence of significant t-values indicates that the relationship between these factors and productivity is highly unlikely to have occurred by chance. Furthermore, p-values < 0.05 provide a strong level of statistical significance, further supporting the validity of the obtained results.

5. Conclusion

This quantitative research study employed multiple regression analysis to investigate the impact of integrated variables related to agro-production and local agro-governance on labor productivity. The mechanization status of farmers, use of tractors, mini-power tillers, motorized pumps, seeders, organic and inorganic fertilizers (both), expenses for controlling pests/diseases, farming experiences (years), number of parcels within the cropped area, annual budget approval on time, agro-services received by the respondents, and preparedness of rural municipality for agriculture development showed a statistically significant relationship to predict labor productivity in the study area. The study findings supported our hypothesis regarding the significant influence of local agro-governance on labor productivity. Hence, local agro-policies should focus on farm mechanization (agriculture machinery and implements), use of organic and inorganic fertilizers, integrated pest management, farm engagements of farmers, land reform techniques, and agriculture extension and delivery programs for the enhancement of labor productivity on paddy production. Wider understanding and effectively managing those factors are crucial for optimizing labor productivity and promoting sustainable agricultural practices.

One notable limitation of this study is the limited sample size, along with the underlying assumptions of homogeneity in socio-economic status among farmers, uniformity in farm assets and practices, and consistent environmental and climatic conditions within the study area. In spite of that, detailed analysis of farm mechanization, the role of farm inputs, and post-harvest activities are left for future studies. However, the findings of this study have major implications for local agriculture development, policy input for the stakeholders, and open avenues for future researchers. Thus, to achieve comprehensive agro-development, and sustainable outcomes, after minimizing the policy shocks: it is essential to create and execute distinct short-term and long-term labor-intensive approaches.

References

Abro, Z. A., Alemu, B.A., Hanjra, M.A. (2014). Policies for agricultural productivity growth and poverty reduction in rural Ethiopia. World Dev. 59, 461-474. https://doi.org/10.1016/j.worlddev.2014.01.033.

ADB (Asian Development Bank), 2013. Nepal: Agricultural Development Strategy-Final Report (Technical Assistance Consultant's Report. Prepared by PPTA Consultants Kathmandu, Nepal for Government of Nepal).

Amire, C. M. (2016). The Effect of Agricultural Productivity on Economic Growth in Nigeria. Journal of Advances in Social Science and Humanities, 2(4).

Awoyemi, B. O., Afolabi, B., & Akomolafe, K. J. (2017). Agricultural productivity and economic growth: impact analysis from Nigeria. Scientific Research Journal (SCIRJ), 5(10), 1-7.

Babbie, E., & Benaquisto, L. (2001). Qualitative field research. The Practice of Social Research, 9, 298-300.

Babu, S. C., Mavrotas, G., Prasai, N. (2018). Integrating environmental considerations in the agricultural policy process: evidence from Nigeria. Environ. Dev. 25, 111-125.

Barkley, A. & Barkley, P. W. (2020). Principles of Agricultural Economics, (3rd ed.). New York, NY: Routledge, 2020. ISBN 0429284799, 9780429284793, DOI: https://doi.org/10.4324/9780429284793.

Basnet, B. M. S. (2012). Rice: Water, food security and climate change in Nepal. Hydro Nepal: Journal of Water, Energy, and Environment, 78-80.

Basnet, B.M.S. (2010a). Environmentally-friendly and sustainable rice production: A success story, Congress program, a paper presented at the IRRI, 3rd International Rice Congress, Hanoi, Vietnam, 8-12, November 2010.

Basnet, B.M.S. (2010b). Climate change and food security, a paper presented at the Nepal Federation of Environment Journalists (NEFEJ), Kathmandu, Nepal.

Bedari, A., Rawat, G., Amgain, L. P., Thapa, D. B., & Poudel, M. (2020). Productivity and profitability of different varieties of Chaite rice grown under different sowing methods at Baniyani, Jhapa. Nepalese Journal of Agricultural Sciences 2020, 19, 155-164.

Bhandari, D. R., Sanjel, P. K., & Adhikari, S. (2017). Policy review of paddy production in Nepal. Rice Science and Technology in Nepal (MN Poudel, DR Bhandari, MP Khanal, BK Joshi, P Acharya and KH Ghimire, eds) Crop Development Directorate (CCD), Hariharbhawan and Agronomy Society of Nepal (ASoN) Khumaltar, 719-734.

Bishwakarma, B.K., Upreti, B.R., Devkota, D. and Devkota, N.R. (2021). Agricultural Functions and Policies in the Context of Sectoral Restructuring in Nepal. International Journal of Agricultural Extension and Rural Development Studies, 8(2), 12-28.

Bishwokarma, N., (2017). Possibilities and Challenges of the Agriculture Development Strategy 2015.

Blanco, M., Ramos, F., Van Doorslaer, B., Martínez, P., Fumagalli, D., Ceglar, A., & Fernández, F. J. (2017). Climate change impacts on EU agriculture: A regionalized perspective taking into account market-driven adjustments. Agricultural systems, 156, 52-66.

Brodt, S., Six, J., Feenstra, G., Ingels, C., & Campbell, D. (2011). Sustainable agriculture. Nat. Educ. Knowl., 3(1).

CBS (Central Bureau of Statistics). (2013). National Sample Census of Agriculture 2011/2012: National Report, Kathmandu: Central Bureau of Statistics, National Planning Commission, Government of Nepal.

Chaudhary, D. (2018). Agricultural policies and rural development in Nepal: An overview. Research Nepal Journal of Development Studies, 1(2), 34-46.

Choudhary, D., Banskota, K., Khanal, N. P., McDonald, A. J., Krupnik, T. J., & Erenstein, O. (2022). Rice subsector development and farmer efficiency in Nepal: implications for further transformation and food security. Frontiers in Sustainable Food Systems, 5, 740546.

Corral, S., Díaz, A. S., Monagas, M. D. C., & García, E. C. (2017). Agricultural policies and their impact on poverty reduction in developing countries: Lessons learned from three water basins in Cape Verde. Sustainability, 9(10), 1841. https://doi.org/10.3390/su9101841.

Cortignani, R., & Dono, G. (2018). Agricultural policy and climate change: An integrated assessment of the impacts on an agricultural area of Southern Italy. Environmental Science & Policy, 81, 26-35.

Cumming, G. S. (2016). Heterarchies: reconciling networks and hierarchies. Trends in Ecology and Evolution, 31(8), 622-632. DOI: https://doi.org/10.1016/j.tree.2016.04.009.

Devkota, S., & Upadhyay, M. (2013). Agricultural Productivity and Poverty Reduction in Nepal. Review of Development Economics, 17(4), 732-746.

FIARCC. (2016). Unbundling/Detailing of List of Exclusive and Concurrent Powers of the Federation, the State (Province), and the Local Level Provisioned in the Schedule-5, 6, 7, 8, and 9 of the Constitution of Nepal, Kathmandu, Nepal, Report on Federalism Implementation and Administration Restructuring Coordination Committee.

Gauchan, D. (2008). Agricultural development in Nepal: contribution to economic growth, food security, and poverty reduction. Socio-Economic Development Panorama, 1(3), 49-64.

GC, A., Yeo, J. H., & Ghimire, K. (2019). Determinants of farm mechanization in Nepal. Turkish Journal of Agriculture-Food Science and Technology, 7(1), 87-91.

GoN/FAO (Government of Nepal and Food and Agriculture Organization) (2013). Nepal: Country Programming Framework 2013-2017. Government of Nepal and Food and Agriculture Organization of the United Nations, Kathmandu.

Goyal, A., & Nash, J. (2017). Reaping Richer Returns: Public Spending Priorities for African Agriculture Productivity Growth. World Bank Publications.

Houmy, K., Clarke, L. J., Ashburner, J. E., & Kienzle, J. (2013). Agricultural mechanization in Sub-saharan Africa: guidelines for preparing a strategy (Vol. 22). Food and Agriculture Organization of the United Nations (FAO).

Hughes, O. E. (1998). New Public Management. Public Management and Administration: An Introduction, 2nd ed. Macmillan, London.

Ivanic, M., & Martin, W. (2018). Sectoral productivity growth and poverty reduction: National and global impacts. World Development, 109, 429-439.

Jones, J. W., Antle, J. M., Basso, B., Boote, K. J., Conant, R. T., Foster, I., ... & Wheeler, T. R. (2017). Brief history of agricultural systems modeling. Agricultural Systems, 155, 240-254.

Kapri, K., & Ghimire, S. (2020). Migration, remittance, and agricultural productivity: Evidence from the Nepal Living Standard Survey. World Development Perspectives, 19, 100198.

Kaur, H. (2013). Agriculture: The way to inclusive growth. IOSR Journal of Business and Management, 9(6), 42-47.

Milczarek-Andrzejewska, D., Zawalińska, K., & Czarnecki, A. (2018). Land-use conflicts and the common agricultural policy: evidence from Poland. Land use policy, 73, 423-433.

Mittenzwei, K., Persson, T., Höglind, M., & Kværnø, S. (2017). Combined effects of climate change and policy uncertainty on the agricultural sector in Norway. Agricultural Systems, 153, 118-126.

MoALD (Ministry of Agriculture and Livestock Development). (2020). Collection of Agriculture Policies, Ministry of Agriculture and Livestock Development, Kathmandu.

MoALD (Ministry of Agriculture and Livestock Development). (2021). Annual Progress Report (वार्षिक प्रगति प्रतिवेदन), Ministry of Agriculture and Livestock Development, Kathmandu.

MoALD (Ministry of Agriculture and Livestock Development). (2022). Ministerial Report on Rice Production and Productivity in F.Y. 2022/23. Ministry of Agriculture and Livestock Development, Kathmandu.

Mogues, Tewodaj., & Erman, Alvania. (2016). Institutional arrangements to make public spending responsive to the poorâ€" (where) have they worked?: Review of the evidence on four major intervention types. International Food Policy Research Institute (IFPRI) discussion papers, (1519).

Mueller, B., & Mueller, C. (2016). The political economy of the Brazilian model of agricultural development: Institutions versus sectoral policy. The quarterly review of economics and finance, 62, 12-20.

NPC (National Planning Commission) (2020). The Fifteenth Plan (2019/20-2023/24). National Planning Commission, Kathmandu.

NSO (National Statistics Office). (2023). National Population and Housing Census, 2021. (In Nepali). National Statistics Office, Office of the Prime Minister and Council of Ministers, Government of Nepal, Kathmandu.

Organization for Economic Co-operation and Development (OECD). (2001). Measuring Productivity: Measurement of Aggregate and Industry Level Productivity Growth: OECD Manual. Organization for Economic Co-operation and Development.

Oskam, A., Meester, G., & Silvis, H. (2011). EU Policy for agriculture, food, and rural areas. Wageningen academic publishers.

Pradhanang, U. B., Pradhanang, S. M., Sthapit, A., Krakauer, N. Y., Jha, A., & Lakhankar, T. (2015). National livestock policy of Nepal: needs and opportunities. Agriculture, 5(1), 103-131.

Saint Ville, A. S., Hickey, G. M., & Phillip, L. E. (2017). Institutional analysis of food and agriculture policy in the Caribbean: The case of Saint Lucia. Journal of Rural Studies, 51, 198-210.

Sam, I. O. (2013). The measurement of productive and technical efficiency of cassava farmers in the North-Central Zone of Nigeria. Research Journal of Agriculture and Environmental Management. 2(10), 323-331.

Schwartz, B. M. (2012). d'Afrique, Louvain/Paris, Editions Nauwelaerts, 404 pp. 1965-1969, 1, 294.

Sidibé, A., Totin, E., Thompson-Hall, M., Traoré, O. T., Traoré, P. C. S., & Olabisi, L. S. (2018). Multi-scale governance in agriculture systems: Interplay between national and local institutions around the production dimension of food security in Mali. NJAS-Wageningen Journal of Life Sciences, 84, 94-102.

Singh, S. (2012). Institutional and policy aspects of Punjab agriculture: A smallholder perspective. Economic and Political Weekly, 51-57.

Stringer, R. (2001). How Important Are the Non-traditional Economic Roles of Agriculture in Development?. Centre for International Economic Studies.

Swinnen, J. (2018). The Political Economy of Agricultural and Food Policies. Palgrave Macmillan, New York.

Takeshima, H., & Liu, Y. (2018). The role of plant-breeding R&D in tractor adoptions among smallholders in Asia: Insights from Nepal Terai (Vol. 1719). Intl. Food Policy Res. Inst.

Tanentzap, A. J., Lamb, A., Walker, S., & Farmer, A. (2015). Resolving conflicts between agriculture and the natural environment. PLoS biology, 13(9), e1002242.

Timsina, K. P., Shrestha, K. P., & Pandey, S. (2012, April). Factors affecting the adoption of new modern varieties of Rice in eastern Terai of Nepal. In the proceeding of 4th Society of

Agricultural Scientist-Nepal (SAS-N) conference held at Lalitpur from (pp. 4-6).

Uprety, R. (2010, November). Meshing mechanization with SRI methods for rice cultivation in Nepal. In 28th International Rice Research Conference (pp. 8-12).

World Bank Group. (2016). Nepal: Sources of Growth in Agriculture for Poverty Reduction and Shared Prosperity. World Bank.

World Bank. (2007). World Development Report 2008: Agriculture for Development. The World Bank.