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Agricultural and Natural Resources Development and Management Strategy in Nepal

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Introduction

Located in between 26° 12' and 30° 27' N and 80° 4' and 88° 12' E, Nepal's elevation meter above sea level (masl) ranges from 60 meters in Terai to 8,848 meters at the top of Mt. Everest (Shrestha, 2007). With an average east-west length of 885 km and the north south breadth ranging from 145 to 241 km, Nepal contains five physiographic regions from south to north: Terai (60-300 masl), Siwalik Hills (120-1,800 masl), Middle Mountains (500-2,750 masl), High Mountains (1,970-4,500 masl), and High Himalaya (4,500-8,848 masl). Climatic zones extend from tropical climate in the lower lands of Terai to sub-tropical in middle hills and valleys, temperate in mountains, alpine in Himalayan region, and tundra or arctic climate in high altitudes. The nearest port city of Kolkata, India, is 648 km far from Kathmandu, Nepal, with a driving distance of 866.3 km (Distance Calculator, 2018). Agricultural land consists of 28.7 percent (4,228,548 hectare) of the country's total surface area of 14,718,100 hectare, and the Terai, Hills, and Mountain regions contain, respectively, 70 percent, 26 percent and 4 percent of total agricultural land (Shrestha, 2007). About 90 percent of agricultural land is devoted to the production of cereal crops and remaining 10 percent is under the production of cash crops. Almost 68 percent of Nepal's nearly 29 million people depend on agriculture for livelihoods. The National Sample Census of Agriculture 2011/12 showed a total of 3,715,555 households engaged in crop production (having > 0.01 ha land) and 115,538 households were engaged in the production of only livestock (having < 0.01 ha land) in the country (NPC, 2013). Nepalese agriculture contributes about 33 percent to national GDP.

Despite nearly seven decades of governmental efforts on agricultural development, Nepalese agriculture is currently experiencing a serious downward spiral. Past agricultural initiatives such as land reforms, investment on irrigation projects and agricultural roads, establishment of agro-industries, subsidized fertilizers and credit facilities to the producers; investment on agricultural research, education and extension; and the promotion of agricultural exports were expected to result in food self-sufficiency, economic growth, and overall development of the nation; but, Nepal is currently undergoing through serious food deficits, malnutrition, and increasing dependence on foreign countries for agricultural products. In Nepal, 25 percent population is below the poverty line, 36 percent of children are suffering from stunting, 10 percemt from mass wasting, and 53 percent from anemia (NDHS, 2011). Similarly, 41 percent of women of reproductive age are suffering from anemia, and 17 percent are suffering from long-term energy deficiencies.

According to the Ministry of Agricultural Development (MoAD) (2014), average productivity of fish, timber, paddy, vegetables, and buffalo milk production, respectively, were at 36 percent, 2.5 percent, 24.7 percent, 75.3 percent, and 45 percent. These statistics clearly indicate that there is a huge potential to increase agricultural productivity in Nepal. In order to increase agricultural productivity, timely availability of improved seeds and other agricultural inputs, access to sustainable technologies and practices, and presence of required infrastructure for agricultural development is necessary. Conversion of agricultural lands to other uses is another major problem in Nepal. The World Bank (2018) reports that there was 3,655,238 hectare of agricultural land in 1961, which increased to 4,221,045 hectare in 1981, and to 4,370,809 hectare in 2001. In 2015, total agricultural land area reduced to 4,228,548 hectare, which was less than 142,262 hectare as compared to 2001. There is a widespread degradation of agricultural lands due to soil erosion, compaction, depletion of plant nutrients, acidification, soil pollution, destruction of soil structure, loss of soil carbon, and decline on soil biodiversity. Land degradation is also occurring due to landslides, debris flow and deposition, sedimentation, river cutting, overgrazing, and deforestation.

In 2014/15, Nepal had a negative trade balance of Rs. 622.37 billion (of which 63.22 percent was with India and 14.21 percent was with China), and two top imports in 2014/15 included agricultural products (Rs. 137.12 billion) and petroleum products (Rs. 112.16 billion) (CBS, 2016). In agricultural imports, rice and paddy constituted Rs. 23.79 billion (684,130 MT) and maize Rs. 7.43 billion (290.993 MT), with more than 95 percent of rice and paddy and maize coming from India. Other agricultural products imported in 2014/15 included fat and edible oil (Rs. 22.51 billion); vegetables (Rs. 15.93 billion); fruits and nuts (Rs. 10.54 billion); animal fodder (10.02 billion); oil seeds (9.11 billion); coffee, tea and spices (Rs. 4.27 billion); and sugar and confectionery (Rs. 3.49 billion). During the same period, Nepal imported live animal worth Rs. 2.42 billion, dairy products Rs.2.15 billion, and fish Rs. 1.15 billion. Nepal's total outstanding public debt in 2015/16 was Rs. 627.8 billion.

Deforestation and forest degradation is a widespread natural resource problem in Nepal. Overharvesting of forests to meet firewood needs of local communities in rural areas is a persistent problem. Key drivers of deforestation and forest degradation in Chitwan-Annapurna Landscape, for example, include unsustainable harvest of forest products, infrastructural development, forest encroachment, agricultural expansion, forest fires, overgrazing, invasive plants, landslides and floods, stone mining, and recreation (WWF Nepal, 2013). Forest degradation affects wildlife habitat, biodiversity, biomass production, and hydrology. Although Community Forestry program is taken as a great success in Nepal, it still has several problems including implementation challenges, inconsistent policies, rules and regulations; lack of pro-poor programs, exclusion of ultra-poor people in management decision making, elite capture of the resources, and inequitable sharing of the benefits (Gurung et al., 2011). Nepal has been trying to implement Reducing Emissions from Deforestation and Forest Degradation (REDD+) program with a view of conservation, sustainable

forest management, and enhancement of forest carbon stocks. Major challenges identified for REDD+ implementation include confusion on tenure, weak governance, and high opportunity cost (Paudel et al., 2013). Similarly, Nepal is struggling with several national parks management challenges which include connectivity and corridors, landuse changes, deforestation, poaching, and park-people conflicts (Thapa, 2016). Overharvesting of medicinal and aromatic plants, garbage disposal, and lack of designated trekking areas constitute additional park management challenges in Nepal.

Nepal is highly affected by climate change impacts (Sharma, 2010; Devkota and Bhattarai, 2012). Climate change impacts are noticed as declining precipitation, increasing temperature, drying springs, extreme rain events, droughts, increasing risks of flash floods, decline in yield of agricultural crops, soil erosion and land degradation, and emerging diseases and parasites (Yang et al., 2014; Poudel, 2015; Poudel and Duex, 2017). The vulnerability of Nepalese society to climate change impacts remains very high due to low level of economic development, insufficient implementation of adaptation measures, and high dependence agriculture. Rapid climate change coupled with unsustainable developmental practices and strategies has called for urgent development of comprehensive national policies and programs gearing Nepal towards green economy for poverty reduction, climate change adaptation, and sustainable development (Karki, 2013).

Agricultural and Natural Resources Developmental Initiatives

The Government of Nepal started its involvement on agricultural development with the establishment of *Krishi Adda* in 1921, followed by the establishment of the Ministry of Agriculture in 1952. Some of the highly noteworthy initiatives during initial years of agricultural development include the formation of the Land Reform Commission in 1953, launching the First Five-Year Plan in 1956, promulgating the Land Reform Program in 1956, establishing the Institute of Agriculture and Animal Science (IAAS) in 1959 and Agriculture Development Bank in 1968 (Poudel, 2004). Development of agro-industries in sixties and seventies and launching several Integrated Rural Development Projects across the country in 1970s and 1980s include other important agricultural developmental initiatives taken by the Government of Nepal. Similarly, implementation of several irrigation projects, construction of agricultural roads, and establishment of Nepal Agricultural Research Council (NARC) in 1991 can be cited as additional praiseworthy initiatives for agricultural development in Nepal.

Nepal government launched 20-year Agriculture Perspective Plan (APP) 1995-2015 in 1997 aiming accelerated agricultural growth, poverty alleviation, improved standard of living, expanded employment opportunities, transformation of subsistence-based agriculture to commercialized agriculture, and overall economic growth (NPC, 1995). The APP followed the "Pocket Package Strategy" in which agricultural production pockets were to be identified and infrastructural development was to be followed for an increased agricultural production. The APP proposed increasing irrigated land from 45,900 hectare in 1994/95 to 1,126,000 hectare in 2014/15 with corresponding increase on fertilizer use from 101,000 mt in 1994/95 to 628,000 mt in 2014/15 (Basnet, 1999). However, results from APP were not satisfactory. Major reasons for poor performance of APP include, lack of targeting vulnerable people in rural areas, political instability, inability to cover whole country as a production base, lack of a lead agency for program implementation, dependence on imported technologies such as improved seeds, fertilizers, pesticides and farm equipment; targeting cities for food production rather than the rural masses, and lack of sustainable local food production practices (Cameron, 2009; MoAD, 2014).

The Government of Nepal recently launched Agriculture Development Strategy (ADS) 2015-2035 envisioning the development of a self-reliant, competitive, and inclusive agriculture for food and nutrition security, livelihoods, food sovereignty, and economic growth (MoAD, 2014). The ADS serves as an umbrella program for agricultural development. Four flagship programs, in addition to several core programs, identified by ADS include: 1) Food and Nutrition Security Program; 2) Decentralized Science, Technology, and Education Program; 3) Value Chain Development Program; and 4) Innovation and Agro-entrepreneurship Program. Notable agricultural initiatives implemented under the umbrella of ADS include the Zero Hunger Challenge National Action Plan (2016-2025), the Prime Minister Agriculture Modernization Project (PM-AMP) (2016-2025), and the Multi-sector Nutrition Plan (MSNP) (2013-2023).

The Zero Hunger Challenge National Action Plan 2016-2025 (MoAD, 2016) is a major agricultural initiative that is developed in line with the Rio+20 Conference on Sustainable Development held in Brazil in 2012. The National Action Plan aims to make Nepal, where five million people are undernourished, 41 percent of children under five-year age are stunted, and 29 percent children under five are underweight, free from hunger and malnutrition by 2025. The five pillars of the Zero Hunger Challenge National Action Plan include: 1) 100 percent access to adequate food all year round, 2) zero stunted children less than two years, 3) all food systems are sustainable, 4) 100 percent increase in smallholder productivity and income, and 5) zero loss or waste of food. The National Action Plan puts emphasis on increased food production and productivity, increased investment in agriculture, development of physical infrastructure and agribusiness, increased employment opportunities, increased support for smallholder and landless population, and improved food governance. Total expenditures estimated for 10-year of the Zero Hunger Initiative is Rs. 242,500 million.

The Prime Minister Agriculture Modernization Project (PM-AMP) (2016-2025) is a flagship agricultural development initiative undertaken by the Government of Nepal (MoAD, 2017). The PM-AMP aims at achieving self-sufficiency in wheat and vegetables by 2017, paddy and potato by 2019, maize and fish by 2020, and fruits like bananas, papaya and litchi by 2021 (*Kathmandu Post*, March 13, 2017). The PM-AMP aims at developing specialized agricultural production areas as Super Zone (1000 hectare), Zone (500 hectare), Block (100 hectare), and Pocket (10 hectare), and allocating funds and providing services accordingly. The PM-AMP sets the target of developing number of Super Zone, Zone, Block, and Pocket from its first year as 7, 30, 150, and 2,100 to its 10th year as 21, 300, 1,500, and 15,000, respectively. However, successful implementation of the program has become a challenging task primarily due to weak connection between producers and governmental agencies, lack of supporting legislations and policies, lack of manpower, and weak coordination among agencies that are responsible for project implementation.

In line with Millenium Development Goals (MDG), particularly stunting, Nepal Planning Commission launched Multi-sectoral Nutrition Plan (MSNP) 2013-2017 (2023) to address chronic malnutrition problem in Nepal. The MSNP aims at strengthening institutional framework and facilitate collaborations among different stakeholders particularly Ministry of Health and Population, Ministry of Education, Ministry of Federal Affairs and Local Development, Ministry of Urban Development, and Ministry of Agricultural Development. Along with reducing poverty level and ensuring food security and improving maternity child nutrition, the MSNP expects several outputs including update and incorporation of nutrition indicators in policies and plans, enhancing multi-sectoral coordination mechanism, improving maternal and child nutritional care, capacity-building, food availability and reducing diarrhoeal diseases and Acute Respiratory Infection (ARI) episodes among young mother, children and infants.

Multilateral and bilateral agricultural development projects, which are implemented through the Government of Nepal or directly by the multilateral and bilateral agencies, also keep high

significance in agricultural development of Nepal. Major multilateral and bilateral agricultural projects in Nepal are the Project for Agriculture Commercialization and Trade (PACT), 2009-2018 (World Bank); the Raising Incomes of Small and Medium Farmers Project (RISMFP) (Asian Development Bank); the Knowledge-Based Integrated Sustainable Agriculture in Nepal (KISAN) project (USAID); the High Mountain Agribusiness and Livelihood Improvement (HIMALI) Project (Asian Development Bank); the Inclusive Growth Program in Nepal (UNNATI) (DANIDA); the Samarth-Nepal Market Development Program (Samarth-NMDP) (DFID); and the Sahaj-Nepal Agricultural Market Development Program (Sahaj-NAMDP) (SDC). Main developmental goals of these projects generally include, commercialization, poverty reduction, exports of agricultural commodities, physical infrastructural development, climate change adaptation, value chains, and agricultural market development.

Irrigation has received high priority in agricultural development since the beginning of political transformation 67 years ago, when the Government of Nepal created the Ministry of Agriculture for the first time in 1952 with two departments, Agriculture and Irrigation. Department of Irrigation is currently housed under the Ministry of Energy, Water Resources and Irrigation. Department of Irrigation currently oversees several irrigation projects across the nation including the four projects of national significance, the Sikta, Babai, Ranijamara Kulariya, and Bheri Babi Diversion (MoEN, 2018). Total irrigable land of Nepal is estimated as 2,178,000 hectare of which 1,091,000 hectare receive irrigation water from surface and ground water and from farmers' managed irrigation. An estimated 418,000 hectare agricultural land is with year-round irrigation. Rainfed agriculture predominates the hill and mountain regions. Nepal receives on average 200 cm of annual rainfall in the eastern region, 150 cm in the central region, and 100 cm in the western region (Shrestha, 2007). Amount of annual rainfall decrease from south to north. In a survey study, Dahal et al. (2000) reported almost one-half (48.2 percent) of the respondents suggesting irrigation as the top priority area for agricultural development in Nepal, followed by agricultural market (11.4 percent), quality fertilizers (10.4 percent), modern tools/equipment (9.4 percent), land ownership (7.6 percent), credit facilities (6.0 percent), removal of land ceiling (0.8 percent), and others (2.6 percent) with no responses (3.6 percent).

The Government of Nepal has undertaken many natural resources conservation, development and utilization initiatives. The scope of these initiatives span from field level to watershed, basin, and landscape levels. Some of these initiatives include, the Chure Conservation Program, National Biodiversity Strategy, *Hariyo Ban* Program, Wildlife Management Project, Adaptation for Smallholder in Hilly Areas Project, Agroforestry and Community Forestry, Climate Resilience of Watersheds, Watershed Management, Soil and Water Conservation, Kailash Sacred Landscape Conservation Initiative (KSLCI), Building Resilience to Climate Related Hazards (BRCH), and Community Based Flood and Glacial Lake Outburst Risk Reduction Project (CFGORRP) (MoFE, 2018; MoEN, 2019). Water resources management for irrigation, drinking water, industries, recreation, and agriculture constitute additional high priority natural resource management activities in the country.

Following the enactment of National Parks and Wildlife Conservation Act 1973, Nepal embarked on establishing national parks, wildlife reserves, and conservation areas for natural resources conservation and development and tourism promotion in the country. Subsequent acts and regulations include National Parks and Wildlife Conservation Regulations 1974, Wildlife Reserves Regulations 1978, and Buffer Zone Regulations 1996. Nepal has an excellent network of national parks, wildlife reserves, and conservation areas representing tropical, subtropical, temperate and alpine climatic conditions with a wide range of floras and faunas. Nepal currently hosts 20 protected areas (national parks, wildlife reserve, conservation areas, and hunting reserve). They include, Chitwan National Park (1973), Langtang National Park (1976), Rara National

Park (1976), Bardia National Park (1976), Shivapuri National Park (1976), Sagarmatha National Park (1976), Shuklaphanta Wildlife Reserve (1976), Koshitappu Wildlife Reserve (1976), Parsa Wildlife Reserve (1984), Khaptad National Park (1984), Shey Phoksundo National Park (1984), Annapurna Conservation Area (1985), Dhorpatan Hunting Reserve (1987), Makalu Barun National Park (1991), Kangchenjunga Conservation Area (1997), Manaslu Conservation Area (1998), Blackbuck Conservation Area (2009), Gaurishankar Conservation Area (2010), Banke National Park (2010), and Api Nampa Conservation Area (2010) (Shrestha, 2007; MoFE, 2018). Although protected areas in Nepal were established initially for the protection of wildlife, the scope of these areas now has broadened to the preservation of natural, cultural, historic, and scenic values of the nation (Lekhak and Lekhak, 2009).

Fundamental Challenges of Agriculture and Natural Resources Development

Nepalese agriculture is highly diverse, labor intensive, small landholding size, and strongly linked with livestock, forest, and other natural resources. More than 40 percent of households operate less than 0.5 ha of land and 66 percent of households operate less than one ha of land (Acharya, 2005). There is an increasing engagement of women in Nepalese agriculture due to outmigration of young male workers. According to South Asia Alliance for Poverty Eradication (SAAPE) (2011), major causes of poor status of agriculture sector in Nepal include insufficient research, excessive control and regulations, inefficient public enterprises, inefficient investment portfolio, inefficient administration, and faulty planning process. Major challenges of agricultural development in Nepal include low productivity agriculture, traditional farming, fragmented agricultural land, lack of commercialization and industrialization, lack of agricultural infrastructures such as food storage facilities, collection centers, and agricultural roads, and lack of irrigation facilities (Samridhi, 2011). Similarly, major challenges in natural resources sector include fragmented and poorly coordinated programs, lack of appropriate laws and regulations, equitable distribution of benefits accruing from natural resources, tenancy issues, and lack of timely monitoring and evaluation. These issues, problems and challenges in agriculture and natural resources sectors can be tied together into five fundamental challenges as follows:

Community Awareness

While community awareness is fundamental to conservation and sustainable utilization of natural resources and agricultural development (Poudel, 2008), local communities at large exhibit low level of awareness with respect to their market opportunities, policies and regulations, soil and water conservation technologies, governmental programs, pesticide contamination, food safety, soil conditions, and animal health. As agricultural production closely links to natural resources such as forest, water, soils, crop varieties and climatic conditions, a holistic approach to agricultural and natural resources management is necessary for sustainable development. Understanding linkages between agricultural and natural resources, local communities, production practices, and governmental policies and programs is critical for overall development of agriculture and natural resources (Poudel, 2016). For sustainable agriculture and environmental quality, local communities should be sufficiently aware of agricultural and natural resources issues such as food security, pesticide residue and food safety, environmental pollution, market opportunities, water quantity and quality, forest degradation, climate change impacts, and livestock health. Therefore, there is a need for a coordinated effort from public media, governmental agencies, private sectors,

academia, business communities, industries, and other stakeholders for community awareness on agricultural and natural resources development and management.

Sustainable Management of Agricultural and Natural Resources

Sustainable management of land, irrigation water, crop varieties, animal breeds, wildlife, medicinal and aromatic plants, mineral and mines, and natural beauty of Nepal for food, energy, tourism, employment, and industrial growth is another fundamental challenge (Shrestha, 2007; Poudel, 2011). A thorough assessment of agricultural and natural resources in relation to their status, problems, and opportunities for their best development and utilization is necessary for sustainable development (Poudel, 2008). In Nepal, large tracks of agricultural lands are left barren mainly due to labor shortage and lack of market opportunities. Even fully irrigated lands are being underutilized, producing just one crop in a year. Similarly, national parks and conservation areas are underutilized because of poor infrastructure coupled with lack of appropriate programs and strategies. Drying springs is an increasing and widespread environmental and hydrological problem (Poudel and Duex, 2017). Surface water pollution due to sediments, pathogens, nutrients, and other substances is affecting public health and freshwater supply. For sustainable agricultural and natural resources development, it is critical to identify, develop and implement appropriate sustainable technologies and practices for crop production, livestock management, irrigation water management, soil management, forest management, park management and other activities across the nation.

Capacity-building

Capacity-building at national, regional, and local level is another fundamental challenge in agricultural and natural resources development and management. According to Poudel (2012), capacity-building is a process which involves identification of problems, analyzing the problems, developing collaborative projects, project implementation, monitoring and evaluation of the projects, and reporting. Science-based agricultural and natural resources development and management strategies and practices are necessary for higher agricultural productivity, economic growth, and natural resources sustainability. Capacity needs to be built-up for basic, applied, and integrative research. Capacity-building for climate change adaptation, agro-industrialization, tourism, and environmental/ecological restoration is urgently needed because of heavy climate change impacts, poverty, and the degradation of environmental quality across the nation. As NARC has evaluated and developed a large number of agricultural technologies and practices over the past 26 years, there is a great opportunity for off the shelf technology transfer and capacity-building for agricultural and natural resources development and management in Nepal.

Policies, Institutions, Trade and Governance

Another fundamental challenge for sustainable agricultural and natural resources development is the formulation and successful implementation of appropriate policies, programs, and strategies (Poudel, 2009). Agricultural and natural resources management policies and strategies should be developed based on availability of local resources, competitive advantages, grassroots participation, self-reliant economic development, and fast paced socio-economic transformation. Agriculture and forestry sectors promise high for green economy in the country. The practices

that lead to green economy can be cited as organic agriculture, biofuels, forest-based livelihoods, bio-gas, micro-hydro, and sustainable harvesting of forest products (Karki, 2013). Sustainable harvesting, processing, and marketing of medicinal and aromatic plants include another important practice leading to green economy in Nepal. The Constitution of Nepal 2015 has devolved power from central government to provincial and local governments. Federalized administrative and governance structure remains a challenge for agricultural and natural resources development and management (Poudel, 2016; Poudel, 2018). Both the horizontal and vertical integration of agricultural and natural resources policies and guidelines, laws and regulations, and management strategies at the national, provincial and local level is critical for successful planning and development of agricultural and natural resources.

Sustainable Community Development

Making direct and visible impact to sustainable community development is another fundamental challenge of agricultural and natural resources developmental initiatives. Sustainable community development requires implementation of integrated developmental initiatives targeting specific community ensuring income and employment generation, access to education and health services, peace and security, food security, environmental quality, free from poverty and malnutrition, and community resiliency (Poudel, 2016). Thus, agriculture and natural resources development policies and programs must lead to overall development of local communities. Every quarter of the society, including disadvantaged population, must directly benefit from agricultural and natural resources development. Agricultural and natural resources initiatives must promote self-reliant development.

Drivers of Agricultural Development

Smallholder mixed-farming system, which is the backbone of Nepalese agriculture, evolved from thousands of years of cultivation of hill slopes, valleys, and flat lands in a small scale by individual families primarily to meet their household needs of food supply (Poudel, 2015). Smallholder family farms are the soul and pride of rural communities in Nepal. A family farm in smallholder mixed-farming system produces almost everything needed for a family such as cereals, fruits and vegetables, medicinal and aromatic plants, spice crops, ornamental plants, fodder trees, religious plants and their products, livestock, poultry, and other farm products. The key drivers of Nepalese agricultural development are presented in Figure 1.

Driver 1. Sustainable Commercialization of Smallholder Mixed-farming System

The smallholder mixed-farming system presents unique opportunities for commercialization. Some of the approaches to commercialize smallholder mixed-farming system include contract farming, integration of new crops, value chain approach, specialized crop production zones, off-season crop production, agricultural cooperatives, and the development of rural agricultural industries. Smallholder mixed-farming system offers a great opportunity for intensified crop rotation, maximum utilization of land, water, forest, crop types, animal resources, and engagement of agricultural labor year-round. Organic production is still a predominant agricultural practice in smallholder mixed-farming system. According to Poudel and Wildman (2001), nutritional

composition of foods relate to soil characteristics and farming systems, and an improvement of soil physical, chemical and biological properties through organic farming system leads to the production of nutrition rich foods and thereby improve human health. Organic farming results on healthy soils and increases soil and water conservation. Diversified agro-ecoregions of Nepal present unique and favorable crop growing conditions throughout the year and, thus, allow the production of organic fruits and vegetables and other crops in a competitive basis in the country (Poudel, 2008). Home gardens, which are utilized for the production of organic fruits, vegetables, condiments, and spices for family consumption, need further development. Specialized agriculture such as fruit orchards, vegetable production, agronomic crops such as jute, cotton and sugarcane production; tea gardens, coffee, cardamom, ginger, and rubber production are some of the examples of commercialized smallholder mixed-farming production in Nepal. Agricultural productivity of these production systems can be increased through the implementation of appropriate agronomic practices, irrigation management, climate change adaptation, nutrient management, integrated pest management, soil and water conservation, improved crop varieties, information technology, and the use of agricultural biotechnology (Raman, 2006).

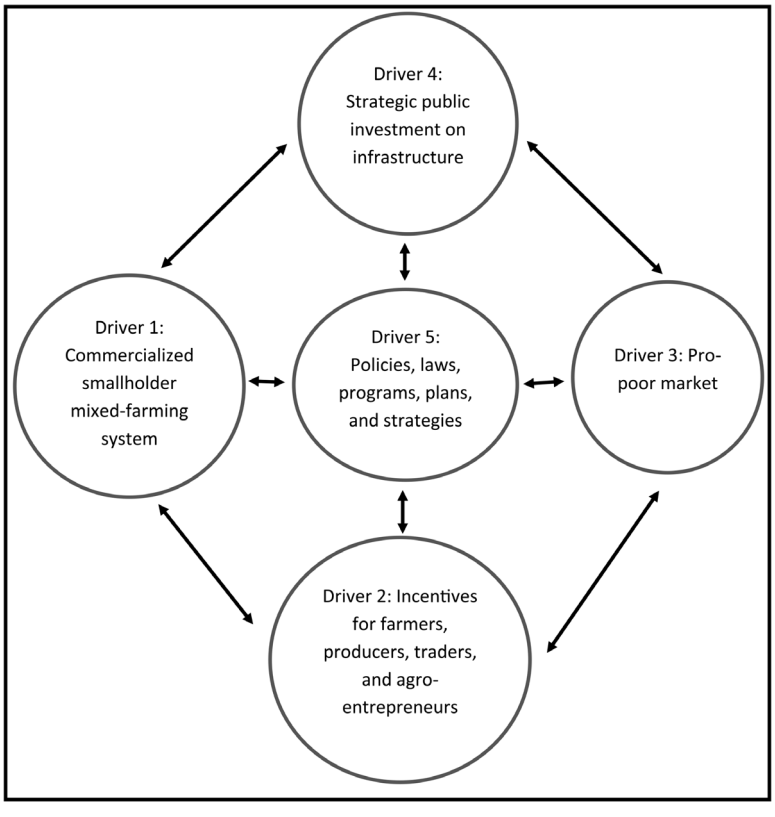

Figure 1. Five Drivers of Agricultural Development in Nepal

Driver 2. Incentivized Individual Farmer, Trader, Supplier, and Agro-entrepreneur

Appropriate incentives for individual farmers, traders, suppliers, retailers, and other agents engaged in agricultural production, marketing and distribution is necessary for agricultural development. Premium prices or price guarantee on organic products will promote organic agriculture. Incentive mechanism such as Payment for Ecosystems Services (PES) support stakeholders who implement green economy practices such as soil and water conservation, reforestation, and organic farming in upstream areas to improve water quality and ecological integrity downstream (Karki, 2013; Prajapati and Joshi, 2014). Financial rewards can be given to farmers planting green manure crops in their farms. Similarly, economic incentives, transfer payments, and financial rewards can be made available for farmers who implement various farm management practices such as livestock shed improvement, landslide control, riverbank protection, gully erosion control, agroforestry intervention, and other similar measures. Governmental support for crop and livestock insurance is another way of incentivizing producers. Incentivized agro-tourism is another way of strengthening rural agriculture. Agri-tourism incentives may include governmental support for the improvement of farm roads, establishing viewing towers, establishing playgrounds, water supply, construction of welcome centers, providing tourist guides, and many other facilities. Tax relief and financial assistance can be provided to traders for selling green technologies and products such as bio-pesticides, bio-fertilizers, food storage bags, etc. Interest-free or reduced interest loans may serve as additional incentives for agricultural traders, suppliers and other stakeholders.

Driver 3. Pro-poor Market

According to Dahal et al. (2000), accurate market information, appropriate enforceable rules and regulations, and extensive networks for social interactions are necessary for a good market. They further stated that the government has a key role to play in order to develop a market by providing necessary physical infrastructure and institutions that support private sector and market dynamics. Accelerated growth on agribusiness (agro-processing, post-harvest operation, and marketing) was identified as one of the priority outputs of APP for agricultural development in Nepal (NPC, 1995). Market measures and structures such as value chain approach, contract farming, cooperatives, development of auction barns and slaughter houses, farmer's markets, price guarantees, premium prices, collection centers, and storage facilities help developing pro-poor markets. Relationships between producers, middlemen, processors, retailers, and exporters should be strengthened. The process of organic certification, quality check and quality assurance should be facilitated and simplified. Credit, loans, and other financial assistance should be easily available to the producers and landowners. Agricultural inputs supply mechanism should be robust.

Driver 4. Strategic Public Investment on Infrastructure

The Government of Nepal should strategically invest on transportation, agricultural roads, natural resources conservation, communication, irrigation, power supply, education and outreach. Lack of roads or poor road conditions, unreliable power supply or lack of power supply, and insufficient research on agricultural development were recognized by APP as major bottlenecks for agro-industrial development in Nepal (NPC, 1995). Consequently, the APP emphasized roads and power supply among the major priority inputs including irrigation, fertilizer, and improved agricultural production technologies. Along with attracting private investment, the Government

of Nepal should encourage public-private partnerships for agro-industrial as well as agro-infrastructural development.

Driver 5. Comprehensive Policies and Programs, Rules and Regulations, and Trade Agreements

Policies and programs, rules and regulation, and trade and agreements play crucial role in agricultural development by promoting agricultural production, processing, and exports. Agricultural policies and programs should be developed considering competitive advantage, inclusiveness, and available local resources for agricultural development. Due to the federalization of the governance and administrative structure, it is necessary to review existing agricultural policies and design appropriate ones to fit into new administrative and governance structure without any delay. Nepal's agricultural development process so far has largely a top-down, which needs to be changed into a bottom-up approach for accelerated agricultural growth. Current policies such as crop and livestock insurance, specialized crop production zones, agricultural modernization initiatives, etc., should be well coordinated horizontally and vertically for their successful implementation. Land banks, land rehabilitation programs, lease companies, and other innovative approaches may be necessary for expedited agricultural development. International trade agreements and treaties need periodic reviews, revisions, and update. Some of the existing international trade agreements include the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), the South Asian Free Trade Area (SAFTA), and the World Trade Organization (WTO).

Asta-Ja Framework

About a decade ago, Poudel (2008) published a groundbreaking framework of Asta-Ja meaning eight *Ja* in Nepali letter, *Jal* (water), *Jamin* (land), *Jungle* (forest), *Jadibuti* (medicinal and aromatic plants), *Janshakti* (manpower), *Janawar* (animal), *Jarajuri* (crop plants) and *Jalabayu* (climate) as fundamental resources for nation's economic development and socio-economic transformation in Nepal (Poudel, 2008). This publication was followed by a series of other publications on Asta-Ja Framework, which include, policy framework (Poudel, 2009), strategic framework (Poudel, 2011), and capacity building framework (Poudel, 2012). Other subsequent groundbreaking publications on this framework include management of Asta-Ja system (Poudel, 2016) and the focus of Asta-Ja on national planning and development (Poudel, 2018). Asta-Ja Framework suggests full consideration of all eight elements while utilizing Asta-Ja resources for economic development. In order to enhance sustainability and profitability of agriculture, it is critical to conserve and develop natural resources such as land, forests, and water and utilize climatic conditions appropriately in a comprehensive way. Agricultural productivity of smallholder mixed-farming system in Nepal closely relates to soil quality, water availability, forest resources, climatic conditions, improved crop varieties and animal breeds, and management practices (Poudel, 2015). The eight principles of Asta-Ja Framework: community awareness; capacity-building; policy decision making; comprehensive assessment; interrelationships and linkages; sustainable technology and practices; institutions, trade and governance; and sustainable socio-economic transformation and community development (Poudel, 2016) provide practical guidelines for design and successful implementation of policies and programs relating to Asta-Ja resources.

Knowledge Transfer and Nepalese Diaspora

Knowledge transfer is a fundamental process of development (Paulin and Suneson, 2012). While there exists a large pool of knowledge in developed countries, developing nations are struggling for necessary knowledge required for their economic growth, environmental quality, education, law and order, and socio-economic transformation. While knowledge transfer is regarded as one of the most important processes for economic growth of developing countries, successful knowledge transfer is a quite challenging task. According to Cummings (2003), at least five factors affect successful knowledge transfer: the source's knowledge sharing capability, the broader environment of knowledge sharing, recipient's learning conditions, the relationship between the source and the recipient, and the form and location of knowledge. In addition, the fitness of the knowledge that is being transferred, level of capacity-building of source and recipient organizations through training for knowledge transfer, identification of barriers of knowledge transfer, and having correct understanding of social and technical systems of recipient (Newell, 2005; Paulin and Suneson, 2012; Ekore, 2014) include additional factors for successful knowledge transfer.

In the past 10 years, more than 3.5 million workers received permits from the Government of Nepal for foreign works in more than 150 countries (Dhungana, 2018; *The Himalayan Times*, 2018). Major destination countries for foreign works include Malaysia, Saudi Arabia, Qatar, United Arab Emirates, Kuwait, and South Korea. Nepal received $6.6 billion (31.3 percent of Nepal's GDP) in remittances in the FY 2016/17 and ranked the fourth largest country in relation to the contribution of remittances in 2016 followed by Krygyzstan and Tajikistan (Nepal Sansar, 2018). The biggest sources of remittances to Nepal in 2016 were Qatar, Saudi Arabia, India and the United Arab Emirates. However, problems related to worker's safety due to harassing job environments in foreign countries along with adverse socio-economic conditions at home are very serious. Similarly, a total of 146,870 no objection letters permitting students to go abroad, mainly Australia, Germany, USA, Ireland, Canada, and New Zealand, for higher studies, were issued from FY 2010/11 to December 2016, (Aryal, 2017; Nandi, 2018). The large number of migrant workers together with an increasingly high number of Nepalese students bound for foreign countries every year constitute a relatively robust, widespread, and large Nepalese diaspora around the globe.

Nepalese diaspora especially in western countries including Australia, New Zealand, and Japan have been quite successful in getting higher education, acquiring access to new technology and skills, and getting experience in business management. Thus, there exists a huge pool of global knowledge, skills, and technology with Nepalese diaspora, which can be utilized for the development of Nepal through their effective transfers and management. For this, it is important to understand the form and location of knowledge, capability of diaspora for knowledge transfer, knowledge transfer mechanism and successful implementation of knowledge in Nepal. Nepalese diaspora can contribute to knowledge, skills, and technology transfer in the following five thematic areas:

Planning and Design, Implementation, and Monitoring and Evaluation

Nepalese diaspora come from different corners of Nepal and their collective wisdom, experiences, and knowledge of their home environments becomes an invaluable asset for effective planning and design of agricultural and natural resources programs in Nepal. Experience gained by Nepalese diaspora in foreign agricultural and natural resources policies and programs and laws and regulations is another valuable asset, which can be utilized in planning and design, implementation, and monitoring and evaluation of projects in Nepal. If effectively transferred, the

first-hand experience gained by Nepalese diaspora on agricultural development, industrialization, natural resources, environmental management, education, public health, and research and development in diverse settings around the globe will be very useful for nation-building.

Capacity-building

Nepalese diaspora can contribute to capacity-building at national, regional and local level for agricultural production and natural resources development by transferring knowledge and skills and through private investment. Nepalese diaspora can work closely with governmental agencies, private businesses, local communities, academic institutions, and other stakeholders for design and implementation of knowledge transfer and capacity-building in agriculture, natural resources and other sectors. Nepalese diaspora can contribute to training and skills development of local stakeholders in various fields including computer modeling, evaluation of production technologies and practices, data collection and analysis, program monitoring and evaluation, and scientific writing, which is necessary for sustainable agricultural and natural resource development and management.

Private Investment

Nepalese diaspora can contribute to agricultural and natural resources development in Nepal through private investment. They can invest on a wide spectrum of agro-industries, banking, education, health services, water harnessing, irrigation, eco-tourism, agri-tourism, laboratory facilities, and local business. One of the challenges of Nepal's development include the need for huge investment in processing and value addition (Karki, 2013). Nepalese diaspora keep high potential for small, medium, or even large investment. Of course, appropriate policies, rules, and regulations and possibly some incentives should be in place in order to attract private investments from Nepalese diaspora.

Sustainable Community Development

Nepalese diaspora can assist sustainable community development at the local level by launching various programs including home gardening, nutrition and health, education, drinking water supply, environmental quality, wildlife and habitat conservation, community orchards, and program design and implementation. Nepalese diaspora can also effectively serve local communities by building community centers, agricultural produce collection centers, and running local markets. Agri-tourism presents another possibility for engaging Nepalese diaspora directly on community development. The diaspora can help raising community awareness in relation to several agricultural and natural resources issues, including food safety, food storage, agricultural technologies, forest conservation, natural resources development, wildlife protection, environmental quality, and climate change adaptation.

Trade and Tourism Promotion

Nepalese diaspora spread all over the world can play a crucial role in the promotion of trade and tourism in Nepal. The diaspora can simultaneously promote markets for Nepalese products in foreign countries and tourism in Nepal through various activities including cultural shows,

documentary and film festivals, Nepal Day events, exhibitions, and radio and TV networks. Nepalese diaspora can contribute to national planning and development for tourism and trade in Nepal.

Although Nepalese diaspora keep a huge potential for knowledge transfer, the success of knowledge transfer depends largely on the capacity of diaspora, demand from Nepal, and the presence of appropriate mechanism for knowledge transfer. Figure 2 shows that only a small amount of knowledge could be transferred even if there exists a large pool of knowledge among Nepalese diaspora and the Government of Nepal is also willing for knowledge transfer. The transfer of the skills and knowledge occurs only at the domain where three spheres of knowledge transfer intersect. According to Gordon (2003), knowledge transfer occurs at the suboptimal level due to several reasons, and they include, underutilization of the expertise of the innovators, reactive rather than proactive efforts on knowledge transfer, unavailability of technical assistance in the process, very limited strategies for the utilization of transferred knowledge, insufficient efforts for identification or correction of barriers to knowledge transfer, and lack of facilitations for knowledge transfer.

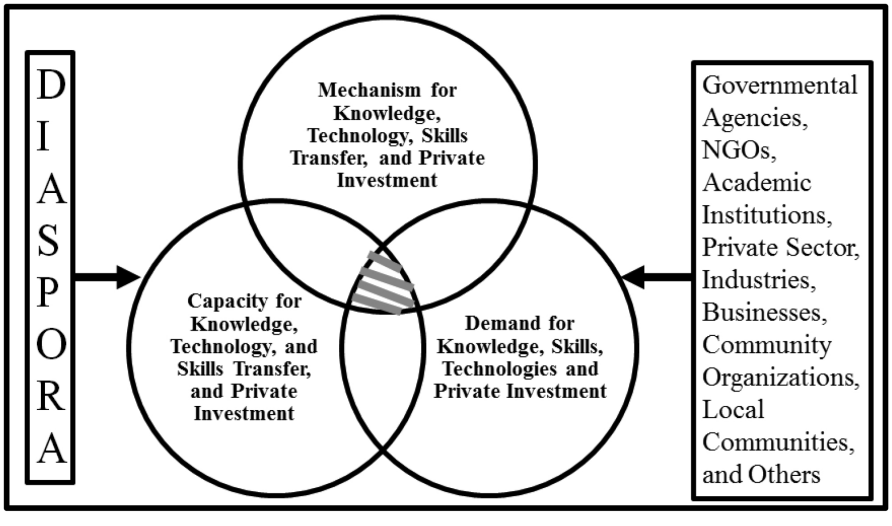

Figure 2. Venn Diagram of Knowledge, Technology, and Skills Transfer from Nepalese Diaspora

Conclusions

Smallholder mixed-farming system serves as the "nucleus" for agricultural development in Nepal. Five key drivers of Nepalese agricultural development are: 1) Commercialization of smallholder mixed-farming system; 2) Incentives for individual farmers, traders, buyers, and agro-entrepreneurs; 3) Pro-poor markets; 4) Strategic infrastructural development; and 5) Formulation of appropriate policies, programs, regulations, laws, and trade agreements. Commercialization of smallholder mixed-farming system can be done through many different ways including integration of new crops, organic agriculture, contract farming, value chain approach, specialized crop production zones, off-season crop production, agricultural

cooperatives, and the development of rural agricultural industries. To motivate producers and other stakeholders in agricultural production, it is important to incentivize individual producers, sellers, traders, buyers, agro-entrepreneurs and other stakeholders in agricultural activities such as production, processing, marketing, and export. Individual decision-making by producers and other stakeholders in agricultural activities is critical for agricultural transformation. Similarly, market mechanisms should favor the poor and disadvantage population. Public investment on agricultural development should focus largely on irrigation projects, agricultural roads; education, research and extension, and projects in which investments from private sector are unlikely. Timely formulation of appropriate policies and plans, rules and regulations, and signing and revising agricultural trade and treaties is necessary for overall fast-paced development of agriculture and natural resources. Emphasis should be given on the design and implementation of innovative programs such as land markets, land banks, land rehabilitation, agricultural modernization, and, as a starting point, declaration of the mid-hills and high mountains as organic agricultural regions. Nepalese diaspora possess a large pool of knowledge on agricultural and natural resources. Knowledge transfer from Nepalese diaspora can effectively occur in the areas of planning and design, capacity-building, private investment, sustainable community development, and trade and tourism. For successful knowledge transfer, it is imperative to locate available knowledge source first, and, then, develop appropriate mechanism for knowledge transfer considering the demand from the Government of Nepal and other stakeholders for knowledge transfer. Institutional strengthening at the national, regional, and local level is necessary for providing services to farmers, traders, agro-entrepreneurs, and other stakeholders. Agriculture Development Strategy (ADS) 2015-2035 presents valuable framework for agricultural development. However, due to several implementation challenges including the federalization of governance and administrative structure, an immediate revision of ADS to develop a comprehensive Agricultural and Natural Resources Development and Management Strategy (ANRDMS) is suggested.

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