Value Chain for Livelihood Promotion in Nepal Hills

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Abstract: High value cropping and integration of the poor in such activities to the market are the typical poverty reduction strategies in traditional agrarian societies. In this background this study intended to explore the avenues how high value cropping in high poverty incidence hilly region in Nepal could be supportive to raise the level of income of the poor conducive to poverty reduction. The study selected potato as the crop in western Nepal hills that has wider scope for further enhancing value chain system. We collect primary data from farmers, traders, and consumers, as well as secondary information from policy makers and concerned provincial ministry. The study concludes that in addition to the extension of the area under potato cultivation, the quality and size of the product need improvement for the use of potato in commercial / manufacturing industries producing potato chips and other products. This paves the way for the substitution of large quantity potato import in Nepal with prospect of employment generation and poverty reduction in Nepal's western hill region where the incidence of poverty is highest in the country.

Keywords: High Value Crops, Value Chain Analysis, Production function; Poverty Reduction.

1. Introduction

Agriculture is the major means of the livelihood for the majority of Nepalese people in rural area. It is still the backbone of Nepalese economy which employs approximately two-thirds of the country's labour force and contributes less than one-fourth of the GDP (Economic Survey 2021/ 22, Ministry of Finance). However, agriculture in Nepal is still subsistence in nature lacking commercial farming and modern technologies but still remains as a key issue for economic growth, poverty alleviation, better living standard of the people and overall Human Development of the entire population (www.samrriddhi.org).

Agricultural development is crucial not only for the promotion of livelihoods of the people but also for the sustainability of the entire ecosystem (Upadhyaya, 2006). The concept of sustainable livelihoods is basically useful for understanding the nature of poverty and also for identifying strategies and activities conducive to poverty reduction in an

effective and sustainable manner (Rasul & Kollmair, 2008). This is critically linked to the capabilities, assets – both material and social — and activities required to enhance in meeting these ends (Carney, 1998). It is sustainable when it can cope with and recover from external stresses and shocks as well as maintain or even enhance its capabilities and assets both now and in the future (DFID, 1999).

Fourteenth periodic plan of Nepal (2016/17-2018/19) gave high priority for entire agricultural and rural development including irrigation and water control, livestock, forestry, environment, agribusiness, credit, and institutions as well as associated rural development activities (Chaudhary, 2018). The 15th periodic plan has also proposed to industrialize agriculture sector for increasing employment, generating income and alleviating poverty in Nepal. For agricultural commercialization, the policy is to transform the agriculture from the subsistence to a modern commercial level and to connect agricultural products to the local, national and foreign markets.

The value chain framework seeks to overcome the constraints of market channels by identifying different entry-points and linkages that small and medium enterprises can leverage in a given production or supply chain. The value chain concept also entails the addition of value as commodities are transferred from the different stages of processing units and actors along with the routes of producer to consumers. A value chain, therefore, incorporates productive transformation and value addition at each stage of the value chain. Value addition is the result of different activities such as sorting, cleaning, processing, packaging, transporting, grading, etc. The value of product changes along with different actors and transactions. The promotion of value chains in agribusiness aims, therefore, to improve the competitiveness of agriculture in national and international markets and to generate greater value added within the country. In Nepal, the current agriculture development strategic plan (2015-2035) has prioritized the need to accelerate the development of value chain of major high value crops.

1.2. Agricultural value chain and livelihood promotion

Potato is cultivated worldwide in more than 150 countries of the world as a staple food including Nepal (Sapkota & Bajracharya,2018). The survival of hundreds of millions of people in the developing countries depends on the potato today (Timsina et al., 2011). It is fourth highest agricultural output consumed in the world after wheat, rice and maize (Tolno et al. 2016, Gaihre et al. 2017). It is also important cash crops to address food requirements among small holders in the countries like Nepal (Bajracharya

& Sapkota, 2017). In Nepal, it occupies first position in terms of productivity (14.03 ton/ha), 2nd position in total production, and 5th position in the area under cultivation (2,805,582 ha) (Panta et al., 2017). Potato is an important crop for both hills and Terai of Nepal. It is an important crop for food security in the high hills of Nepal contributing substantially to the livelihood of resource poor farmers in the mountains (Ghimire et al. 2016). In Nepal potato is planted in different seasons and harvested accordingly in different times, almost throughout the year. Mostly, the farming is subsistence type with small average landholding of only 0.68 ha per family (CBS, 2013). The cultivation of potato is popular among smallholder farmers due to its wider adaptability, high yield potential and demand in the market. Thus, it has become a major sources of food, income and employment to many rural farmers. Arguably, it is highly important and plausible to reduce rural poverty through the value chain development of high value crops. Furthermore, it requires integration of large number of people of high poverty incidence areas to these high value agricultural productions.

Livelihood promotion through high-value cropping is not the new research agenda in Nepal; however, we circumvent these issues in light of value chain analysis of major cash crop in Nepal hills: potato, which has not yet been covered in the literature. We take the case of mid-west region of the country, the Karnali Province, where the poverty incidence is highest and poverty reduction strategies are not yet effective so far.

As area specific studies are lacking in this regard, the present study intends to fulfil this gap. The rest of this article is organized as follows. Section 2 is about the objectives and methods of the study. It presents the procedure of crop selection for value chain, sample size, mode of data collection, value chain approach and the method of analysis. The value chain analysis is in Section 3 followed by the findings. Section 4 concludes and draws some implications of the study.

2.   Objectives and Methods

2.1. The objectives

The overall objective of this research is to explore how the promotion high value crops, potato in case of Nepal hills, in high poverty rate areas can reduce the incidence of poverty by improving the livelihood of the farmers. More specifically, the research is to:

    (i) Conduct the value chain analysis of potato in western Nepal hills,

   (ii) Assess the potentiality of expansion of potato cropping in the study area,

(iii)Develop a discourse how to integrate low-income families in potato cropping and improve their livelihood.

The specific objectives of this study are, therefore, three-folds: value-chain analysis of potato in high hills Nepal, exploration of the potential expansion of this crop the region and develop plausible avenues for the integration of poor families to this farming for the support to their livelihood.

2.2. Methods

2.2.1. Study locations

Karnali Province is the smallest Province in Nepal, with 5.4 percent of the country's population. The province has nearly 600,000 MPI (multi-dimensional poverty index) poor living in the province, which represents 8.1 percent of all MPI poor in the country. It has the highest MPI among all provinces in Nepal, at 0.230. This is well above the national MPI of 0.127. This scenario suggests that Karnali Province should receive considerable effort to boost specific economic activities in reducing the incidence of poverty.
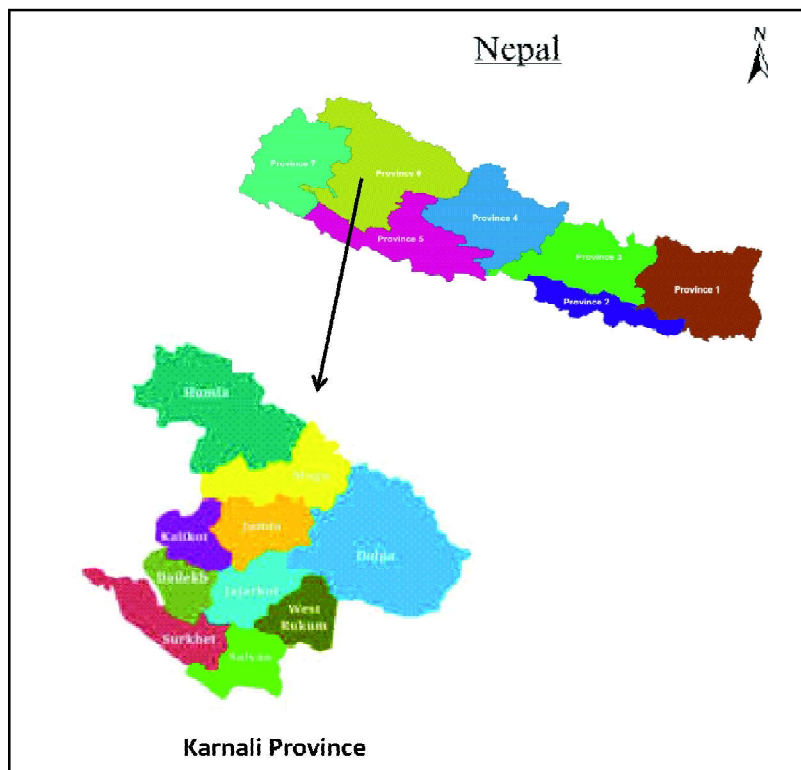
2.2.2. Selection of the crop for value chain analysis

The study conducted focus group discussions including six agriculture experts in Karnali province for selecting one most prospective high value crop in the province. The participants in the discussion were working under provincial Ministry of Land Management, Agriculture and Co-operatives.

The most promising – high yield — crops for the province were listed based on the matrix ranking exercise. Furthermore, the study team also listed the existing pocket areas and potential areas for the crops based on the secondary data available in the provincial ministry and/or directorate. The pocket areas were then ranked based on the level of poverty in the province. Thereafter, one area was selected based on the highest yield of the selected crop and the second area was selected based on the prospective yield in the future. In this way, two sites from the province were selected for further value chain analysis. The study team conducted purposive and thereafter stratified random sampling for the field study, the first for the selection of the crop and the second for the selection of the households for the survey.

With due consultation among the stakeholders in the province, this study selected potato for the value chain analysis to the Karnali province of the country. This product revealed the potential for the livelihood promotion and poverty reduction in the province.

The experts selected two districts for the purpose of field study - one as a district producing potato in a commercial scale and another as a district with high potential for commercial production in future. For the dual purpose as mentioned above, the experts selected Dailekh and Jumla districts, respectively. The selection of the study area was based on the following parameters:

i) Commercial District (Dailekh)

   a. The farming/production in a commercial scale,

   b. Area having road network, collection centres and other physical infrastructures,

   c. Support available from the provincial and local governments, and

   d. Having the scope to further strengthening the crop value chain.

ii) District potential for commercial production (Jumla)

   a. Currently, the potato production in lower scale,

   b. With potentiality of commercial production,

   c. Having/potential road network for agricultural marke,

   d. Having the scope of potato production with value chain perspective,

    e.　Scope for the expansion of market linkages, and

    f.　Support being provided from provincial and local government.

Based on the above parameters, Gurase of Guras Rural Municipality of Dialekh and Urthu Village of Patmara Rural Municipality of Jumla were selected respectively for the potato value chain in the study area. They represent the area undergone for commercial production and potential for commercial production in coming days, respectively.

2.2.3. Sample size

After the selection of the crop and survey area for the wider value chain system, the study conducted the survey using semi-structured questionnaire used for interviews with key informants. This included a number of participants at different stages of the market chain including the producers in the study areas. The people inhabiting the study districts are predominantly peasant farmers cultivating mainly food and cash crops.

With the support from provincial agricultural ministry and other stakeholders, four major stakeholders were providing information/data to the study. They include officials in the ministry/department of agriculture and livestock, producers, traders, and consumers.

Twenty producers, ten traders, and three available agricultural entrepreneurs provided data/information in the study area. Likewise, five consumers were purposively selected in the province for the interview. Altogether the study used four sets of questionnaires/checklist to collect primary data. One questionnaire was to collect information from producers regarding the production and supply; another questionnaire was to collect information from traders regarding marketing and competitiveness, and the third questionnaire for consumers regarding the substitutes of the high-value crop under study and competitive prices of these products. The interview with agricultural entrepreneurs used a different questionnaire. In addition, there were two sets of focus group discussion guidelines to each group of producers and traders, and one checklist to get information from government authority. The latter was to collect secondary data/information/reports. Following is a summary of the data/information collection protocol used in this study:

2.2.4. Data collection tools

The study has used primary data collected from the following sources:

    i)　Randomly selected producers, traders and consumers provided data/information as envisaged by structured questionnaire

    ii)　One Focused Group Discussion (FGD) with the producers in each study area,

Table 1: Log-frame for data/information collection protocol

Informant	Data collection tool	Major indicators	No. of interviews/KII/ FGD for VCA
Ministry of Agriculture & Livestock Development (MOALD), Department of Agriculture (DOA), Ministry of Land Management, Agriculture and Cooperative (MoLMAC), Directorate of Agriculture Development, Research centre, Agriculture Knowledge Centres[1]	Checklist	• Past and present interventions related to the particular value chain sub sector • Details of enablers for the commercialization of the particular crop (what, how) • Priority areas of intervention (long term and short term – basically for answering what, who, whom, how, and where	
Producers (farmers)	Key Informant Interview (KII), and Focus Group Discussions (FGD)	• Cost of production for the particular crop • Farm gate price • Contribution of farm activities to the total family income • Information regarding input (availability, details of input suppliers) • Technological availability and excess (availability of technical support, knowledge regarding crop management, improved varieties, machineries, equipment, and so on) • Information related to financial provisions (financial intermediaries, loan policy, etc.) • Information regarding the farmers' access to other services including education, health, financial / credit, information/ communication, legal factors	20 KII + 2 FGD

Informant	Data collection tool	Major indicators	No. of interviews/KII/FGD for VCA
		• Institutionalization status (farmers groups and cooperatives)	
		• Activities performed by men and women	
		• Marketing strategy (how the farmers sell their products)	
		• Priority areas of intervention (long term and short term – in terms of what, who, whom, how, where)	
		• Strengths, weaknesses, opportunities, and threats regarding market access, input supply, technology and product development, management and organization, access to finance, infrastructure, governance of empowerment, regulation and others that are related to the production and marketing of the particular value chain sub sector (selected crop).	
		• Problems regarding input supply, production and marketing faced by the farmers and explore market-based solutions regarding those problems	
		• Priority areas of intervention (long term and short term – in terms of what, who, whom, how, where)	
		• Details of enablers (what, how)	

Informant	Data collection tool	Major indicators	No. of interviews/KII/ FGD for VCA
Traders	Key Informant Interview (KII), and Focus Group Discussions (FGD)	• Cost involved during the product procuring and selling of the particular product • Selling price for the product • Problems faced by the traders while purchasing and selling the particular product and explore solutions • Access to services or resources • Priority areas of intervention (long term and short term – in terms of what, who, whom, how, where) • Details of enablers (what, how) • Details of target markets	10 KII + 2 FGD
Consumers	KII	• Price situation of the particular product at different markets • Consumers satisfaction to the existing products • Substitutes in the market • Availability of the foreign product in the market and price competitiveness • Quality control system in the market • Delivery system to the consumers • Consumer' access to the producers, the gap between farm price and price to the consumers	5 KII

Questionnaires and checklists were developed based on these indicators.

Table 2: No. of interviews, key informant interviews, and focus group discussions

Federal level	*Provincial level*	*District level*	*Total (Federal + Provincial + District)*	*Remarks* *One to each institution*
Ministry of Agriculture and Livestock Development (MoALD),	Ministry of Land Management, Agriculture and Cooperative (MoLMAC),	Agriculture Knowledge Centres (One in each district, high or low performance)	Nine interviews using the checklist	Head
Department of Agriculture (DOA), Research centre (one interview from each district using a checklist)	Directorate of Agriculture Development, Research centre (3 interviews in the province using a checklist)	Producer (20 KII) (2 FGD) Trader (10 KII) (2 FGD) Consumer (5 KII) Entrepreneurs (3 KII)	38KII and 4 FGD	One FGD among producers and one among traders in each survey district
Total: Four interviews	Total: Three interviews	Total: 38 KII + 2 checklist interviews + 4 FGD	51 (Checklist interview+ KII + FGD+)	

iii) In-depth interview with consumers, and

iv) The personal discussions with the traders in each district.

A framework interview schedule for primary data collection was initially developed. Five distinct groups of stakeholders involved in potato production and marketing, i.e., producers, collectors, traders, processors and consumers required five sets of questionnaires that were developed accordingly. Among farmers, the household survey questionnaire required pre-testing before its administration. This helped bringing the questionnaire in the final shape for household survey.

The data collection included indicators on production, distribution/sales, delivery of potatoes to the consumer, shortcomings and opportunities to the farmers, characteristics/interest of the actors involved in the processing of potatoes and their marketing. The field study not only collected data using the structured questionnaire but also from direct field observation and the focus group discussions. The questionnaire got translated into Nepali for the convenience to both field surveyors and the respondents.

2.2.5. Value chain approach

While analysing the value chain of potato, we identify and analyse the value chain actors and value chain functions including input supply, production, marketing and consumptions. Moreover, we analyse the value chain enablers separately for producers and traders. Regarding production function, we analyse profitability of the selected crops and run a regression to see the input and output relation in the framework of Cobb-Douglas production function. We further analyse the production problems using Relative Importance Index (RII). Our analysis on the intervention areas and future plan of the farmers and government institutions helps develop the mode of commercialization of the selected value chains. Similarly, while analysing marketing function, we identify marketing channels, value addition maps, analysis of demand and supply situations, and strategies on pricing, improvement on competitiveness and marketing.

2.2.6. Method of analysis

Cobb-Douglas production function has been most widely used by the researchers while establishing the technical relationship between the inputs and outputs in agriculture sector, (Zellner (1966), Meeusen & van Den Broeck (1977), Murthy (2002), Rastogi & Trivedi (2016), Bajracharya & Sapkota (2017)). It is because the relation between agriculture inputs and output is not linear. Therefore, we have used this function to analyse the relationship between the inputs and income from potato production. In

this production function, the coefficients represent the elasticity of respective inputs, and the summation of all the coefficients represents the nature of returns to scale. The following form of Cobb-Douglas Production Function has been used in this study:

$$Y = aX_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} X_6^{\beta 6} e^u$$

Where Y = total income from the potato production (per Ropani) (in NRs.),

X_1 = land rent amount per Ropani (NRs)

X_2 = depreciation amount per Ropani (NRs)

X_3 = raw materials

X_4 = labour cost per Ropani (NRs)

X_5 = bullock cost per Ropani (NRs), and

X_6 = marketing cost per Ropani (NRs)

e^u is the error term and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5,$ and β_6 coefficients (elasticity) of X_1, X_2, X_3, X_4, X_5 and X_6 respectively.

For the ease in computation, the Cobb-Douglas Production Function was linearized in a logarithmic function as below:

$$Ln\ Y = \ln a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + u$$

Where, ln = natural logarithm, a = constant and u = random disturbance term

The study estimates the elasticity coefficients of the change in the various explanatory variables pertinent to the poor households with respect to the change in the output of the potato in the study area. Poverty statistic of the province is the important end variable under this study. However, current poverty statistic of all the survey areas at local level was not available; neither the time series data of the poverty level for several years are available. Therefore, a regression based on the data of two-district survey has been carried out with annual household income as a proxy for poverty level (as a dependent variable) – low level of household income referring high poverty incidence.

The regression model was fitted with the survey data. The dependent and independent variables mentioned are considered to have been associated in the framework that stem from the value chain analysis implemented in the study. The selected variables in this VCA are captured by the block of independent variables or their proxies in the regression analysis.

3. Findings

Nepal has various soil and climatic conditions suitable for potato production throughout the year. If supply chain and production mechanism be enhanced, the best quality potato could be produced commercially. In the

country, it is estimated to have around 300 to 400 potato-chips plants that produce French fry, *Alutikki*, potato finger, *krinkle cut*, and potato chips. Only three of them are large sized plants. One plant is in Butwal (central Nepal) established by Chaudhari Business Group; another is in Mahendranagar (Far West Nepal), and the third one is in capital (Kathmandu) established by Bhatbhateni Supermarket. Only these three plants import Indian potatoes with required sizes. Other small plants use local varieties that are considered not suitable for the products mentioned above.

Productivity Analysis

The productivity of potato in the farm of respondent farmers ranged from 9.2 Mt/Ha to 15.25Mt/Ha in the study area. The productivity of sample farms in Dailekh and Jumla was lower than that of the average national productivity which was 16.65 Mt/Ha in the year 2019/20 (MoALD, 2021). To improve the productivity and enhance the livelihood of the poor, proper intercultural operations including weeding and earthing are required as per the expert suggestions in the survey.

Returns to scale analysis

Returns to scale describes what happens to long run returns as the scale of production increases, when all input levels including physical capital usage are variable. The summation of respective coefficients obtained from Cobb-Douglas Production Function gives the value of return to scale; if the value is greater than 1, meaning the production undergoing increasing return to scale. Similarly, the value equal to 1 indicates a constant return to scale and a value less than 1 indicates a decreasing return to scale.

Table 3: Production function analysis of potato

Variable & Parameters	Coefficients	Std. Error	t-value	P-Value
Constant	3.318	2.558	1.297	0.203
Lnrent	0.842	0.261	3.232	0.003
lndepreciation	-0.013	0.040	-0.323	0.749
Lnmaterial	-0.020	0.141	-0.140	0.890
Lnlabour	-0.062	0.224	-0.276	0.784
Lnbullock	0.044	0.051	0.875	0.387
Lnmarketing	0.227	0.075	3.010	0.005
R2	0.753			
Adjusted R^2	0.712			
F-Value	18.319***			
Σbi	1.018			

Note: *** significant at 1% level. Lnrent, lndepreciation, Lnmaterial, Lnlabour, Lnbullock, Lnmarketing refer logarithmic values of the expenditures on rent, depreciation, material inputs, labour cost, bullock ploughing, and marketing, respectively.
Dependent variable : annual household income

The model was statistically significant (Table 3, F-value 18.319) at 1 percent level. This indicated that the model has good explanatory power. Moreover, the coefficient of determination was 0.753 that indicated 75.3 percent variation in income from potato was explained by the six explanatory variables.

The summation of coefficients (b_i) was 1.018 which indicated increasing return to scale in potato production. This further implied that the farmers were producing at lower scale and they could enhance the level of production by increasing the level of inputs because the production function is following increasing returns to scale type.

Land rent and marketing cost were significantly influencing the income from potato. Other factors were not significant. However, those factors also showed some degree of influence on the level of income. Keeping other factors constant, it is evident that 1% increase in land rent would increase the income from potato by 0.842%. This implied that the land under potato cultivation could be increased to raise the income of potato farmers. Moreover, 1% increase in depreciation amount would decrease the income by 0.013%, however this increment was not found statistically significant. The use of machineries increases the cost of production and reduces the total income. Moreover, 1% increase in production materials (inputs) cost would decrease the income by 0.02%, though the increment was not significant. Similarly, 1% increase in labour cost would decrease the income by 0.062%. However, 1% increase in the cost of bullock and marketing cost would increase the income from potato by 0.044% and 0.227% respectively.

Based on the stakeholder consultation, the promotion of the value chain required harmonization of a series of factors connected with production, distribution, and marketing of potato and the more benefits could be filtered to the producers. The idea has been summarized in the following framework:
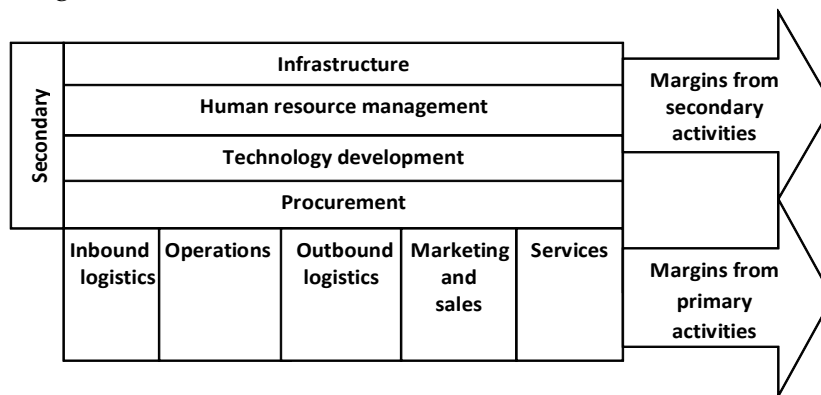
Secondary	Infrastructure					Margins from secondary activities
	Human resource management					
	Technology development					
	Procurement					
	Inbound logistics	Operations	Outbound logistics	Marketing and sales	Services	Margins from primary activities

Figure 1: Value chain analysis with the role of different stakeholders

Primary activities

The value chain analysis of potato reveals that the higher return to the producers flow from two level of activities. Farmers have to manage the primary activities themselves to raise the margins from inbound logistics, production activities, outbound logistics, marketing/sales, and private services. Likewise, the secondary activities associate some exogenous factors that also affect the level of income of the farmers; they include the quality and level of infrastructure, human resource management, technological development, and procurement activities from the public sector. The quality of rural agricultural road, technical support from district level agricultural knowledge centres, and distribution/availability of subsidized chemical fertilizers from the public sector are important in this regard.

4. Conclusion and Implications

Overall, land clustering, pooling, mechanization, assurance of subsidized farming coupled with quality seed and input supply, and promotion of off-season production will help increase the area under cultivation, production and productivity of potato in the Karnali Province along with solving the marketing and labour shortage problems. This will further help increase the employment opportunity.

The processing activities of potatoes in Nepal are rather limited to the production of potato chips so far. Furthermore, the size of potatoes required for this industry is not met by the Nepalese potatoes; therefore, development of new varieties is crucial in this regard.

The land area under potato farming and available mandays for employment in these farm activities are two major factors causing the growth of household income in the study areas. This shows the scope of the extension of potato production activities in this high poverty incidence province of the country that will be conducive to the growth of household income and reduction of income poverty. Extension of land and the marketing efforts are, therefore, the two crucial elements for raising the level of income of the farmers.

The study applied Cobb Douglas production function and used several inputs to measure their impacts in potato production. One unit increase in all inputs has caused 1.018 units growth in output; this signifies the increasing returns to scale in this farm activity. More specifically, one percentage growth in the land under cultivation, bullock used, and marketing would raise the total output by 0.84, 0.04, 0.23 percentages, respectively. However, the use of more labour force does not contribute the output that signifies the prevalence of disguised unemployment in these activities. Mechanization of potato farming deem necessary and the

prospect of further employment does not exist as already more labour force has been engaged in this activity. However, along with mechanization, the skilled-employment is expected to increase.

Two possible avenues exist in benefitting the potato farmers from their farm activities that stem from our value chain analysis. The primary activities include the margins from inbound logistics, production activities, outbound logistics, marketing/sales, and private services. Potato farmers need to get empowered to get benefit from these activities either to reduce the cost of production or expansion of the market of their products. Likewise, the secondary activities associate some exogenous factors that also affect the level of income of the farmers; they include the quality and level of infrastructure, human resource management, technological development, and procurement activities from the public sector. The quality of rural agricultural road, technical support from district level agricultural knowledge centres, and distribution/availability of subsidized chemical fertilizers from the public sector are important in this regard. These activities in different stages of value chain not only contribute extension and intensification of potato farming but also help explore market expansion that result in higher return to the potato producers.

Note

1. These institutions mentioned in this block belong to federal, provincial, and district levels. For details, see Table 2.

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