

# Constraints and opportunities of vegetable subsector in Kaski and Kapilvastu District of Western Nepal

B. Gurung<sup>1\*</sup> • P. Regmi<sup>1</sup> • D. Gautam<sup>1</sup> • R. Thapa<sup>1</sup> • G. Gurung<sup>2</sup> • K.B. Karki<sup>3</sup>

<sup>1</sup>Institute of Agriculture and Animal Science, Tribhuvan University, Kathmandu, Nepal.

<sup>2</sup>Department of Sociology, Tribhuvan University, Kathmandu, Nepal.

<sup>3</sup>NARC, Khumaltar, Lalitpur, Nepal.

\*Corresponding author. E-mail: bhimseng@yahoo.com.

Accepted 2<sup>nd</sup> February, 2016

**Abstract.** Nepal is a land of geographical diversity with mountains and hills occupying roughly 85% of the total topography with about 81% of the total population directly or indirectly absorbed by the agriculture sector. There are 25.16% of the populations living below the poverty line. Hence, to overcome the poverty, Prosperity Realization through Irrigation and Smallholder Markets (PRISM) is implemented as an approach of intervention based on constraints and opportunities identified in agriculture sector. In order to identify the constraints and opportunities of vegetable subsector, Kaski in the hill and Kapilvastu in the Terai were randomly selected for the study. Household survey was done in Kaski and Kapilvastu covering 15 different groups with 105 households in Kaski and 24 groups with 168 households in Kapilvastu. The information was collected through semi-structured questionnaire including participatory rural appraisal meetings using structured checklist. The information collected was tabulated, processed and analyzed through SPSS program. The survey outcome reflected that the vegetable subsector pinpointed different opportunities and constraints related to input supply, production, and output marketing levels including finance, technology, policy and infrastructure. The opportunities identified needs to be tapped and interventions designed and implemented to address the constraints at various categories and levels. Programs planned and implemented on the basis of constraints and opportunities identified could prove more effective and vibrant for the growth and development of the whole vegetable subsector in those studied area.

**Keywords:** Vegetable subsector, opportunities, constraints.

## INTRODUCTION

Misuse of fertilizers and plant protection chemicals on vegetable cultivation have greatly become hazardous to human health. Because of nutritional and health value as well as free of chemicals there is an ever increasing demand of organic vegetables by the consumers worldwide (Rana, 2015). The enhanced demand of vegetable may also be related to rapid industrialization and urbanization, population pressure and increase in general awareness about the essence of having vegetables with high nutritional value (Epstein et al., 2001; Rana, 2015). As a result, fresh vegetable production is on the increase but the supply is still much less than the consumers demand and hence Indian vegetables are imported to meet the local demand.

However, the productions of vegetables have increased manifolds over the years due to the intervention of GOs, NGOs and INGOs programs in the vegetable subsector. Moreover, the increase in production can be attributed to the farmer's shift of cultivation trend from cereal crops to vegetable crops due to high economic returns. The increased production has resulted in less import of vegetables thereby contributing significantly in the balance of payment in Nepalese economy (Pandey et al., 2014).

Vegetable cultivation requires the collaboration of different stakeholders such as input suppliers, technical knowhow and other required services like irrigation technologies, finances/funds for investment on vegetable

production and the output traders. The output traders buy the vegetable products and market them at local, regional, national and international levels (Nepal and Thapa, 2009). Equally important is the mapping of the vegetable subsector showing all the actors involved their functions and relationship. However, some constraints and opportunities do exist at each level. Identification of constraints and opportunities in the vegetable sub-sector is very important for the vegetable industry to flourish. It indicates the hindering issues related to the vegetable subsector and suggests the designing and implementation of appropriate interventions that address the constraints (Ruel and Levin, 2002). Whereas the opportunities can help find the potential market and areas where the poor farmers can participate as vegetable entrepreneurs (Emana and Gebremedhin, 2007). Being correlated both constraints and opportunities have to be studied together.

Kaski district in the hill and Kapilvastu in the Terai were randomly selected for the study where International Development Enterprises (IDE) implemented Prosperity Realization through Irrigation and Smallholder Markets (PRISM) project. This project creates sustainable opportunities through market-oriented interventions by: (1) creating networks of small enterprises to provide agricultural inputs needed by poor farmers; (2) working with farmers to improve small-farm productivity; and (3) linking small-farm families to markets their farm produce. The main idea of this study is to identify the constraints and opportunities of vegetable sub-sector before and after the vegetable program through PRISM approach in the above mentioned districts.

## MATERIALS AND METHODS

For this study, household survey was carried out in 15 different groups covering 105 households in Kaski and 24 groups with 168 households in Kapilvastu by using random table number. Questionnaire and checklists were prepared and used as survey tools to collect information. Pre tested questionnaires and checklists were used in the survey by the trained personals. Using structured checklist to get necessary information; twenty participatory (10 in each district) rural appraisal meetings were held in the project sites.

The data collected from the household survey were tabulated and entered in Excel data sheet, compiled, processed and analyzed through SPSS program. Pre and post project period were compared and transformations / positive changes brought about by the PRISM project were noted and inferences drawn based on these comparisons.

### Attractiveness and ranking matrix

An attractiveness matrix is a subsector prioritizing,

ranking and selection tool. A matrix is used with percentage (1 to 100%) of respondents in X axis and ranks (Number 1, 2 and 3) in Y Axis following Likert-types of scale as used by Boone and Boone (2012). Out of many options given in number one to three ranks, such options were selected as number one to three that has obtained highest percentage from the respondent.

### Before and after the project analysis

Conditions or situations on different aspects of the PRISM approach before and after the project period were compared and transformations/positive changes brought about by the project and inferences drawn accordingly as per those comparisons. As PRISM projects were in operation since a decade, comparisons of before ten years and after were made. The information collected was based on memory power of the respondents.

## RESULTS AND DISCUSSION

The findings of the study identified are opportunities and constraints in vegetable subsector, constraints of input suppliers, farmers and output traders. The findings are given as follows:

### Opportunities and constraints

Tables 1 and 2 depict the opportunities/constraints as perceived by the respondents of Kaski and Kapilvastu districts of Nepal. From the table it is evident that prior to the implementation of PRISM project, unmet market demand was pointed out by 71% of the respondents followed by GO/NGO/INGO working together (48%) and establishment of market center (34%) as opportunities in these two districts. The situation got altered after the implementation of the PRISM project. In Kaski, good road facilities (39%), high incentives/motivation to farmers (51%) and availability of micro-irrigation technology, like simple and low cost drip irrigation (59%) were number one, two and three opportunities, respectively. Likewise, high motivation to farmers (33%), availability of appropriate technologies to grow vegetables throughout the year (15%) and availability of micro irrigation technology (21%) such as Treadle Pump were the number one, two and three most important opportunities, respectively in Kapilvastu districts. The farmers indicated that if these opportunities were tapped they can do much better in vegetable production and increase income. Road is a basic infrastructure that the farmers need to transport inputs as well as the products (Joshi et al., 2006). Larger irrigation project for smallholders may not be economical and hence micro-irrigation is appropriate for the small holders (Nzomoi et al., 2007). Landslides and flooding of the river disturbed transportation and

**Table 1.** Opportunities/constraints as perceived by respondents in Kaski and Kapilvastu districts.

Kaski		Kapilvastu	
Before	After	Before	After
Unmet market demand (71%)	Good road (39%)	Unmet market demand (18%)	Farmers have high motivation on vegetable farming (33%)
GO/ NGO/ INGO working together (48%)	Farmers have high motivation on vegetable farming (51%)	GO/ NGO/ INGO working together (15%)	Veg. can be grown throughout the year (15%)
Established market center (34%)	Availability of micro irrigation technology (59%)	Established market center (13%)	Availability of micro irrigation technology (21%)

**Table 2.** Opportunities and constraints as perceived by respondents on vegetable sub-sector in both Kaski and Kapilvastu districts.

Opportunities and Constraints	Rank	Before	% of respondents
1. Unmet market demand	1st	Unmet Market Demand	39%
2. Farmers have high motivation	2nd	GO/NGO/INGO Working	27%
3. Vegetable can be grown year round	3rd	Established Market Center	21%
4. Significant shallow ground water			
5. Good road		<b>After</b>	
6. Support from government	1st	Farmers have high motivation	30%
7. Proximate to the market	2nd	Farmers have high motivation	38%
8. Availability of financial institutions.	3rd	Availability of micro-irrigation technology	35%
9. Established market center			
10. Availability of technology			
11. GO/NGO/INGO working			
12. Advantage of geography			
13. Availability of micro irrigation technology			

vegetables rot in the collection centers. Lack of improved technology reaching to the farmers and adaptation is a prerequisite of vegetables farming (Van den Berg et al., 2007). Technology that should be delivered to the farmers should be adopted easily so that the technology developed in the research station will be utilized (Fernandez-Cornejo et al., 2005). Establishment of market is another opportunity and constraints for the vegetables producers (Ortmann and King, 2007; Minten et al., 2009). If not an established market the producers cannot harvest profitable prices.

It is distinctly obvious from the table that before the PRISM project, the main opportunities/constraints in order of priority were high motivation to farmers (39%) established market center, good roadway network and availability of financial institutions respectively. The second most important opportunity was GO/NGO/INGO working in the project area (27%), established market center, advantage of geography i.e. vegetables, like ladies finger, cucurbits, chilli, brinjal, etc. could be produced earlier in Kapilvastu while rainy tomato can be grown in Kaski but difficult in Kapilvastu. Availability of financial institutions was also equally important.

Established market center as expressed by 21% of the respondents was yet another important opportunity. Government agencies have very little manpower but NGOs working in a particular locality can have their own people to guide the farmers and supervise the farm activities which can clear the difficulties that the farmers face on the spot. The Government agencies is to make policy, monitor the project and evaluate it for the replication to other sites and hence they should work together (Osbah et al., 2008; Hunsberger, 2010).

The first most important opportunities/constraints after the PRISM project felt by the respondents were high motivation (30%), good road facilities and unmet market demand followed by high motivation to farmers (39%), and supports from the government. This opportunity and constraints is also pointed out by Hara et al. (2013). The third most important opportunities were availability of micro irrigation technologies, support from government and advantage of geography (Kulecho and Weatherhead, 2005) and hence irrigation water supplied in the form of drip as micro-irrigation and available power is used to lift water. When the farmers do not have the access to other sources of power, solar power is good and cheap source

**Table 3.** Agri-inputs related constraints as perceived by respondents in Kaski and Kapilvastu districts.

Kaski		Kapilvastu	
Before	After	Before	After
NA	1. Lack of access to quality inputs	NA	1. Lack of inputs to quality inputs
NA	2. Poor relationship between farmers and input suppliers	NA	2. Complicated process to import inputs
NA	3. Lack of soil testing skill, and facilities	NA	3. Lack of soil testing skill and facilities.

**Table 4.** Agri inputs related constraints as perceived by respondents in both Kaski and Kapilvastu district.

Constraints	Rank	Before	% of respondents
1.Lack of access to quality inputs (Seeds/fertilizers/other)	1st	None	
2. Lack of knowledge and skill in technical aspects	2nd	None	
3. Complicated process for importing inputs from India	3rd	None	
4. Poor relationship between farmers and input suppliers			
5. Lack of soil testing knowledge, skill and facility		<b>After</b>	
6. Poor quality of raw materials	1st	Lack of access to quality inputs	66%
7. Lack of suppliers	2nd	Complicated process for importing inputs from India	34%
8. Existing supplier limited outreach	3rd	Lack of soil testing knowledge, skill and facility	40%

of renewable energy for micro-irrigation (Burney et al., 2010).

It was obvious that farmers were highly motivated as they got good income from the vegetables. The existence of road facilities to market the vegetable produce, government supports and also the involvement of NGOs and INGOs helped the farmers considerably. The advantage of geography and availability of micro irrigation technologies helped the farmers to produce vegetables in more quantity and got sustainable returns from the sale. For commercial vegetable production and income generation even from a small piece of land, these opportunities are best suited.

### Constraints related to Agri-input

Before the PRISM project, the constraints realized in the area of input supply in both the districts are presented in Table 3 and Table 4. The table reveals that hardly any input suppliers existed before the PRISM project. After the successful implementation of PRISM project in the targeted districts, more and more areas are covered by vegetable cultivation. There was also the development and establishment of input suppliers. The net result was that demand for more quantity having better quality agriculture inputs increased and hence some constraints realized. The most important number one, two and three constraints were lack of easy access to quality inputs like seeds, fertilizers etc (66%), complicated importing process of inputs from India (34%) and lack of soil testing knowledge, skill and facility (40%), respectively.

Inputs for crop cultivation depends on quality inputs

such as; fertilizer, chemicals, machinery, human, water for irrigation and seed energy. Without their supply in time with quality and quantity, profitable vegetables production is not possible (Hatirli et al., 2006). These are the real constraints in vegetables production in the PRISM as pointed out by majority of the farmers (Tables 3 and 4.). Availability of the fertilizers, quality seeds is another problems especially in the remote areas in the hills (Raut et al., 2011).

### Constraints related to output marketing

Tables 5 and 6 present the constraints encountered by the farmers of Kaski and Kapilvastu particularly in the area of produce marketing. Lack of market information (4.5%), lack of market demand (3%) and high transportation cost due to inadequate road facilities (4%) were the severe constraints before the PRISM project implementation. However, after the project implementation, the situation changed drastically. Lack of linkages to large buyers (33%), lack of information on product demand (41%) and lack of access to market information (42%) were the major constraints.

Consumers are aware that the vegetables contain essential vitamins and minerals, dietary fiber, phytochemicals, and can reduce risk from diseases and other medical conditions which are dangerous to human health. Increasing urbanization and lack of space for vegetables cultivation in urban and peri-urban area, the urban people must depend on the market for the purchase of vegetables and thus can have diversified vegetables for their kitchen (Pokharel, 2010).

**Table 5.** Constraints as perceived by respondents on produce marketing in Kaski and Kapilvastu districts.

Kaski		Kapilvastu	
Before	After	Before	After
Lack of access to market information (12%)	Lack of linkages to large buyers	Lack of marketing organizations/brokers	Inability to produce by smallholder as per market demand
Lack of information on product demand (5%)	Lack of marketing organizations/broker	Inability to produce by small holder as per market demand	Lack of marketing organizations/brokers
High transport cost (10%)	Lack of access to market information	High transportation cost	Lack of market information

**Table 6.** Constraints as perceived by respondents on produce marketing in both Kaski and Kapilvastu districts.

Constraints	Rank	Before	% of respondents
1. Lack of access to market information	1st	Lack of access to market information	4.50%
2. Inability of smallholder to produce as per market	2nd	Lack of information on product demand	3%
3. Lack of marketing organizations/Broker	3rd	High transportation cost	4%
4. Lack of information on product demand			
5. Lack of marketing methods		<b>After</b>	
6. High transportation cost	1st	Lack of linkages to large buyers	33%
7. Lack of linkages to large buyers	2nd	Lack of information on product demand	41%
8. Lack of market outlets	3rd	High transportation cost	42%

**Table 7.** Additional training needed by respondents.

Kaski		Kapilvastu	
Before	After	Before	After
Technical skill and production technology	Appropriate tools/ machine and technology	NA	Appropriate tools/machine and technology
Appropriate tools/ machine and technology	Technical skill and production technology	NA	Technical skill and production technology
Marketing skills/ methods and information	Marketing skills/methods and information	NA	Marketing skills/methods and information

Supermarkets are being developed in organized markets in Nepal where affluent consumers can purchase their regular supply and diverse products of vegetables. These changes have increased pressure on traditional, small, and poor farmers to keep up, with the requirements of good seed, efficient practices, hiring help beyond the family, market awareness, and the ability to provide safe and high quality vegetables (Piotrowicz et al., 2015).

The expanded commercialized production of vegetables in the developing countries has also led to challenges and difficulties (Pingali et al., 2005). A small farmer, in order to develop more commercial operation, needs capital for improved seeds, hired labor, and equipment, in order to remain a reliable supplier. The farmers must be able to supply a consistent flow of vegetables that are high quality and free of pesticide residues. New strategies for production and marketing

have been required. Production of vegetables is more profitable than traditional cereal production, but it requires more knowledge, more capital, more acceptances of risk, and new methods. Hence PRISM project has organized the market and despite taken longer time to develop the marketing system.

### Technology related constraints

The additional training needed by farmers is shown in Tables 7 and 8. The training needed by the farmers in order of priority are marketing skills/methods/information, technical skill and production technologies and appropriate tools/machine and technologies. Since the farmers were producing vegetables for self-consumption in traditional ways jumping to commercialization, the

**Table 8.** Additional training needed by respondents in both Kaski and Kapilvastu districts.

<b>Additional training needed</b>	<b>Rank</b>	<b>Before</b>	<b>% of respondents</b>
1. Appropriate tools/machinery/technologies	1st	Technical skills and production technologies	4%
2. Technical skills and production technologies	2nd	Appropriate tools/machinery/technologies	4%
3. Marketing skills/methods/information	3rd	Technical skills and production technologies	4%
		<b>After</b>	
	1st	Technical skills and production technologies	72%
	2nd	Appropriate tools/machinery/technologies	66%
	3rd	Technical skills and production technologies	70%

**Table 9.** Sources of funds used by respondents.

<b>Kaski</b>		<b>Kapilvastu</b>	
<b>Before</b>	<b>After</b>	<b>Before</b>	<b>After</b>
Local money lender	Cooperatives	Local money lender	Cooperatives
Friends and relatives	Friends and relatives	Friends and relatives	Saving and credit groups
Banks and banking institutions	Banks and banking institutions	Banks and banking Institutions	Banks and banking institutions

farmers need training on the improved technology. Moreover all the participating farmers were not educated and hence there is need for training for the proper amount of fertilizer use, IPM technology adaptation and cultivation practices as well as post-harvest handling (Poulton et al., 2010). The participating farmers have rightly pointed out that they need training in different aspect of vegetable cultivation (Tables 7 and 8). In the process of commercialization farmers have to operate the new machinery as well for which they need continuous guidance (Dinham, 2003; Yang et al., 2008).

### **Constraints related to finance**

Before the initiation of the PRISM project, the major sources of funds were the local money lender, friends, relatives, banks and banking institutions. However, after the implementation of the project, the major sources of funds in order of priority were cooperatives, saving and credit groups, banks and banking institutions. Small farmers indicate that they are poor and lack access to organized finance. This is reflected in Tables 9 and 10.

Small holders need credit facilities and borrowed from local money lenders, friends and relatives with higher rate of interest earlier to the PRISM project. Later after the start of the project, banking institutions including cooperatives, saving and credit groups were institutionalized. Financing the smallholders is not a problem alone in Nepal but in similar developing countries (Bingen et al., 2003; Reardon et al., 2009). Since the project organized credit facilities through

cooperatives, saving and credit groups were preferable but still these are the constraints as these institutions are not well established.

### **Policy related constraints**

The government regulations and policies were not so conducive to the farmers. Such regulations and policies mainly obstructed the farming business of the farmers. Before the project implementation, inadequate regulations of the government and subsidies provided were the main hindrances. However, even after the project implementation, the tax policies of the government did not encourage local producers. Besides improper regulations and lack of crop insurance also hindered the farming business (Tables 11 and 12). The government of Nepal has developed several plans and policies such as Agricultural Perspective Plan, Horticulture Master Plan etc. but no plans and policies included small farmers and targeted to vegetables production. Government also promotes fruits and fresh vegetable crops and emphasized to attain self-sufficiency in the short run while moving gradually to export in the long run. The production function is gradually transferred to private sector. The government's role in the future will be confined to quality control, technical services and monitoring. Appropriate governmental policies and programs, rules and regulations, credit availability, insurance policies, and governmental support systems should be in place for a successful farmer cooperative movement especially targeted to small farmers (Brown and

**Table 10.** Sources of funds used by respondents in both Kaski and Kapilvastu districts.

Sources of funds	Rank	Before	% of respondents
1. Local money lender	1st	Friends and relatives	44%
2. Friends and relatives	2nd	Local money lender	43%
3. Cooperatives	3rd	Saving and credit groups	40%
4. Saving and credit groups			
5. Banks and Banking institutions		<b>After</b>	
6. others	1st	2. Friends and relatives	35%
	2nd	4. Saving and credit groups	24%
	3rd	5. Banks and Banking institutions	42%

**Table 11.** Government policies and regulations that obstruct respondents business.

Kaski		Kapilvastu	
Before	After	Before	After
Lack of regulation	Import tax that penalize local producer	Subsidies	Import taxes that penalize local producers
Subsidies	Lack of regulation	Incentives	Lack of regulation
Registration and inspection	Insurance	Insurance and subsidies	Insurance

**Table 12.** Government policies and regulations that obstruct respondents business in both Kaski and Kapilvastu districts.

Government policies and regulations	Rank	Before	% of respondents
1. Import tax that penalize local producers	1st	Lack of regulation	3%
2. Artificial price subsidies	2nd	Subsidies	1.50%
3. Lack of regulation	3rd	Subsidies	2%
4. Registration			
5. Inspections		<b>After</b>	
6. Incentives	1st	Insurance	38%
7. Insurance	2nd	Insurance	34%
8. Subsidies	3rd	Inspections	34%
9. others			

Kennedy, 2005; Poudel, 2007).

### Infrastructural constraints

Tables 13 and 14 present the major infrastructural constraints faced by the respondents. The major infrastructural constraints as perceived by respondents before the project were: road facilities, telephone services and transport conditions. Road, refrigeration and cooling facilities and storage, electric supply were the major infrastructural constraints after the implementation of PRISM project. Though Agricultural Perspective Plan (APP) has pointed that there should be agricultural road where commercial agricultural production is concentrated. Electricity, irrigation facilities and credits should go side by side. To concentrate technology

dissemination for higher agricultural production Government of Nepal also has emphasized on Pocket Package Program, Public-Private Participation etc. but required infrastructure to facilitate the vegetable production is not yet developed (Dahal et al., 2009). To promote smallholders and poverty reduction, infrastructures such as road, storage facilities, electricity, irrigation system, collection centers are needed. The project has emphasized on these infrastructures but the government should pay attention to smallholders vegetables production and poverty reduction (Mehta and Heinen, 2001).

### CONCLUSION

The demand and supply of vegetables have increased

**Table 13.** Major infrastructural constraints as perceived by respondents.

Kaski		Kapilvastu	
Before	After	Before	After
Road	Transport conditions	Road	Road
Telephone	Electricity supply	Transport condition	Refrigerator and cooling facilities and storage
Transport condition	Refrigerator and cooling facilities and storage	Telephone service	Electric supply

**Table 14.** Major infrastructural constraints as perceived by respondents in both Kaski and Kapilvastu districts.

Infrastructural constraints	Rank	Before	% of respondents
1. Road	1st	Road	4%
2. Transport conditions	2nd	Telephone service	2%
3. Telephone service	3rd	Transport conditions	3%
4. Electric supply, storage			
5. Refrigeration or cooling facilities etc.		<b>After</b>	
6. Others	1st	Road	57%
	2nd	Refrigeration or cooling facilities etc.	27%
	3rd	Electric supply, storage	43%

manifold due to the factors like rapid urbanization and industrialization and of course the ever escalating population growth. However, in our context, supply is comparatively less. To reduce the poverty to half by the year 2015 AD, the government of Nepal has recognized the commercial cultivation of vegetables as an important step to uplift the economically marginalized pro poor farmers. Hence to support the government target, PRISM project was implemented in several districts of Nepal and an evaluation made to study the impact of PRISM on small holder's vegetable producers and its effect on poverty. In this connection, Kaski and Kapilvastu districts of Western Development Region of Nepal were chosen for study and constraints and opportunities in small holder vegetable producers presented as such. In this study, the farmers revealed the major constraints on input supply, output marketing, technology transfer, credit facilities, policy and infrastructures. Thus to sum up there is high potential for market oriented vegetable production if the major constraints are addressed and the farmers encouraged towards vegetable cultivation with enough financial leverage and government subsidiaries to the small holder vegetable producers. Such mechanism would definitely motivate the farmers to capitalize on vegetable production and thereby help in poverty reduction in Nepal even if it is minimal.

## ACKNOWLEDGEMENTS

The authors would like to appreciate and thank Mr. Janga Bahadur Gurung and Mr. Falman Gurung including their team members who gave me full supports for data

collection. I would also like to thank all respondents of Kapilvastu and Kaski districts who provided invaluable and reliable information during the field survey. Very special appreciation and thanks goes to my youngest son Mr. Muktisen Gurung who helped me at various stages of this study right from questionnaire preparation, data tabulation, compilation, processing and data analysis. Finally, the authors would like to acknowledge all those individuals and institutions who helped me directly or indirectly in making this study a success.

## REFERENCES

- Bingen J, Serrano A, Howard J (2003). Linking farmers to markets: different approaches to human capital development. *Food Pol.* 28:405-419.
- Boone HN, Boone DA (2012). Analyzing likert data. *J. Ext.* 50:1-5.
- Brown S, Kennedy G (2005). A case study of cash cropping in Nepal: Poverty alleviation or inequity? *Agric. Hum. Values* 22:105-116.
- Burney J, Woltering L, Burke M, Naylor R, Pasternak D (2010). Solar-powered drip irrigation enhances food security in the Sudano-Sahel. *Proceed. Natl. Acad. Sci.* 107:1848-1853.
- Dahal BM, Nyborg I, Sitaula BK, Bajracharya RM (2009). Agricultural intensification: food insecurity to income security in a mid-hill watershed of Nepal. *Int. J. Agric. Sustain.* 7:249-260.
- Dinham B (2003). Growing vegetables in developing countries for local urban populations and export markets: problems confronting small-scale producers. *Pest Manage. Sci.* 59:575-582.
- Emana B, Gebremedhin H (2007). Constraints and Opportunities of Horticulture Production and Marketing in Eastern Ethiopia. In: <http://www.everythingharar.com/publication/Report%2046.pdf>. DCG Report No. 46.
- Epstein LH, Gordy CC, Raynor HA, Beddome M, Kilanowski CK, Paluch R (2001). Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. *Obes. Res.* 9:171-178.



- Fernandez-Cornejo J, Hendricks C, Mishra A (2005).** Technology Adoption and Off-Farm Household Income: The Case of Herbicide-Tolerant Soybeans. *J. Agric. Appl. Econ.* 37:549-563.
- Hara Y, Tsuchiya K, Matsuda H, Yamamoto Y, Sampei Y (2013).** Quantitative assessment of the Japanese "local production for local consumption" movement: a case study of growth of vegetables in the Osaka city region. *Sustain. Sci.* 8:515-527.
- Hatirli SA, Ozkan B, Fert C (2006).** Energy inputs and crop yield relationship in greenhouse tomato production. *Renew. Energy* 31:427-438.
- Hunsberger C (2010).** The politics of Jatropha-based biofuels in Kenya: convergence and divergence among NGOs, donors, government officials and farmers. *J. Peasant Stud.* 37:939-962.
- Joshi PK, Joshi L, BIRTHAL PS (2006).** Diversification and Its Impact on Smallholders: Evidence from a Study on Vegetable Production. *Agric. Econ. Res. Rev.* 19:219-236.
- Kulech IK, Weatherhead EK (2005).** Reasons for smallholder farmers discontinuing with low-cost micro-irrigation: A case study from Kenya. *Irrigation and Drainage Syst.* 19:179-188.
- Mehta JN, Heinen JT (2001).** Does Community-Based Conservation Shape Favorable Attitudes Among Locals? An Empirical Study from Nepal. *Environ. Manage* 28:165-177.
- Minten B, Randrianarison, L, Swinnen JFM (2009).** Global Retail Chains and Poor Farmers: Evidence from Madagascar. *World Dev.* 37:1728-1741.
- Nepal R, Thapa GB (2009).** Determinants of agricultural commercialization and mechanization in the hinterland of a city in Nepal. *Appl. Geograph.* 29:377-389.
- Nzomoi JN, Byaruhanga JK, Maritim HK, Omboto PI (2007).** Determinants of technology adoption in the production of horticultural export produce in Kenya. In: *Afr. J. Bus. Manage.* Available online <http://www.academicjournals.org/ajbm>. pp. 129-135.
- Ortmann GF, King RP (2007).** Agricultural cooperatives II: Can they facilitate access of small-scale farmers in South Africa to input and product markets? *Agrekon.* 46:219-244.
- Osbahr H, Twyman C, Neil Adger W, Thomas DSG (2008).** Effective livelihood adaptation to climate change disturbance: Scale dimensions of practice in Mozambique. *Geoforum* 39:1951-1964.
- Pandey D, Agarwal PK, Kumar S, Singh R (2014).** Indo-Nepal Trade Relations in Agricultural Commodities. *Econ. Affairs* 59:711-725.
- Pingali P, Khwaja YC, Meijer M (2005).** Commercializing Small Farms: Reducing Transaction Costs In: *The Future of Small Farms: Proceedings of a Research Workshop.* IFPRI (International Food Policy Research Institute) Wye, UK pp. 61-74.
- Piotrowicz W, Cuthbertson R, Bhattarai R (2015).** Supply chain development under conflict conditions: case of Nepal. In: *supply chain design and management for emerging markets.* Springer International Publishing, pp. 283-309.
- Pokharel DM (2010).** Comparison of Farm Production and Marketing Cost and Benefit among Selected Vegetable Pockets in Nepal. *J. Agric. Environ.* 11:10-25.
- Poudel DD (2007).** Farmer Cooperatives for Food Self-sufficiency, Agricultural Commercialization, and the Socio-economic Development of Nepal. In: *Proceedings of Unfolding Futures: Nepalese Economy, Society, and Politics.* Ottawa, Canada.
- Poulton C, Dorward A, Kydd J (2010).** The Future of Small Farms: New Directions for Services, Institutions, and Intermediation. *World Dev.* 38:1413-1428.
- Rana D (2015).** Vegetables and Human Health. In., Scientific Publisher, New Delhi, India, [https://www.researchgate.net/profile/Tamilmani\\_Eevera/publication/271503275\\_Herbal\\_Remedies\\_for\\_Urinary\\_Stones/links/54c900e70cf25087c4ec2bb2.pdf](https://www.researchgate.net/profile/Tamilmani_Eevera/publication/271503275_Herbal_Remedies_for_Urinary_Stones/links/54c900e70cf25087c4ec2bb2.pdf).
- Raut N, Sitaula BK, Bujracharya RM (2011).** Agricultural Intensification: Linking with Livelihood Improvement and Environmental Degradation in Mid-Hills of Nepal. *J. Agric. Environ.* 11:83-94.
- Reardon T, Barrett CB, Berdegue' JA, Swinnen JFM (2009).** Agrifood Industry Transformation and Small Farmers in Developing Countries. *World Dev.* 37:1717-1727.
- Ruel MT, Levin CE (2002).** Food-Based Approaches for Alleviating Micronutrient Malnutrition: An Overview. *J. Crop Prod.* 6:31-53.
- Van den Berg MM, Hengsdijk H, Wolf J, Van Ittersum MK, Guanghuo W, Roetter RP (2007).** The impact of increasing farm size and mechanization on rural income and rice production in Zhejiang province, China. *Agricultural Systems*, 94:841-850.
- Yang P, Liu W, Shan X, Li P, Zhou J, Lu J, Li Y (2008).** Effects of training on acquisition of pest management knowledge and skills by small vegetable farmers. *Crop Protect.* 27:1504-1510.