Cooperative-led Green Value Chain Development for Selected Highland Vegetables in Buguias, Benguet

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ABSTRACT

This study proposes a cooperative-led green value chain model for selected highland vegetables in Buguias, Benguet. Primary and secondary data were used in the study. Primary data were gathered through KII, FGD, and survey interviews among 30 farmer-members of LIFMPC. Descriptive, cost and returns, and value chain analysis were conducted. The proposed model of cooperative-led green value chain for selected highland vegetables was developed based on current practices of the farmer respondents. The greening opportunities were identified in different segments of the chain, from input sourcing to consumption, as well as the actors and their activities. Performing these green practices would result in environment-friendly and resource-efficient green value chain with its financial, social, and environmental benefits. It also enabled the farmers to expand their marketing opportunities through participating in the consolidation program of the cooperative, which resulted in an increase in income and improvement in technological capabilities.

Keywords: *value chain, highland vegetables, cooperatives, green practices*

Introduction

Food security and inclusive agricultural growth are key development agendas in support towards achieving sustainable development goals. Regional market integration aims to address these key development agendas by improving the agri-food value chains. Natural resources such as land and water are key inputs to these value chains in carrying out economic activities such as production, marketing, and consumption which makes climate change a major concern for its improvement.

Moreover, as competition intensifies together with market standards and requirements, ensuring better income among market players and providing adequate food for the growing population through agri-food value chain development is expected to require more resources, thereby contributing stress and waste to the environment. At Rio+20, countries emphasized the inclusive green economy as one of the important tools for achieving sustainable development. Greening is defined in the United Nations Economic and Social Commission for West Asia (ESCWA) and German Agency for International Cooperation (GIZ) (2013) as the process by which suppliers, producers, processors, buyers, and consumers reduce their negative social, economic and environmental impact

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by using less energy and water and decreasing waste and emissions while also treating waste, promoting fair-trade and/or adopting appropriate quality and safety and other standards of corporate social responsibility. Conservation and sustainable use of ecosystem services and natural capital are the kinds of transformative changes that SDGs could and should catalyze (UNEP 2013).

In particular, the "greening the economy with agriculture" concept of FAO (2012) refers to ensuring food and nutrition security and contributing to the quality of rural livelihoods while managing natural resources efficiently and improving resilience and equity throughout the food supply chain (FAO 2012). One of the approaches to greening an economy is through the value chain approach (DCED 2014). In this context, a green value chain development project through a cooperative approach is being proposed here because of the inherent nature of cooperatives as builders of sustainability and promoters of green development.

For this study, which was to develop a model of a cooperative-led green value chain of selected highland vegetables, the definition of greening in a value chain would show any one of the following criteria: 1) Increase in the recycling of inputs; 2) Maximization of processes such that material inputs are efficiently used; and/or 3) Reduction in environmental impacts along the different stages of the chain. This model is a visual representation of the proposed strategic plan to systematically show the recommended greening process for all segments in the value chain to achieve the desired social, environmental, and financial benefits.

The sustainability of the value chain plays out simultaneously along three dimensions: economic, social, and environmental. On the economic dimension, an existing or proposed upgraded value chain is considered sustainable if the required activities at the level of each actor or support provider are profitable. On the social dimension, sustainability refers to socially and culturally acceptable outcomes in terms of the distribution of the benefits and costs associated with increased value creation. Lastly, on the environmental dimension, sustainability is mainly determined by the ability of value chain actors to show little or no negative impact on the natural environment from their value-adding activities (Neven 2014). Hence, a cooperative-led green value chain development is expected to promote efficient, effective, and resilient agri-food systems that would contribute to competitiveness, inclusive agricultural growth, and food security without compromising social and environmental sustainability.

Methodology

The study utilized the data from the DOST-PCAARRD funded project titled, "Cooperative-led Green Value Chain for Selected Agricultural Commodities." It was conducted in Buguias, Benguet because of its high contribution (65%) to the regional and national production of highland vegetables (Dionisio, 2018), the accessibility of the area, and the presence of cooperatives actively engaged in the production and marketing of highland vegetables.

Thirty (30) farmer-respondents who are members of Lengaoan Indigenous Farmers Multi-Purpose Cooperative (LIFMPC) and producers of cabbage, carrots, or white potato during their last cropping period in 2018 were purposively selected as the respondents of the study. The selection was based on their willingness to participate in the trainings since this study is based on a project with a capacity-building component.

Primary and secondary data gathered in 2018 were used in the study. Primary data were gathered through key informant interviews (KII), focused group discussions (FGD), and surveys. Surveys were conducted among members of LIFMPC and market intermediaries

identified through tracing the value chain. Secondary data consisted of the industry profiles such as volumes and areas of production.

Data analyses were done using descriptive analysis, cost and returns analysis, and value chain analysis. The descriptive method was used to discuss and analyze the data collected from the survey interviews. The costs and return analysis were conducted to determine the average net income of the farmer-respondents in the production and marketing of highland vegetables. Total returns included cash returns such as the total sales of the farmer-respondent, and the value of highland vegetables consumed at home, stored as planting material, given away, and rejected produce as non-cash returns. Cash costs included the costs of material inputs such the planting material, fertilizers, pesticides, hired labor, and other production and marketing costs. Non-cash costs include family labor and depreciation of the material assets of the farmer-respondents. The net income was determined by deducting the total costs from the total returns.

Value chain analysis is conducted by identifying each part of the production process and identifying where steps can be eliminated or improvements can be made. These improvements can result in either cost savings or improved productive capacity (Harrison 2019). The value chain was analyzed by identifying the key players involved, their production and marketing practices performed along the chains, and selling and buying prices. The study focused only on the production aspect since cooperative was only identified in that segment. Hence, greening opportunities in other segments, including distribution and consumption, were only identified through consultation with experts.

The Philippine National Standard: Code of Good Agriculture Practices (GAP) for Fruits and Vegetable Farming served as the guideline for the recommended practices to prevent and/or minimize risk to food safety, environmental impact, workers' health, safety, and welfare, and product quality. The recommended practices aimed toward prevention and minimization of risk occurrences include food safety, environmental impact, worker health, safety and welfare, and product quality (BAFS 2017). A green value chain model for highland vegetables was developed through the consolidation of the results of the survey and a series of consultations with experts.

Results and Discussion

The LIFMPC was formerly registered as Lengaoan Indigenous Farmers Credit Cooperative on June 13, 2011, under the Cooperative Development Authority (CDA) which envisions to uplift the socio-economic and spiritual well-being of the members. LIFMPC offers services on capital build-up, lending, and marketing of vegetables produced by its members.

The survey was conducted among 30 members of the LIFMPC, a credit cooperative that offers services on capital build-up, lending, and marketing of vegetables produced by its members. Highland vegetable farming was their main source of income. Aside from white potato, cabbage, and carrot, they also planted Chinese cabbage, lettuce, chili pepper, celery, beans, and broccoli. The total land area operated by the 30 farmer-respondents was about 22 hectares, ranging from 0.09 to 2.5 hectares. About 14 hectares of land (59%) was planted with vegetables, including white potato, cabbage, carrot, lettuce, beans, and broccoli. Out of the 14 hectares, 52% (7.37 ha) was planted with white potato, 27% (3.80 ha) was planted with cabbage, and 15% (2.10 ha) was planted with carrots.

The most common vegetables planted were *Granola* or white potato recommended for table use, *Wonderball*, *Luckyball* and *Rareball* for cabbage, and *Terracotta* and *Heartland* for carrots. Other farmers who practiced multi-cropping also planted lettuce, beans, and/or broccoli.

Awareness and Adoption of GAP

Good Agriculture Practices (GAP) for Fruits and Vegetable Farming served as a guide in the identification of practices related to "*greening"*. All the farmer-respondents were aware of *green* practices, GAP, and organic farming.

Table 1 shows the awareness and adoption of the farmer-respondents to GAP. It indicated that all farmer-respondents were aware of the site history and management. Seventy-three percent follow the guidelines under site history and management with a 57% adoption rate. Some guidelines under site history and management include the following: 1) the activities on site must follow the environmental laws; 2) there must be a risk assessment such as analysis and characterization of the potential impact of adjacent sites, and 3) production maps should be prepared. In purchasing planting materials, twenty-eight farmer-respondents were aware, and 96% of them were following the guidelines with an 82% adoption rate. In this aspect, the varieties' yield quantity and quality, market and grower's preferences, and adaptability of the variety should be considered. Variety should be adaptable to soil type, nutrient level, water availability, and incidence of pests and diseases. In soil conservation, twenty-three farmer-respondents were aware, and 83% of them were following the guidelines with a 65% adoption rate. In this aspect, crop production must be integrated with soil conservation practices such as minimum tillage in land preparation and crop rotation in crop establishment.

The same trend can be seen for other activities except for the post-harvest washing, post-harvest treatment, cooling system, personal hygiene and farm sanitation, and worker's health, safety, and welfare, which require equipment and facilities. Hence, the low to zero adoption rate for these activities.

Table 1. Awareness and adoption of Good Agriculture Practices of the 30 highland vegetable farmer-members of LIFMPC, Buguias, Benguet, 2018

Practice	Awareness		Adoption		
	No.*	%	No.*	%	Perceived Rate (%)
Site history and management	30	100	22	73	57
Planting material	28	93	27	96	82
Soil and soil conservation	23	77	19	83	65
Fertilizer and soil additives	22	73	19	86	60
Water management	26	87	18	69	66
Crop protection	28	93	23	82	76
Harvesting and handling produce	28	93	25	89	62
Post-harvest washing	19	63	2	7	16
Post-harvest treatment	15	50	2	7	27
Cooling system	15	50	-	-	-
Off-farm facility for handling	26	87	16	62	75
Personal hygiene and farm sanitation	19	63	-	-	-
Worker's health, safety, and welfare	21	70	-	-	-
Traceability and recall	24	80	13	54	82

*multiple responses

Profitability of Highland Vegetables Production

In planting white potatoes, the total cost incurred by the farmer-respondents was PHP 152,578.79, wherein 56% or PHP 86,185.32 was spent on purchasing material inputs, particularly planting materials. They earned a total returns of PHP 234,777.48 and had a net income of PHP 82,198.69 per hectare. On the other hand, the total cost incurred by the cabbage farmer-respondents was PHP 163,985.20, wherein 51% or PHP 59,781.54 was spent on purchasing material inputs, particularly fertilizers. They earned a total return of PHP 345,606.32 and had a net income of PHP 181,621.11 per hectare. Lastly, the total cost incurred by the farmer-respondents in planting carrots was PHP 127,362.51, wherein 35.17%

of PHP 44,796.90 was spent on purchasing material inputs. They earned a total returns of PHP 249,110.00 and had a net income of PHP 121,747.49 per hectare.

All farmer-respondents had positive net farm income for a 4-month cropping cycle, with the highest income from producing cabbage (PHP 181,621.11/ha), followed by carrots (PHP 121,747.49/ha) and white potatoes (PHP 82,198.69/ha).

Table 2. Average costs and returns of 30 farmer-respondents during a 4-month production cycle, Buguias, Benguet, 2018

Type of Highland Vegetable	Total Returns (PHP)	Total Costs (PHP)	Net income (PHP)
White potato	234,777.48	152,578.79	82,198.69
Cabbage	345,606.32	163,985.20	181,621.11
Carrot	249,110.00	127,362.51	121,747.49

Marketing of Highland Vegetables

Usual Product Flow of Highland Vegetables

The highland vegetables usually pass from the farmers to assembler-wholesalers or the vegetable dealers through commission agents or disposers. Farmers were reliant on the price information from the disposers, who coordinate with the vegetable dealers from different areas. The vegetable dealers assemble the products from different areas and distribute it to wholesaler-retailers, then to the retailers. Lastly, the retailers sell their products to end consumers.

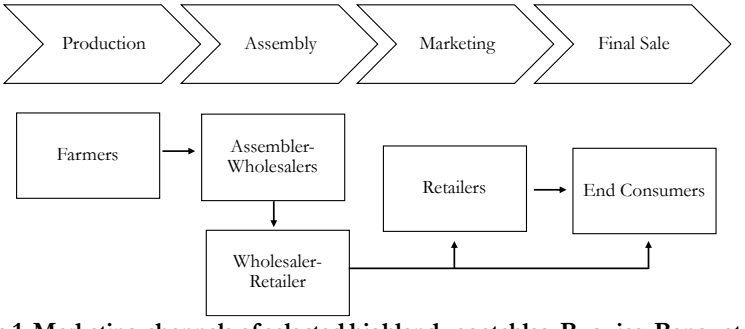

Figure 1. Marketing channels of selected highland vegetables, Buguias, Benguet, 2018

Geographically, the highland vegetables produced in Buguias, Benguet were sold in La Trinidad Trading Post in Benguet to the vegetable dealers through the disposers. The produce sold by the vegetable dealers in La Trinidad were then distributed and sold to the wholesaler-retailers in Metro Manila, particularly in Balintawak.

Figure 2. Geographic flow of selected highland vegetables produced in Buguias, Benguet, 2018

Marketing practices such as transporting, sorting, trimming, and packaging were performed as the selected highland vegetables were moved from the farmers. Each of the marketing participants identified in the channels performed different marketing practices. These were as follows:

Farmers

The marketing practices performed by the farmer-respondents were transporting, sorting, and packaging. The highland vegetables produced by the farmer-respondents were all delivered and sold to La Trinidad Trading Post. Most of the farmer-respondents (97%) transported the vegetables by truck. Half of the farmer-respondents used plastic as packaging material. They hired laborers in the trading post to wrap the vegetables with plastic. Many of them (97%) were paid in cash by the assembler-wholesalers.

Disposers or Commission Agents

The disposers serve as a major link between the farmer and the vegetable dealers. They negotiate with the buyers, earning a commission per kilogram from the sold selected highland vegetables. They were the ones who coordinate with the laborers to be paid by the farmers in sorting and packaging the vegetables sold to the vegetable dealers.

Vegetable Dealers

The vegetable dealers performed transporting by transferring the highland vegetables from the trading post to another point of sale by using vehicles, particularly trucks. This also includes loading and unloading the products. They hired laborers to perform these marketing practices.

The farmers sold the highland vegetables to the vegetable dealers through the disposers in the La Trinidad Trading Post at an average selling price of PHP 24.50/kg for carrot, PHP 31.00/kg for white potato, and PHP 25.50/kg for cabbage.

Consolidation Program of LIFMPC

The LIFMPC was the first cooperative in the municipality that has developed a consolidation program in partnership with the Benguet Agri-Pinoy Trading Center (BAPTC), which started in 2017. Through the implementation of the consolidation program, farmers can directly sell their produce to an institutional buyer, particularly the North Point Inc. in Bulacan, which supplies vegetables to known fast food chains such as KFC and Tokyo Tokyo. The farmers were able to get prices higher than the prevailing selling price to other market

intermediaries such as the assembler wholesaler, given that they would follow specific quality standards and volume requirements of these buyers.

The farmers attended trainings on food safety standards such as GAP. They adopted an internal control system on the Integrated Pest Management based on GAP to facilitate and attend to the buyer's requirements with regards to standardized quality and safe produce. Hence, performing green practices gave the farmers an opportunity to increase their income through the consolidation program of the cooperative.

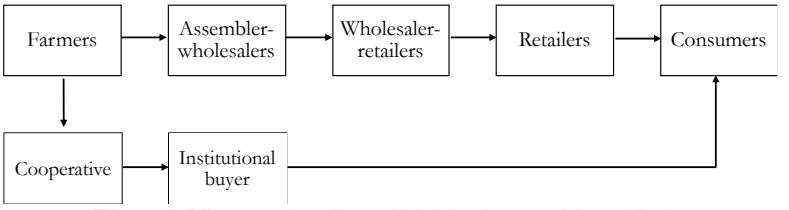

Figure 3. New product flow of highland vegetables with the consolidation program of LIFMPC, 2018

The farmers sold the highland vegetables to the cooperative at an average selling price of PHP 64.50/kg for carrot, PHP 58.00/kg for white potato, and PHP 41.50/kg for cabbage. Based on the average selling prices of highland vegetables by individual selling as compared through the consolidation program, farmers would have higher selling prices and income through the latter. Correspondingly, a study by Swaminathan (2015) emphasized the need for group dynamics in agricultural marketing. Organizing farmers into groups to pool their produce will help them gain economic benefits such as overcoming high transaction costs incurred when acting individually and having a more assured market and agreed price.

Table 3. Average selling prices of highland vegetables through the cooperative and by individual selling, 2018

Type of highland vegetable	Amount (PHP/kg)	
	Individual selling	Through cooperative
Carrot	24.50	64.50
White potato	31.00	58.00
Cabbage	25.50	41.50

In 2018, the cooperative had a total sales of about PHP 17 million by consolidating and selling highland vegetables. LIFMPC incurred about PHP 16 million as expenses, including the per diem of laborers who clean, sort, and pack the vegetable, helper, and *comboy*; travel and transportation expenses for hauling, porter fee, van rental, fuel, toll fee, and fare; meals and snacks of driver and helper; packaging materials such as plastics; communication expense; representation expense in conducting meetings; and office rental and supplies. LIFMPC has a net income of about PHP 800,000.00 in implementing the consolidation program.

Green Value Chain Model

Adapted from Michael Porter's Supply Chain Model, Figure 4 shows the value chain model exhibiting the greening opportunities in different segments of the chain from input sourcing to consumption, as well as the actors and their activities. The key actors involved were farm supplies and agents for input sourcing, highland vegetable farmers for production, assembler-wholesaler, wholesaler-retailers and retailers for distribution, and lastly, the consumers for consumption.

Greening opportunities were identified at each segment. In input sourcing, the input suppliers should have available high quality and recommended input materials such as disease-resistant seed varieties, processed chicken manure, and other organic material inputs for the

highland vegetable farmers to perform *green* practices that would require such inputs. In the production segment, the identified *green* practices were based on the Good Agriculture Practices such as manual plowing, crop programming and use of pest and disease resistant seed varieties, use of compost, conducting soil analysis, Integrated Pest and Disease Management, proper waste disposal, and personal hygiene and farm sanitation.

In the distribution segment where procurement and transporting were the main activities, proper sanitation of transport vehicles, use of eco-friendly packaging materials, and proper waste disposal were identified. Lastly, in the consumption segment, there should be proper disposal of food wastes.

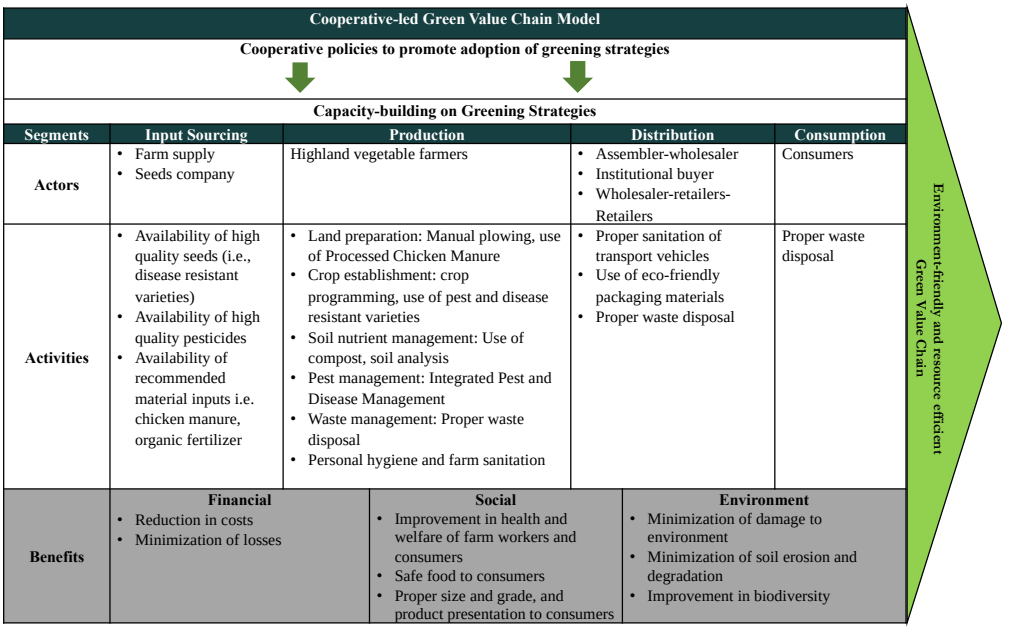

Figure 4. Segments of the Green Value Chain Model for highland vegetables, Buguias, Benguet, 2018

Benefits of Green Practices

According to Dr. Rodel G. Maghirang, performing the Good Agriculture Practices would result in an environment-friendly and resource-efficient *green* value chain with financial benefits. This is by reducing the costs due to proper record keeping and efficient pest control resulting in decreased losses. With proper recording, the farmers will learn how to handle finances which will enable them to know which activities are costly and even redundant. With this, expenses will tend to decrease. On the other hand, with the proper use of pesticides, there will be minimal losses in production since pests can be controlled effectively. Hence, the decrease in economic losses that the farmers will incur.

Social benefits can be realized by the improvement of the health and welfare among farm workers. Through following GAP on worker health, safety, and welfare, farmers can have very minimal exposure to pesticides. There will be lower medical bills and lower downtime for the farmers and the whole family. On the other hand, consumers can also benefit from *greening* the value chain since pesticides can be prevented or minimized among produce.

Lastly, environmental benefits are mainly associated with impacts on soil, water, and biodiversity, which will also positively affect the farmers in the long run with minimized health risks. With proper use of fertilizers and pesticides, management of water resources, and proper

land preparation, there will be minimal damage to the environment. Soil erosion and degradation, especially in the highlands, can be minimized. There is also a positive impact on biodiversity due to the proper use of pesticides and fertilizers, which will have less impact on the beneficial insects and soil microflora and fauna.

Accordingly, through the *greening* process, a sustainable value chain can be achieved, which is one that is profitable at all levels, has broad-based benefits for society, and shows non-negative impacts on the natural environment (Neven 2014).

Summary and Conclusion

This study proposed a cooperative-led *green* value chain model of selected highland vegetables in Buguias, Benguet. This model was based from current practices of 30 farmer-respondents who are members of LIFMPC and are producers of the selected highland vegetables in 2018. These farmer respondents were purposively selected.

Highland vegetable farming was the main source of income by the farmer-respondents. The total land area operated by the 30 farmer-respondents was about 22 hectares, ranging from 0.09 to 2.5 hectares. The highland vegetables usually pass from the farmers to assembler-wholesalers or the vegetable dealers through commission agents or disposers. The vegetable dealers assemble the products from different areas and distribute it to wholesaler-retailers, then to the retailers. Lastly, the retailers sell their products to end consumers. On the other hand, through the consolidation program, the farmers had the opportunity to sell directly to consumers through institutional buyers with higher selling prices compared to individual selling.

The cooperative-led *green* value chain model for selected highland vegetables was developed by identifying *green* opportunities at each segment. Through cooperative policies in promoting *green* practices adoption in each segment and conducting capacity building among key actors, a sustainable cooperative-led *green* value chain can be achieved.

In conclusion, performing these *green* practices would gain financial, social, and environmental benefits. It also enabled the farmers to expand their marketing opportunities by participating in the cooperative's consolidation program. Also, the income of farmers and LIFMPC has been increased, and the technological capabilities of the farmers have been improved.

Recommendations

Based on the results of the study, the following recommendations were formulated:

Adoption of Green Practices in Highland Vegetable Production

The cooperative could promote the adoption of the identified *greening* strategies for highland vegetable production. Since the cooperative focuses on providing production loans and deposits such as savings and time deposits services, the cooperative can include in the guidelines or requirements in the issuance of credit the attendance to various trainings and practice of the identified *green* practices.

Continuous Capability Building on Green Practices

The Local Government Unit, particularly the Municipal Agriculture Office of Buguias, Benguet, should provide continuous capability-building activities on *green* practices such as GAP and Integrated Pest Management among stakeholders and institute the simultaneous distribution of Information, Education, and Communication (IEC) materials in different dialects.

Further Studies on the Development of a Green Value Chain

Further studies including the pilot-testing of the developed *green* value chain model are recommended to determine the feasibility of the model and the actual benefits that can be derived from it. With this, specific policy recommendations can be formulated.

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References

Bureau of Agriculture and Fisheries Standard (BAFS). 2017. "Code of Good Agricultural Practices (GAP) for Fruits and Vegetable Farming." BAFS, accessed August 3, 2017, http://www.bafs.da.gov.ph/bafs_admin/admin_page/pns_file/PNS%20BAFS%2049-2017%20Code%20of%20GAP%20for%20Fruits%20and%20Vegetable%20Farming%20(1)%20(1).pdf.

Dionisio, D. 2018. "PH's Top Veggie-growing Town Prods Local Farms to go Organic." PhilAtlas, accessed September 14, 2021, https://www.philatlas.com/luzon/car/benguet/buguias.html.

Economic and Social Commission for Western Asia (ESCWA) and German Agency for International Cooperation (GIZ). 2013. "Green Agricultural Value Chains for Improved Livelihood in the Arab Region." ESCWA, accessed August 3, 2017, https://www.greengrowthknowledge.org/sites/default/files/downloads/resource//UNESCWA_green%20agriculture%20value%20chain.pdf.

Epino, M. 2001. "Buguias: RP's Vegetable Capital." PhilStar, accessed September 14, 2021, https://www.philstar.com/business/agriculture/2001/12/16/143818/buguias-rp146s-vegetable-capital.

Food and Agriculture Organization (FAO). 2012. "Greening the Economy with Agriculture." FAO, accessed on August 3, 2017, https://www.fao.org/3/i2745e/i2745e00.pdf.

_____. 2014. "FAO-FiBL Knowledge Exchange Forum for the Development of Green Value Chains." Workshop Report. Food and Agriculture Organization of the United Nations, Rome, Italy, accessed August 3, 2017, https://www.fibl.org/en/info-centre/news/fao-fibl-workshop-a-knowledge-exchange-forum-for-greening-of-food-value-chains.

Harrison, K. 2019. "What is Value Chain Analysis?" Business News Daily, accessed April 14, 2021, https://www.businessnewsdaily.com/5678-value-chain-analysis.html.

International Co-operative Alliance (ICA). 2013. "Blueprint for Cooperative Decade." ICA, accessed September 14, 2021, https://www.ica.coop/en/media/library/blueprint-co-operative-decade-february-2013.

Milagrosa, A. 2001. "Marketing of Vegetables in the Cordillera Region: A Transaction Cost Analysis." MS thesis, Ghent University, accessed February 4, 2021, https://www.researchgate.net/publication/40124697_Marketing_of_vegetables_in_the_Cordillera_region_a_transaction_cost_analysis.

Napitupulu, T., R. Natawidjaja, and Lantican, J. 2009. "Adding Value to Fresh and Processed Produce through Product Certification." Working Paper, Center for Alleviation of Poverty through Secondary Crops' Development in Asia and Pacific, accessed August 3, 2017, https://ageconsearch.umn.edu/record/121040/files/WP104.pdf.

Neven, D. 2014. "Developing Sustainable Food Value Chains: Guiding Principles." FAO of the United Nations, accessed August 3, 2017, http://www.fao.org/3/a-i3953e.pdf.

Provincial Agriculture Office of Benguet. 2017. Volume of Production Data by Vegetable and Municipality. Unpublished, Provincial Agriculture Office of Benguet.

Smartsheet. n.d. "What Is Value Chain Analysis? Porter's Concept of Value Chain Analysis." Smartsheet, accessed February 4, 2021, https://www.smartsheet.com/everything-you-need-to-know-about-value-chain-analysis.

Swaminathan B., Sivabalan K.C., and Anandaraja, N., 2015. "Leveraging Group Dynamics and Upscaling Agricultural Marketing Efficiency in India." *Annals of Plant and Soil Research 17* (Special Issue): 32-35, accessed February 4, 2021, https://www.researchgate.net/publication/279526450.

The Donor Committee for Enterprise Development (DCED). 2012. "Green Value Chains to Promote Green Growth." DCED, accessed February 4, 2021, https://www.enterprise-development.org/wp-content/uploads/Green_Value_Chains_to_Promote_Green_Growth.pdf.

_____. 2014. "Green Growth and Private Sector Development – Stocktaking of DCED Experiences." DCED, accessed August 3, 2017, https://www.greengrowthknowledge.org/sites/default/files/downloads/resource//DCED_Stocktaking_of_DCED_Green_Growth_Working_Group_Experiences.pdf.

United Nations. n.d. "Food Security and Nutrition and Sustainable Agriculture." United Nations, accessed February 4, 2021, https://sdgs.un.org/topics/food-security-and-nutrition-and-sustainable-agriculture.

United Nations Environment Programme (UNEP). 2013. "Embedding the Environment in Sustainable Development Goals." UNEP Post-2015 Discussion Paper 1. UNEP, Nairobi, accessed August 3, 2017, https://sustainabledevelopment.un.org/content/documents/972embedding-environments-in-SDGs-v2.pdf.