Doctoral Dissertation

Reciprocity of Rural Households through Transactions in a Developing Country: A Case Study from Lao PDR

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Table of Contents

Abstract

The strong human relations through trade, the exchange of goods and services, as well as money between households in disadvantaged areas lead to an increasing role of economic interactions and potentially wider economic development and growth. The main purpose of this research is to examine the interdependence among rural households through their transactions using a village input-output table (VIOT) model and a transformed QVIOT model created from our own household survey data conducted in a rural village in northern Lao PDR. Furthermore, this research also investigates the influence of external financial support as remittances on transactions in that corresponding village.

Several previous studies on input-output (IO) model and its analysis focused on the economic impact evaluation and industrial sectors interdependence for a specific national, international or regional, and interregional level. However, this type of research on IO studies at the village level has been rarely conducted because researchers often lack enough information and socio-economic statistics. In addition, the survey approach is costly and time-consuming. Few studies that used rural IO information from household survey data. Taylor and Adelman's (1996) study is one among the previous studies that focused on rural IO model, including a social accounting matrix (SAM) and computational general equilibrium (CGE) models.

To fulfil our research objectives and to construct the VIOT for interdependence analysis, we conducted household surveys in a selected and target rural village in northern Luang Prabang province, Lao PDR in 2015 and 2016 to obtain relevant data and information. The target village was selected by local government, when we asked which village was the most challenged regarding economic development in the district or province. As of 2016, there were 124 households in the village, which had 720 inhabitants. The main household income was rice (45%), followed by non-timber forest products (25%), livestock (19%), and wages and remittances (7%), respectively. The monthly per capita income was 197,365 Kip (US$ 25), which is above the Lao national poverty line for rural areas (180,000 Kip/person/month).

VIOT construction is simple, but it is a useful tool to know the economic transactions among villagers in the village because this VIOT offers comprehensive and detailed information regarding the sales and purchases of goods and services among households in the village, as well as information on money transfers as remittances and labor services from outside the village. The information contained in such table is also useful for revealing the effects of

production in the village and providing us with directional pair data for buyers and sellers, which can be used to estimate the commodity flows between households and examine the causal effects of a treatment by following a micro-econometric methodology. By using this VIOT model, the study can explore the causes of poverty and immobilization in a society by examining the circular structure of goods and money and as well as identifying key market players within the community. In our opinion, households that have less trade transactions with others tend to have less income because they have little opportunity to obtain money and goods and vice versa. Our basic hypothesis is that less trade with others might induce poverty. This research offers not only the VIOT model but also the QVIOT model as an applicable method to examine household interdependency data in order to capture the interdependence among households. Therefore, VIOT model is an appropriate approach and is particularly applicable for disadvantaged areas where it is often difficult to obtain socio-economic data to fully analyze the reciprocity of their transactions.

The main results of this research are briefly summarized as follow: From a completed version of our VIOT, we can find the degree of interdependency among households in the village by estimating a total output multiplier from the intermediate transaction table matrix. In our estimation, the VIOT produced a total output multiplier of 1.767, which is less than two. Larger values indicate a tightly linked economy, whereas smaller values indicate a more open economy. Generally, this output multiplier is not so high, and we can't conclude that the degree of interdependency among households in the village is weak or strong, but this level of multiplier indicates that village economy depends somewhat on transactions from outside the village. Furthermore, we estimate backward and forward linkages effects to identify who are the key sellers and buyers in the village. We found that non-poor households, especially 4 rich households, namely HH 121, HH 122, HH 123, and HH 124 are the main sellers, while poor households become main buyers in the village.

By converting this VIOT model into a QVIOT model, we can measure the interdependence among households through their economic transactions in this village because each household is not only a producer but also a consumer who is trading products and consuming them within the village. From our estimation, rice transaction is the main economic activity with the most frequent transactions (538,711), followed by crops (25,252), and bamboo transactions (20,983), respectively. More specifically, we found that four higher-income households, especially from HH 121 to HH 124, which mainly trade rice very frequently, are playing key roles in the village economy, and the interdependency among them is stronger than that among lower/middle-

income households. In addition, total transaction numbers of products by multiplying QVIOT by third step show that some lower and middle-income households are isolated from purchase and sale transactions, except rice transaction in the village. The findings also indicate that economic geographic aspects of the four rich households and other poor, and non-poor household interdependence show similar frequently transactions of rice and bamboo in the village.

Data on inter-household transactions obtaining from our VIOT shows that 55 out of 124 households in the village receive remittances from their relatives who are working outside the village. The money sent by their relatives are used and spent on transactions in the village. Our interest is that we assume that households with remittances can facilitate their transactions in the village. The descriptive analysis using data on remittances from our household survey shows a significant different characteristic of households with and without remittances, especially they are totally different in rice and livestock transactions, per capita income, per capita consumption and per capita investment. Furthermore, we apply propensity score matching (PSM) method to compare households with remittances who are transacting their products with other similar households that do not receive remittances. We find that remittances play important roles in enhancing transactions among households with remittances, especially through rice, non-timber forest products (NTFPs), and livestock transactions within the village. In addition, we also find that remittances had a more significant contribution to increased investment rather than consumption in the village.

This research provides us a useful idea and knowledge of the VIOT construction and ways to obtain the QVIOT as useful indicators to identify key players in the markets and capture the economic interdependence in the village. Rice transactions are very common in the village. In general, these four rich households: HH 121, HH 122, HH 123, and HH 124 are amongst key sellers and buyers in the village. Moreover, these VIOT and QVIOT models can be used to form economic policies that enhance human network through trade expansion, marketing strategies and poverty reduction in the region.

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List of Tables

List of Figures

CHAPTER 1

INTRODUCTION

1.1 Introduction

This introductory chapter of the thesis begins by providing a brief review of the research field and its wider context pertaining to an input-output (IO) model and interdependence analysis. This chapter presents the research problem to be considered, namely the lack of research on village input-output model (VIOT) and how it is built with household survey data at the village level for interdependence analysis. This is followed by presenting the main objective of this study and justification of its significance. Finally, the last section briefly presents the research design and the study setting, and then provides an outline of the current thesis, illustrating how the research problem was approached.

1.2 Background of the Research

This research examines the interdependence among rural households through their transactions by using VIOT and extended qualitative village input-output table (QVIOT) constructed from our household survey data conducted in a disadvantaged village in a developing country. Moreover, this study investigates the influence of money transfers as remittances on transactions in such village. In general, rural households are economically dependent upon each other in developing countries, meaning that when so many products are produced in a nation, like a village, jobs become more specialized and economic interdependence is bound to form. When this happens, households must become part of a trading network, and they depend upon each other to supply products that they cannot produce themselves. The effect of economic interdependence can vary based upon a village's type of economy and what that village has to offer. It can be argued that rich households have more to benefit from economic interdependence with poorer and middle-income households and households that have less trade with others tend to have less income because they have little opportunity to obtain money and goods. Therefore, our basic hypothesis is that households that have less trade transaction with others might induce poverty. In both developing and developed economies, finding the causes of poverty and considering how to overcome it are classic problem. One reason for this failure is that economists could not formulate a mechanism that describes how poverty or income gaps emerge in a society; in in addition, each country's economic development is

greatly affected by political conflicts and its particular social context, including institutional and cultural matters.

While classical economists such as Smith and Marx identified principles of economic development through trade and capital accumulation, it is widely known that income gaps frequently emerge. Income gaps and their causes are among the most fundamental issues in economics, along with trade or the exchange of goods and money. The Input-Output (IO) model developed by Leontief has long been a useful tool for such investigations. It was used to develop the concept of the multi-sectoral multiplier in the industrial sector, which is derived from the macroeconomic multiplier developed by Keynes. This multi-sectoral multiplier can be used as an index for the interdependence between industrial sectors in a nation's economy. Several types of IO tables are constructed from observed data for specific national, international, or regional, and interregional economic studies over past decades. For example, the development of regional input-output models dates from early 1950s. The various approaches to constructing a regional input-output table can be broadly categorized as 'surveys, 'non-surveys and hybrid. The survey approach is a popular technique although it makes the survey extremely expensive and time-consuming, but it can provide enough and accurate data to construct the regional input-output tables. Furthermore, this technique is particularly suitable for smaller regions.

The input-out (IO) analysis is a quantitative technique for investigating the interdependence of production sectors in an economy. An IO table identifies the major sectors in an economy and financial flows between them over a year. It indicates the sources of each sector's inputs, whether purchased from other firms in the economy, imported or earned by labor services-household wages and salaries. It also provides a breakdown of each sector's output, which can be sales to other sectors and to final demand (household consumption, government consumption, capital formation and exports). The interdependence between the individual sectors of the given economy is normally described by a set of linear equations, representing fixed shares of input in the production of each input. Thus, by disaggregating the total economy into several interacting sectors, IO analysis provides an effective tool for sectoral and impact analysis.

Several previous studies that used rural input-output information from household survey data, including a village social accounting matrix (SAM) and computational general equilibrium (CGE) model are found in Taylor and Adelman (1996). The authors focused on the main flows of money, including income; therefore, the sector sizes of their IO tables are relatively small,

and they included only five sectors such as farming, livestock, resources extraction, construction and village retail activities. Their main results showed that the production linkages within the village economy were weak, although there were strong consumption and investment linkages, especially for food and livestock.

Furthermore, Isard, W. (1951) described how to compile an interregional input-output (IRIO) table for the United States, while Dietzenbacher, E. et al. (2013) built world input-output tables (WIOTs) for 40 countries plus the rest of the world. Zhang et al. (2015) attempted to construct the provincial-level input-output tables for China for 2002. In addition, Lewis and Thorbecke (1992) employed a SAM approach to examine the economic linkages in a small regional economy in Kenya, while Matin and Holden (2004) built a small village SAM based on household survey in rural Mozambique to capture tree resources and assess the multiplier effects of charcoal production. Furthermore, Agaje (2008) extended their village SAM to capture household income losses due to soil degradation, whereas Subramanian and Qaim (2009) developed a micro SAM to analyze the effects of agricultural biotechnology application on cotton production for rural households in India. Recently, Faße et al. (2014) developed environmentally extended village SAMs for Tanzania to model the input-output relationships among households, to examine the transactions of an entire village economy. In contrast, studies applying graph theory and network analysis to input-output analysis include Defourny and Thorbecke (1984), Holub and Schnabl (1985), Olsen (1992), and DeBresson et al. (1996).

The application of IO analysis for investigating the interindustry linkages in an economy have been studied since the end of 1950s, with the main purpose of identifying the so-called key industries or key sectors that are essential for economic growth and development. For example, the concept of backward and forward linkages for interindustry relations was first introduced by Hirschman (1958). Then, this IO analysis as well as backward and forward linkage analysis have been widely discussed in Leontief (1984), Miller and Blair (1985), Holub and Schnabl (1994), Chenery and Watanabe (1958), Hewings and Romanos (1981), Hewings (1982), Defourny and Thorbecke (1984), Cmiel and Gurgul (2002), San Cristobal and Biezma (2006), Temurshoev and Oosterhaven (2014), Gurgul and Majdosz (2005), and Gurgul and Lach (2015, 2016, 2017).

This study creates a VIOT framework from household survey data that has a similar the regional IO table. In order to investigate the relationships between local economic sectors and the rest of the rural economy, primary data available from a survey of the most important products

transacting in the study area was utilized. The field survey was carried out to nine products plus one item as a "others" product (see details in chapter 2). As a result, our final VIOT constructed consists of nine plus one item from 124 households and formed a 1240 x 1240 size. This VIOT comprises three main parts, namely intermediate demand, final demand and a value-added area. The intermediate demand (intermediate consumption) table is the basis for the IO model itself and includes the matrix of intermediate flows. It represents the transactions for intermediate sales and purchases of goods and services among households. Final demand shows the final use of goods and services by each household, consumptions, investments and exports, and giving-in kind to others. Value-added areas contain labor services such as wages and salaries, loans and remittances and imported inputs from outside the village.

This VIOT offers comprehensive and detailed information regarding the sales and purchases of goods and services among households in the village. The information obtained in our VIOT is useful, it is showing not only major goods and monetary flows between households within the village, but also providing us with a rich data on money transfers as remittances from relatives outside the village. Remittances are used and spent on consumer goods and services as well as intermediate inputs and intermediate demand because each household in the village is not only a producer, but also a consumer who is trading products and consuming them within the village. No empirical studies and evidences that examine the impact of remittances on transactions among households. Therefore, it is interesting to explore ways to maximize the impact that remittances have on inter-household transactions in the village.

In many developing countries, remittances make a direct contribution to increasing income of families left behind, easing budget constraints of the poorest, reducing poverty and improving average living conditions (Acosta, Calderon, Fajnzylber, & Lopez, 2008). The existing empirical studies on the impact of remittances provide mixed evidence. A study of Sylvie Démurger. S., & Wang. X. (2016) find that remittances have a positive impact on income, consumption, investment and a negative impact on education expenditure in rural China. Similarly, the study of Nguyen, D. L., Grote, U., & Nguyen, T.T. (2017) find that migration and remittances have a positive impact on food, health and other non-food items consumption expenditures, and a negative impact on education expenditure. In contrast, Simone. P. et al. (2018) assess the impact of remittances on agricultural production practices and investment in Moldova. They found that remittances reduce family labor and self-produced seeds. In addition, Adams Jr. R. H., & Cuecuecha, A. (2010) find that remittances have a negative impact on food

consumption expenditure in Guatemala. Adams Jr. R. H., & Cuecuecha, A. (2013) also examine the impact of remittances on investment and poverty in Ghana and they found that households with remittances spend more at the margin on education, housing and health care.

As can be extracted from the above, economic interdependence can be a means for enhancing local economic growth and development. Our VIOT and QVIOT model can be used to examine economic transactions among households and their interdependence in the isolated village or disadvantaged areas because each household in the village is not only a producer but also a consumer who is trading products and consuming them within the village. Representing such village structure is necessary to obtain the basic production ability of the village and its potential for development. This study offers the QVIOT model as an applicable method for a VIOT to examine the household interdependency data in order to capture the villagers' interdependency.

1.3 The Statement of Research Problem

As previously discussed, making this VIOT is simple, but it is a useful tool to examine the interdependency among households in the disadvantaged areas where it is often difficult to collect a socio-economic data to fully analyze the reciprocal economic activities. Although a lot of empirical work has been accomplished in this field of research, most of the previous IO model studies and the interdependence analysis have been focused on sectoral linkages or interindustry linkages at the national, international or regional, and interregional level. These IO tables, for example, national IO tables or international IO tables and regional IO tables or interregional IO tables are constructed via non-survey techniques, mainly from national accounts, statistics and data. The IO tables created from the survey approach are much more interesting idea and these techniques could provide enough and accurate data, but these are costly and time-consuming. Therefore, this type of research on VIOT studies using household survey data has been rarely done because most researchers often lack enough information, socioeconomic statistics and data.

1.4 Research Objectives and Questions

The main objective of the current thesis is to examine the interdependence among households through their transactions in a disadvantaged village in a developing country. With this regard, special attention is paid in this study to link between the concept of VIOT, QVIOT model, inter-

household relations, their economic interdependences, and remittance impact assessment on transactions among them.

In order to achieve this objective, a theoretical IO model, and the survey techniques through the household survey data collection have been formulated and conducted to support this research. As a result, the VIOT and QVIOT were created from household survey data collected beforehand in order to examine the reciprocity of households through their transactions. The VIOT and QVIOT are the main body of this research, and are shown and described in chapter 2, and chapter 3, respectively. More specifically, the current dissertation seeks to address and answer the following objectives and questions:

1. To construct a village input-output table for interdependence analysis based on the conceptual framework of interregional and regional IO tables.
2. To investigate the interdependence among households through their transactions in the corresponding village.
3. To measure the degree of interdependency among households through their transactions in the corresponding village.
4. To examine the influence of remittances on transactions, consumptions and investments in the village.

Making a VIOT from household survey data and transformed QVIOT model can be a useful method to answer these following research questions.

1. How is the degree of interdependency within the village?
2. Do interdependence relations vary in the poor and non-poor households?
3. Who are isolated and key players in transactions within the village?
4. Do geographical locations and distances of households affect the transactions among rich households and others in the village?
5. Which product transactions do remittances have a significant impact on in the village?

1.5 Research Hypotheses

As mentioned above, this study addresses five research questions. These research questions can be expressed in four research hypotheses:

Substantive Hypotheses:

H_1: Most of the poor households mainly depend on goods and services supplied by non-poor counterparts in the village (Ch. 2)

H_0: Most of the poor households do not mainly depend on goods and services supplied by non- poor counterparts in the village (Ch. 2)

H_2: The reciprocity of households through the rice transactions within the village is strong (Ch. 3)

H_0: The reciprocity of households through the rice transactions within the village is not strong (Ch. 3)

H_3: Households with remittances can facilitate their transactions in the village (Ch. 4)

H_0: Households with remittances cannot facilitate their transactions in the village (Ch. 4)

H_4: Geographical locations of households and distances between them affect the transactions among rich households and others in the village (Ch. 4)

H_0: Geographical locations of households and distances between them do not affect the transactions among rich households and others in the village (Ch. 4)

1.6 Significance of the Research

This study makes several contributions to the knowledge of IO tables studies and their application for small regions. From a theoretical/academic perspective, this study establishes a VIOT framework that allows us to understand more about the economic interdependence analysis through transactions for intermediate sales and purchases of goods and services among various households of the village economy in a disadvantaged area in a developing country. The created VIOT and QVIOT model, as such, enhance the current knowledge and understanding of the interdependence among households through their trade transactions linkages, and the roles of key players in the village markets. Research on this filed is useful in building and developing VIOT at the village level because this VIOT model could be an applicable method for examining inter-household dependency data and capturing the economic structure of the village, household production, consumption and investment, which improves our understanding of economic interdependence and transactions among key agents in disadvantaged areas, allowing us to identify potential areas for development and interventions, in addition to providing a helpful tool and reference for VIOT studies, for scholars conducting similar studies in the future.

In terms of its practical implications this thesis contributes to monitoring, planning and management of key economic sectors or key products in the village. More precisely, this

research provides researchers and local authorities with invaluable information on goods and money flows between sellers and buyers, as well as producers and consumers in the village, especially, this VIOT method offers comprehensive and detailed information regarding the sales and purchases of goods and services among various sectors of the economy, inflows and outflows of factors of production within and from outside the village such as earning from labor services and remittances. Thus, information contained in our VIOT can be used to examine the effects of production and form economic policies for goals such as poverty reduction, and trade expansion. Furthermore, this VIOT represents an analytical tool for economists, planners, and policy makers in rural economic development. It also draws the attention to a multi-sectoral multiplier that can be used as an index of the interdependency of industrial sectors. By using the VIOT and QVIOT model, we can identify who are the key market players, sellers and buyers, as well as producers and consumers in the village. We could explore the immobilization in a community by examining the circular structure of flows of goods and money between households. By doing so, this VIOT reveals that households with frequent trade transactions with others will gain greater incomes to reduce poverty, and households exhibiting less trade or no trade transactions with others will have lower incomes, leading to poverty. It reveals the strong interrelations of the key players, such as the 4 rich households who are not only producers, but also consumers, with other households in the village economy.

1.7 Study Area

The target village for this research was selected by the local government in Luang Prabang province, Lao PDR, when we asked which village was the most challenged regarding economic development in the district or province. The village's inhabitants are from the Khmu ethnic group, which has a unique culture and dialect. In the past, the village was forested. The village has a total area of 560 hectares. It is in the northern part of Ngoi district, Luang Prabang province, and the households are closely scattered along the main road passing through the village to *Phonthong* district and the Laos-Vietnam border (Figure 1). The village is situated at an altitude between 1,000 and 1,800 meters above sea level. It is approximately 50 Km, 70 Km, and 200 km from the Laos-Vietnam border market in *Phonthong* district, the Ngoi district market and the markets of the capital city of the province, respectively. The surrounding forests are the major source of food and income generation for this village.

In the 1970s, many households were both opium producers and consumers (The Prime Minister Office of the Lao PDR 2009). Several people, particularly men, smoked opium and became

addicted. As a result, they faced serious problems. In the early 2000s, the Laos government decided to take strong actions to eliminate the cultivation of the opium poppy. Later, the villagers transformed their income and economic activities by converting the forests into farmland, growing more rice and other field crops, selling their livestock, cutting firewood, harvesting timber, and selling various NTFPs.

Sticky rice is the staple food in the village; most households also have a small vegetable garden and crops including cotton and sugarcane, but they plant only in small quantities for personal use. The villagers also raise chickens, ducks, pigs, and goats as well as buffaloes and cows for their own consumption and for plowing the fields. In general, households are largely self-sufficient, growing their own food and making their own tools. But they do trade any surplus for such basic items as soap, kerosene, medicine, and kitchen or household goods. The village households cooperate informally, especially in agricultural work, and mutual assistance and labor exchanges are organized based on exchanges among families throughout the year for transplanting, harvesting and threshing. The village's population has been growing, so that prime land for agricultural use is now becoming scarce in its immediate vicinity. In addition, wild areas have been degraded, and access to resources has gradually deteriorated. Bamboo shoots, mushrooms, fruits, medical or culinary roots, and leaves are gathered in the forest according to the season.

After the Lao PDR established its independence in 1975, villagers began to travel to regional population centers in search of work and to earn a daily wage as supplemental income. Domestic trade, social networks, and transactions among the villagers were limited and very small. The Laos government adopted the New Economic Mechanism in 1986, and privately managed general stores and periodic markets began to appear in rural areas that had previously specialized in subsistence farming. Since then, the products from this village have mostly been rice, domestic animals, and agroforest products such as benzoin, cardamom, stick lac, and other NTFPs. Trade transactions only took place via Lao merchants who were middlemen between mountainous villages (*Khmu* traders) and lowland ethnic Lao villages (*Lao Loum* merchants). These middlemen transported the agroforest products and some surplus harvested rice to the ethnic Lao merchants in the lowlands or city markets in Ngoi district in exchange for iron products such as farming implements and sharp tools. There was only one trader of agroforest products in the village in the 2000s. But now there are four local traders who purchase those

products and sell them to merchants in Luang Prabang via Ngoi district and Nam Bak district: some are also sold to Vietnam, Thailand and China.

1.8 Structure of the Dissertation

The current dissertation consists of five chapters. This chapter served as an introductory part to the study by providing information regarding research background, objectives and research questions, hypothesis, significance, our contribution to the research, study area and finally the schematic structure of the doctoral thesis. Chapter 2 introduces a village input-output table (VIOT) created from household survey data. It is the main body of this thesis describing how to make the VIOT from household survey data to examine interdependency among households through transactions. This chapter is further divided into two main chapters, namely chapter 3 and chapter 4. Chapter 3 presents the measurement of reciprocity in the village through social networks. It is extended to examine the interdependency of households through their transactions using a qualitative village input-output table (QVIOT), which is converted from the VIOT as an index of interdependence of households. Chapter 4 is about the investigating the influence of domestic remittances on transactions among households, consumptions and investments in the village. It presents data descriptive analysis and estimates the average treatment effects of money transfers as remittances from outside the village on transactions between households in the village using propensity score matching method. Finally, chapter 5 summarizes the main findings, main discussion, conclusion and policy implication. In addition, my onsite team project is also included in the appendix.

CHAPTER 2
MAKING A VILLAGE INPUT-OUTPUT TABLE FROM HOUSEHOLD SURVEY DATA

2.1. Introduction

The strong human relations through trade, the exchange of goods and services between households or key agents in disadvantaged areas lead to an increasing role of economic interactions and potentially wider economic development and growth. The main purpose of this study is to make a village input-output table (VIOT) from household survey data to examine the interdependency among households through transactions in an isolated and disadvantaged village in a developing country. However, insufficient socio-economic statistics and data are available at the village level. Therefore, we conducted household surveys in a rural village in northern Luang Prabang province, Lao PDR in 2015 and 2016 to gather all relevant data and information.

VIOT construction is simple, but it is a useful tool to know the economic transactions among villagers in the village because the information contained in such tables is useful not only for describing a circular structure of flows of major goods and money within a village, but also for revealing the effects of production in the village and providing us with directional pair data for buyers and sellers, which can be used to estimate commodity flows between households and examine the causal effects of a treatment by following a micro-econometric methodology. Thus, this VIOT is an appropriate approach and is particularly applicable for disadvantaged areas where it is often difficult to obtain socioeconomic data, such as developing countries, to fully analyze the reciprocity of rural households through their economic transactions.

By using the VIOT model, we can identify who are the key market players, sellers and buyers, as well as producers and consumers in the village. Moreover, we could explore the immobilization in a community by examining the circular structure of flows of goods and money in that society. In our opinion, we assume that households exhibiting fewer trade transactions with others tend to present lower incomes as well as minimal opportunities to obtain goods and escape from poverty, while households that frequently exhibit trade transactions with others tend to present increased opportunities to receive income and overcome poverty. Therefore, households with very frequent trade transactions with others will gain greater incomes to reduce poverty, and households exhibiting less trade or no trade transactions

with others will have low incomes, leading to poverty. This VIOT method can provide basic information about this issue and can be used to form economic policies for goals such as poverty reduction by providing information on households playing a key role in the village. Furthermore, this VIOT can be used to measure income gaps or the expansion of poverty based on the frequency of trade between households because interdependency occurs in human relationships through trade. In many rural areas in developing countries, the producers of goods, such as farmers, are also the consumers in the village, which means that each household depends on the other households for both production and their livelihood. In such areas where the same household or person has characteristics of both a producer and a consumer, the VIOT model is therefore an advantageous tool for analysis.

While classical economists such as Smith and Marx identified principles of economic development through trade and capital circulation, it is widely known that income gaps frequently emerge. Income gaps and their causes are among the most fundamental issues in economics, along with trade or the exchange of goods. The input-output (IO) model developed by Leontief has long been a useful tool for investigating interdependency among industries and key sectors in the economy. This model, therefore, was used to develop the concept of the multi-sectoral multiplier in the industrial sector, which was derived from the macroeconomic multiplier developed by Keynes. This multi-sectoral multiplier can be used as an index of the interdependency of industries. Traditionally, the IO model has been employed to relate the product flows from producer to the consumer sectors and is constructed from observed data for economic areas such as nations or regions.

Most researchers focused on IO models and their implications for the specific national, regional or international and interregional IO studies. Their studies have used IO analysis to evaluate economic impact of industrial sectors on a national, international or regional, and interregional level. There have been several types of IOTs constructed and compiled by researchers for these studies over past decades. For example, Izard, W. (1951) described how to compile an interregional input-output (IRIO) table for the United States. Furthermore, Z. Zhang et al. (2015) attempted to construct a province-level IRIO model for China for 2002, and Dietzenbacher, E. et al. (2013) built world input-output tables (WIOTs) for 40 countries plus the rest of the world. However, this type of research on IO studies at bottom-up level, especially from village perspective has been rarely conducted because researchers often lack enough

information and socio-economic statistics. Moreover, survey approach and techniques are costly and time-consuming.

Few studies that used rural IO information from household survey data. Taylor and Adelman's (1996) study is one among the previous studies that used rural input-output information from the village surveys, including a village social accounting matrix (SAM) and computational general equilibrium (CGE) model. The authors focused on the main flows of money, including income; therefore, the sector sizes of their input-output tables were relatively small, and they included only five sectors, namely farming, livestock, resources extraction, construction and village retail activities. Their results showed that the production linkages within the village economy were weak, although there were strong consumption and investment linkages, especially for food and livestock. In addition, Lewis and Thorbecke (1992) employed a SAM approach to examine the economic linkages in a small regional economy in Kenya: their results showed that agricultural activities had the largest impact on income generation. Subramanian and Qaim (2009) developed a micro SAM to analyze the effects of agricultural biotechnology application on cotton production for rural households in India, using village census data from four states to analyze the income effects for large farms. Martin and Holden (2004) also built a small village SAM based on a household survey that they conducted in rural Mozambique to capture tree resources and assess the multiplier effects of charcoal production, and Agaje (2008) extended their village SAM to capture household income losses due to soil degradation. Faße et al. (2014) developed environmentally extended village SAMs for Tanzania to model the input-output relationships among households, to examine the transactions of an entire village economy. These previous studies related to SAM applications were constructed from household survey data, but they mainly used aggregated tables with few sectors. However, A SAM approach does not necessarily include significant IO detail, and the IO structure of the SAM seems to be small and captured major accounts: production activities, factors of production, institutions including households, capital, and rest of the village.

In general, an input-output (IO) analysis is a quantitative technique for studying the interdependence of production sectors in an economy. These interindustry linkages have been studied since the end of 1950s, with the main purpose of identifying the so-called key industries or key sectors that are essential for economic growth and development. The backward and forward linkages first introduced by Hirschman (1958) are the concept of inter-industry linkages analysis. Then, these linkages have widely applied for interdependence analysis (see,

e.g., Chenery and Watanabe, 1958; Hewings and Romanos, 1981; Hewings, 1982: Defourny and Thorbecke, 1984; Cmiel and Gurgul, 2002; San Cristobal and Biezma, 2006; Temurshoev and Oosterhaven, 2014; Gurgul and Majdosz, 2005; Gurgul and Lach, 2015, 2016, 2017). These studies are the main motivating thought for this study, and by following these ideas, we attempted to make use of VIOT created from our own household survey data to investigate the interdependence among households through their transactions in the corresponding village. This VIOT model could be an applicable method for examining inter-household dependency data [1] and capturing the economic structure of the village, household production, and consumption, which improves our understanding of economic interdependence and transactions among key agents in isolated villages or disadvantaged areas, allowing us to identify potential areas for development interventions, in addition to providing a helpful tool and reference for VIOT studies, for scholars conducting similar studies in the future.

The information on transactions for intermediate sales and purchases of goods and services between households in the village is key for the VIOT construction. Theoretically, IO model follows an accounting framework in which the total receipts by sellers must balance the total expenditures by buyers. By that convention, total output is equal to total input for each producing sector in the economy. Surprisingly, when we conducted our household survey, we investigated economic activities related to production and consumption over the previous year, and there was a gap in the balances of sales and purchases for each good in our survey data because respondents did not recall exactly how often they had sold and purchased their goods from others over the previous year. We also faced a difficulty dealing with consumption data distribution, because households did not know correctly how much they consumed each commodity they bought from others, so we had to solve problems in estimating a consumption ratio and then redistributed it in each household, this is an artificial value in consumption vector.

Our Household Surveys were conducted in March 2015 and March 2016 in Phonxay village, which is in the northeastern part of Luang Prabang province, Lao PDR, close to the border with Vietnam. It is a typical disadvantaged village and community under the poverty line in an Asian country. As of 2016, there were 124 households, which had 720 inhabitants in the village. Total annual household income is 1,705,230,000 Kip (US$ 213,145 at market exchange rate on 1 US dollar/8,000 Kip). The average monthly per capita income is 197,365 Kip, which is above the

[1] Our VIOT is a village-level IO model, which is similar with an international or inter-regional IO model, such as the Isard-type table if one considers each individual household to play the role of a country or a region.

Laos' national poverty line for rural areas. The major source of income is rice, contributing 778,640,000 Kip, or 45% of the total annual household income, followed by non-timber forest products (NTFPs) at 428,010,000 Kip (25%), livestock at 330,580,000 Kip (19%), and wages, salaries and remittances (7%). According to our survey data, the Gini coefficient in terms of per capita income in this village is 0.6607, which means that the market income disparity among households is extremely high measured at market prices.

The remainder of this chapter is divided as follows: Section 2 briefly introduces the collection of relevant data from an own household survey and then a summary of those data. The conversion of household survey data to an IO framework is explicitly described in Section 3. A sample VIOT analysis and the relations among households are described in Section 4, including the total output multiplier and backward and forward linkage analyses, to examine the degree of inter-household dependency in transactions. The final section summarizes the main results and provides concluding remarks.

2.2. Household survey data in the targeted village

We targeted a small village selected by local government of Luang Prabang province, Lao PDR (Figure 1). This village is a typical disadvantaged community of an Asian country, under the poverty line. The data and information were collected through direct interviews and questionnaires. We employed five local government officials from the Trade and Industry Office of the Ngoi district who were well known to the local people, and the survey field staff were trained. All 124 household units in Phonxay village provided survey information from February 29 to March 18, 2016. The collected data focused on household monetized spending for both food and non-food items as well as the various possible sources of income received by all household members. Relevant data and information, such as the demographic characteristics of the population, household debt, and borrowing (loans) as well as domestic remittances, were also included. This information revealed the households' major sources of income and expenditures over the past twelve months, which included products bought and sold, home-productions and products given away to other households, and products received from other households within the village.

Table 1 shows a summary of the socio-economic characteristics of Phonxay village in 2015. Our survey work showed that the female population accounts for 51 % of the total population, while males represent 86 % of all household heads in the village. The average household size

is 5.8. Approximately 25% of all household heads have no formal education. Approximately 8% of all households are landless. Female labor accounts for over half (51%) of the total labor force in the village. Table 2 presents the sources of household income in Phonxay village. The survey shows that the total annual household income of the village is 1,705,230,000 Kip (US$ 213,145)[2]. The primary source of income is rice, which contributes 778,650,000 Kip or 45 percent of the total annual household income; followed by NTFPs, which contributes 428,010,000 Kip (25%); livestock, contributing 330,580,000 Kip (19%); and wages and salaries, contributing 99,630,000 Kip (5%). The average monthly per capita income in this village is 197,365 Kip[3], which is above the Lao national poverty line for rural areas (180,000 Kip/person/month or approximately US$ 22,5 /person/month). According to our calculation, the Gini coefficient of the per capita income in this village is 0.6607, which indicates that market income disparity among households is extremely high measured at market prices.

A unique characteristic of this village is that the four highest-income households, namely HH 121, HH 122, HH 123, and HH 124, work not only as producers, but also as traders of products derived from other households. They obtain their profits from the sale of products outside the village at market prices, while other households obtain money from selling wholesale products to these families at village prices, referred to as the "agreed price". The price of each product in the village is shown in Table 3. The village prices and agreed prices listed in the table were obtained from the village office based on the agreement between farmers and buyers in the yearly village meeting, and market price data were obtained from the Trade Office of the Ngoi district. The gap between market prices and village prices is a substantial source of profit for the four families, and this is the fundamental structure that causes income inequality in the village.

[2] The exchange rate between the Lao PDR Kip and The US dollar at the time of the study (at market price on March 20, 2016) was 8,000 Kip/ U. S dollar.

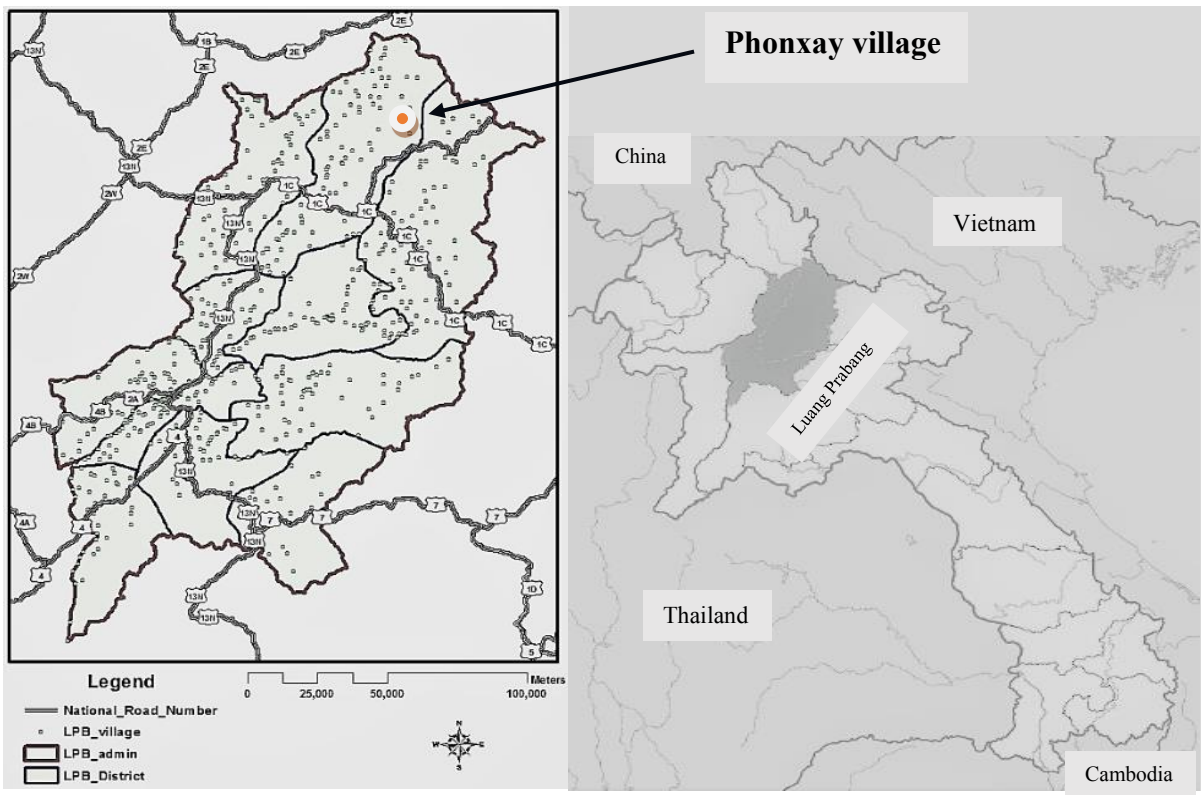
[3] The Prime Minister of the Lao PDR: Decree on Poverty and Development Standard 2010 to 2015, No. 285/PO, dated October 13, 2009, proposed a standard for measuring poverty at the individual level with three levels: (1) the nation: 192,000 Kip/person/month; (2) rural areas: 180,000 Kip/person/month; and (3) urban areas: 240,000 Kip/person/month. In this study, we used the second (2) level because the targeted village is in a poor rural area in northern part of Luang Prabang province, Lao PDR.

Table 1: Socio-economic characteristics of the study village (2016).

Characteristics	Frequency	Percentage (%)	Characteristics	Frequency	Percentage (%)
Total population	**720**	**100**			
Female	368	51.12	**HH size**	**124**	**100**
Male	352	48.88	3 - 5	64	51.61
Gender of HH head	**124**	**100**	6 - 8	57	45.96
Female	17	13.7	9 - 12	3	2.43
Male	107	86.3	**Land ownership**	**124**	**100**
HH head Status	**124**	**100**	Owned & operated	114	91.93
Married	107	86.3	Borrowed & lent	10	8.06
Widowed	17	13.7	**Labor force**	**272**	**100**
Age of HH head	**124**	**100**	Male	132	48.52
20 - 30	10	8.06	Female	140	51.48
31 - 40	30	24.19	**Occupation**	**124**	**100**
41 - 50	31	25	Farming	122	98.38
51 - 60	35	28.23	Civil Service	2	1.62
> 60	18	14.52	**Education Level**	**124**	**100**
Farm size (Hectares)	**124**	**100**	No formal education	31	25
0.0 - 1.0	78	62.9	Primary education	77	62.1
1.0 - 2.0	20	16.12	Secondary education	15	12.1
> 2	26	20.98	Higher education	1	0.8

Table 4 presents household income levels in the targeted village based on the Lao National Poverty and Development Standard (2010-2015). This classification designated forty-four households as the poorest group, namely HH number 1- 44 indicates the poorest households, who have a monthly income per capita of less than 50,000 Kip per person; sixty-seven households as the poor group, from HH number 45-111 denotes poor households, who have a monthly income per capita of 50,001-179,999 Kip; nine households as the non-poor group, from HH number 112-120 indicates non-poor households, who have a monthly income per capita of more than 180,000 Kip and less than 1 million Kip; and the remaining four of the 124 households as the rich group, from HH number 121-124 represents the rich households, who have a monthly income per capita of a million or more Kip per person.

Figure 1: Map of Luang Prabang province and the targeted village.



Source: Lao National Geographic Department_1980_1990_GIS Digital Data (February 2, 2018), edited by author (May 1, 2018)

Table 2: Main sources of household income in Phonxay village (2016).

Source of Income	Household Income		
	Annual	Per Capita	Share (%)
Rice	778,640,000	90,120	45.66
NTFPs	428,010,000	49,538	25.10
Livestock	330,580,000	38,262	19.39
Wages and salary	99,630,000	11,531	5.84
Remittances	20,350,000	2,335	1.19
Other*	48,020,000	5,558	2.82
Total	**1,705,230,000**	**197,365**	**100**

Note: Other* includes agricultural land rent, and other crops.

Table 3: Prices of each product in the targeted village (2016).

Products	Based on year 2015		Unit
	Village prices*	Market prices**	
Rice	2,500	5,000	Kip/Kg
Other crops	3,000	5,500	Kip/Kg
Cattle	63,000	65,500	Kip/Kg
Buffaloes	60,000	64,500	Kip/Kg
Goats	35,000	38,500	Kip/Kg
Pigs	37,000	40,500	Kip/Kg
Duck	45,000	65,000	Kip/Kg
Chicken	30,000	36,000	Kip/Kg
Bamboo shoots	6,000	10,000	Kip/Kg
Broom Grass	6,500	9,000	Kip/Kg
PongPeng (herbal roots)	12,000	15,000	Kip/Kg
Rattan shoots	6,500	10,000	Kip/Kg
PeukMeuk (tree bark)	7,000	9,500	Kip/Kg

Note: *Village prices information are collected from the Phonxay village office; these prices are based on the agreement between farmers and buyers in the village yearly meeting, September 23, 2015. **Market prices information are collected from the Trade Office of Ngoi District, Luang Prabang Province. These prices are based on 2015 prices.

Households that belong to the same income group are assumed to exhibit similar livelihoods with respect to income-generating activities, sources of income, income levels, and market participation. Table 5 identifies the sources of household income in the four groups in the village. The poorest and poor households obtained their incomes from selling NTFPs and from wages and salaries (labor services), whereas the non-poor and rich households primarily received income from livestock and rice production, respectively. Most of the household expenditures were associated with food consumption, especially rice. Table 6 indicates that 35%, 32%, and 27% of the total expenditures in the poorest group, poor group and non-poor group, respectively, were allocated to food and rice, whereas 69% of the total expenditures of the four rich households were allocated to non-food items, such as cars, trucks and motorbikes for their businesses purpose. Household expenditures expressed in the table are in a million Kip.

Table 4. Household income level in the targeted village (2016)

Income Level (Kip)	Number of HHs	Share (%)	Wealth status
<50,000	44 (1-44)	35.48	Poorest
50,001-179,999	67 (45-111)	54.03	Poor
180,000-999,999	9 (112-120)	7.26	non-poor**
>1,000,000	4 (121-124)	3.23	Rich
Total	**124**	**100**	

Note: ** represents a household with an average monthly per capita income>180,000 Kip, which is above the Lao national poverty line for rural areas (2015).

Figure 2 shows the poor and the rich households in the village as of 2016. The households (HHs) numbered 121-124 represent rich households, with a monthly income per capita of a million or more Kip per person. The HHs numbered 112-120 are the non-poor households, with a monthly income per capita of more than 180,000 and less than 1 million Kip. The HHs numbered 45-111 are the poor households, with a monthly income per capita of 50,001-179,999 Kip. Finally, the HHs numbered 1-44 are the poorest households, with a monthly income per capita of less than 50,000 Kip.

Table 5. Sources of household income by group in the targeted village, 2016 (1 million Kip)

Income Source	**All Households (N= 124)**		**Rich (N=4)**		**Non-poor (N=9)**		**Poor (N=64)**		**Poorest (44)**	
	Value	(%)	Value	(%)	Value	(%)	Value	(%)	Value	(%)
Rice	778.64	45.66	706.32	**57.83**	20.10	18.22	43.93	17.09	8.30	9.59
NTFPs	428.01	25.10	326.13	26.70	8.16	7.40	60.93	23.71	32.80	**37.90**
Livestock	330.58	19.39	185.15	15.16	72.57	**65.79**	59.33	23.08	13.53	15.63
Wages, salary	99.63	5.84	0	0	7.50	6.80	64.52	**25.10**	27.61	31.90
Remittances	20.35	1.19	0	0	0.20	0.18	19.65	7.65	0.50	0.58
Others*	48.02	2.82	3.77	0.31	1.77	1.60	8.67	3.37	3.80	4.39
Total Income	**1705.23**	**100**	**1221.37**	**100**	**110.30**	**100**	**257.03**	**100**	**86.54**	**100**

Note: Others* include agricultural land lent and crops income.

Table 6. Total household expenditures by household groups in the village (1 million Kip).

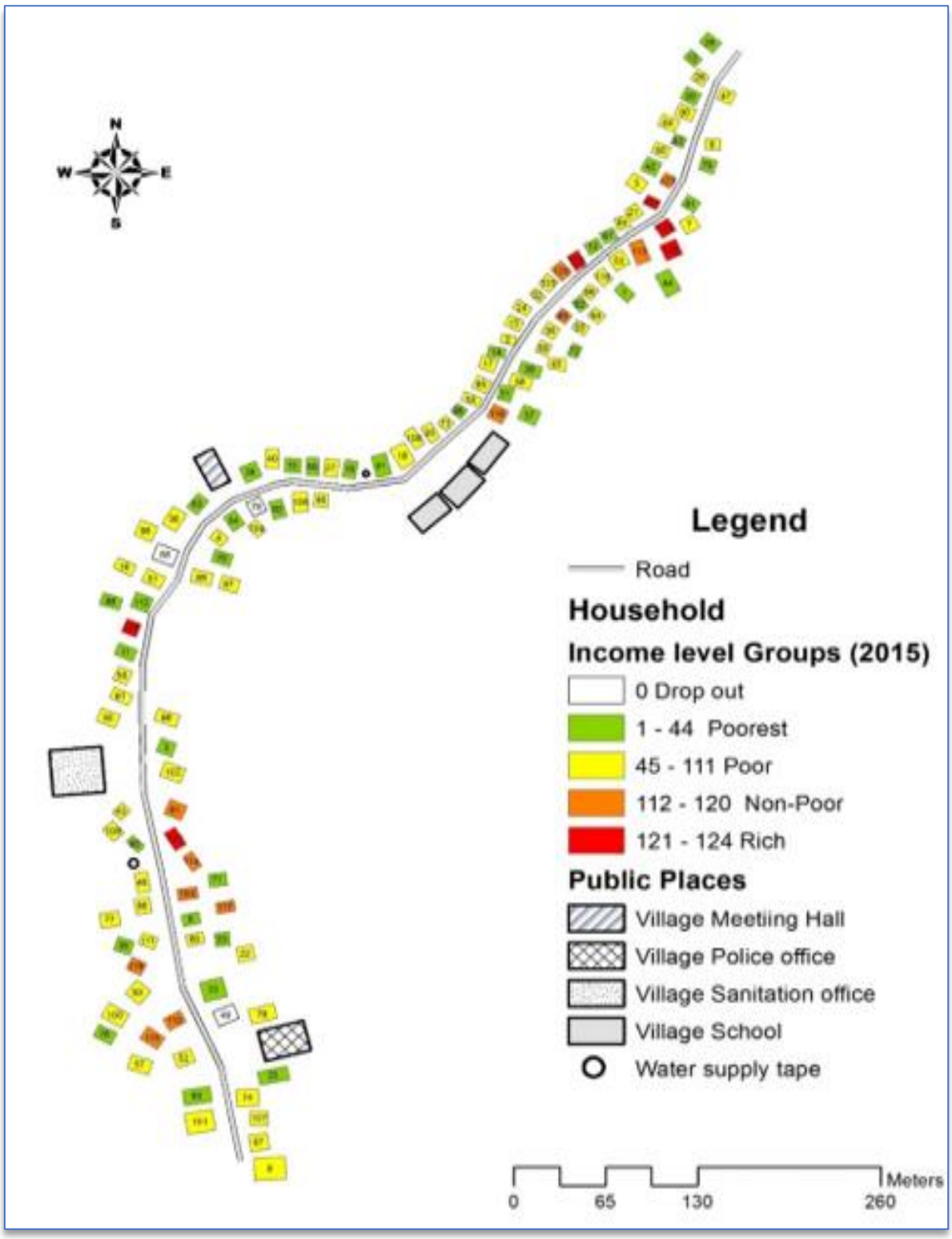
Products	**Total (124)**		**Rich (4)**		**Non-poor (9)**		**Poor (67)**		**Poorest (44)**	
	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
Livestock	37.41	2.2	8.97	2	4.95	4.32	14.67	2.09	8.82	2.02
NTFPs	6.8	0.4	0.45	0.1	0.63	0.55	3.12	0.44	2.61	0.6
Rice (crops)	446.22	26.22	38.4	8.57	31.13	**27.14**	223.06	**31.77**	153.64	**35.14**
Food	299.2	17.58	18.5	4.13	22.6	19.71	151.35	21.55	106.75	24.42
Clothing	81.6	4.79	5	1.12	5.5	4.8	40.4	5.75	30.7	7.02
Education	64.4	3.78	5.1	1.14	5.1	4.45	31.95	4.55	22.25	5.09
Health	140	8.23	42.9	9.58	13.8	12.03	44.7	6.37	38.6	8.83
Land tax	21.1	1.24	1.13	0.25	1.65	1.44	11.1	1.58	7.23	1.65
Electricity	19	1.12	0.99	0.22	1.57	1.37	9.8	1.4	6.64	1.52
Drinks	14.3	0.84	2.3	0.51	0.75	0.65	6.9	0.98	4.35	0.99
Vehicles	316	18.57	311	**69.44**	0	0	5	0.71	0	0
Loans	173.03	10.17	0	0	20.5	17.88	122.45	17.44	30.08	6.88
Others	82.85	4.87	13.1	2.93	6.5	5.67	37.7	5.37	25.55	5.84
Total	**1701.92**	**100**	**447.84**	**100**	**114.68**	**100**	**702.2**	**100**	**437.21**	**100**

Source: Our Household Survey Data, March 20, 2016.

Figure 2 shows the poor and the rich households in the village as of 2016. The households (HHs) numbered 121-124 represent rich households, with a monthly income per capita of a million or more Kip per person. The HHs numbered 112-120 are the non-poor households, with a monthly income per capita of more than 180,000 and less than 1 million Kip. The HHs numbered 45-111 are the poor households, with a monthly income per capita of 50,001-179,999 Kip. Finally, the HHs numbered 1-44 are the poorest households, with a monthly income per capita of less than 50,000 Kip.

Table 7 shows the main flow of product transactions that we have allocated them into VIOT, expressed in thousand Lao Kip. We found that the purchases of products are higher than sales within the village. In general, total sales should be equal to total purchases in the village product transactions in our VIOT. However, we could not capture all sales because most households were reluctant to provide information about certain sales, which were an important part of the income of each household in the village. Conversely, we were able to obtain relatively complete information on purchases, which represented the main component of household expenditures. Therefore, we assumed that the information about the purchases of goods and services for each household was enough and reliable for VIOT construction.

Figure 2: Position of households based on income level in the targeted village (2016).



Note: This map was drawn by authors when conducting the household survey, March 2016.

Table 7: Product transactions in the village input-output table (Unit: 1,000 Kip).

All products	Sales	Purchases	Import/inflow	Export/outflow	Consumption	Investment	Giving in kind
Rice	72,325	629,265	354,595	706,319	318,595	16,050	2,475
Other crops	8,530	45,329	25,480	18,018	67,079	3,730	0
Cattles/buffalo	57,900	89,930	7,500	178,000	13,830	790,000	58,500
Goat/pigs	1,200	112,650	4,900	70,775	19,940	171,610	0
Duck	5,280	20,050	3,640	12,200	15,750	5,265	900
Chicken	12,000	45,700	4,525	21,190	15,705	43,205	0
Bamboo	34,430	47,383	1,430	53,150	7,192	0	0
Broom Grass	51,735	71,275	158,450	300,500	0	0	0
Other NTFPs	23,210	46,420	21,945	100,110	0	0	0
Others	0	0	467,015	0	82,850	0	0
Total	**266,610**	**1,108,002**	**1,049,480**	**1,460,262**	**540,941**	**1,029,860**	**61,875**

Note: Crops include sweet corn, chili pepper, eggplants, and cucumber. NTFPs such as tree bark, rattan shoots, and herbal roots. Others include farm inputs, e.g. tools, equipment, fertilizer, motor vehicles and home appliances.

2.3. Converting the household survey to an IO framework

Our household survey data include information on the value of products sold to or bought from other households, goods given away or donated to and received from others, and basic information such as family members, production activities, household income, and expenditures. Figure 3 shows the household data flows and their allocation in the VIOT. The sales of each household to other households and outside the village **(Q2)** are allocated to the intermediate inputs (along the main diagonal matrices) and final demand (consumption, investment, and export). The purchases of each product from other households **(Q3)** are allocated to intermediate inputs along the main diagonal line in each row of the VIOT. **Q4, Q5, Q7** and **Q8** are directly allocated to the final demand. The imports and inflows **(IM)** of each product to each household from outside the village **(Q6)** are allocated to the intermediate inputs and final demand of the VIOT. **Q1,** which includes wages, salaries and remittances as well as loans, forms part of the household income and money transfer from outside the village and is allocated to the value-added **(VA)** row vector in our VIOT. In theory, data flows in the VIOT, especially material flows and monetary flows, can be expressed as follows:

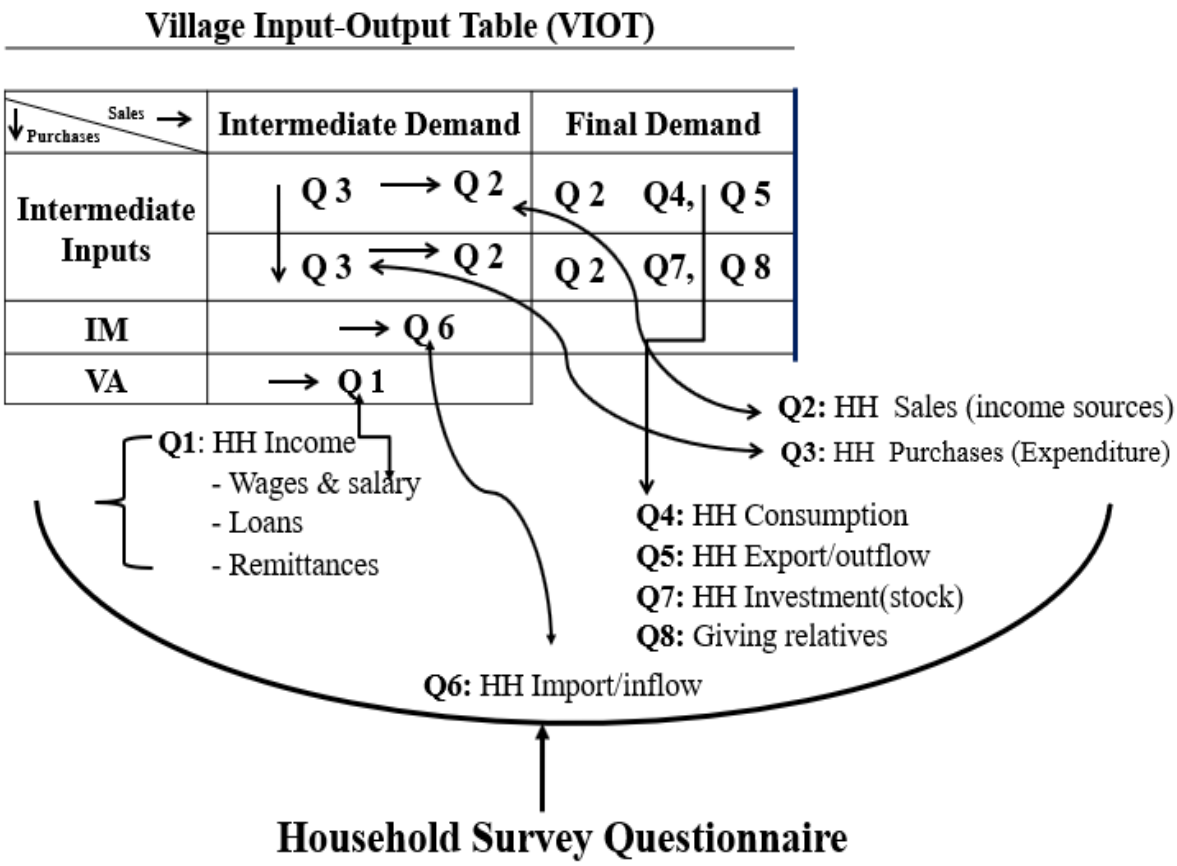
Self-production+**Purchases**+**Inflow/Import** = **Sales** + **Consumption**+**Outflow/Export**+**Investment**[4]

[4] As a similar macroeconomic balance, we use the following equation, which includes only value added: Production + Inflow/Import = Consumption + Outflow/Export + Investment

The term “Self-production” indicates commodities produced by households. “Purchases” are goods or commodities bought from other households, including intermediate inputs and final goods. “Sales” are commodities sold to other households and own-use production, including intermediate inputs and final goods. Data from our household survey 2016 shows that there are 124 households in the study village, and each household primarily produced at least one of the following nine goods: (1) rice, (2) crops such as sweet corn, maize, chili pepper, eggplant, and cucumber, (3) cattle including buffaloes, (4) goats including pigs, (5) ducks, (6) chickens, (7) bamboo shoots, (8) broom grass, and (9) NTFPs such as tree bark, rattan shoots and herbal roots**.** In addition to these products, we established ‘others’ as a sector (10) that included goods such as motor vehicles, fertilizer, feed for livestock and other household equipment and appliances. These items are typically imported goods from outside the village. As a result, our VIOT consisted of nine plus one item from 124 households’ major products transactions and formed a 1240 × 1240 matrix size. The outline of this VIOT is illustrated in Table 8, which is similar with the international or regional input-output table; it contains all 124 households with top 10 goods. Households are ranked from poorest to richest **(**HH1 to HH124**)**, respectively. This VIOT model follows an accounting framework in which the total receipts by sellers must balance the total expenditures by buyers. Therefore, this VIOT offers very comprehensive and detailed information regarding the sales and purchases of goods and services among households in the village. By that convention, total output is equal to total input for each household in the village economy. A very general and simplified outline of this VIOT presented in Table 8 comprises mainly three parts, namely intermediate demand (1), final demand (2), and value-added section (3). Intermediate demand is the basic for the VIOT model itself and includes the matrix of intermediate flows. It represents the transactions for intermediate sales and purchases of goods and services among households in the village.

The final demand shows the final use of goods and services by households, consumption (Cons.), investment (Inv.), outflow/exports (Exp.), and we added one column labeled “giving in kind” (Giv.) to relatives, friends and others. Value-added section shows inflows/imports, wages & salary, loans, and remittances sent by their relatives from outside the village.

Figure 3: Data flows and allocations to the VIOT.



The exchange information among households corresponded to intermediate input and final demand in the VIOT. However, it should be noted that the total number of transactions between households does not include information about how many products were used as intermediate inputs and how many were consumed as final goods. Therefore, we calculated a consumption ratio using the initial survey data for each household. Based on this ratio, the transactions between households under each category are allocated to intermediate inputs and consumption.

Consumptions represent the commodities consumed by each household, including in-kind goods. The intersection of consumption and inflows/imports in the VIOT shows the final consumption as inflows from outside the village (e.g., food, and drink, education, healthcare services, and clothes). ***Investments*** represent the acquisitions of inventory and build-up of the transactions in each household. The intersection of inflows/imports and investments in the VIOT represents the investments as inflows from outside the village (e.g., cars, trucks, motorbikes, and fertilizer, which are imported goods). ***Outflow/Exports*** represent the value of sales for each household to people outside the village. For instance, rice, crops, duck, chicken,

and NTFPs are sold at the weekly market outside the village; these products are treated as exports for the remainder of the village.

Inflow/Import is the value of purchases for each household from people outside the village, but this category is recorded and shown in the table as a new row**.** This approach means that the VIOT is an Izard-type or non-competitive import type of IO table, which is like an international or inter-regional IO table, because the inflows/imports are treated as a vector row and are excluded from domestic transactions when constructing the VIOT**.**

In a typical IO table, indirect taxes less subsidies for each product, consumption and the depreciation costs are placed in the value-added area. Due to the lack of this type of information in our VIOT, we include wages and salaries, loans, remittances or gifts which are money transfers, and surplus and adjustment rows in this area**.** ***Wages and salaries*** are the compensation paid to other households to produce each good, which means that these are payments or costs, not received money.

Loans and remittances or gifts are also included in the value-added area of the table**.** This information represents monetary transfers from relatives outside the village; it is typically not included in an input-output table because these transfers are not value adding inputs or production activities. However, we added this information to the table to understand the quantity of monetary inflows for each household. On the other hand, in the value-added area, the ***surplus*** is a household's earnings for each good, including earnings via labor services for other households to produce goods, which is not included in the other categories**.** Such labor services for other households sometimes contribute to production and can be considered a type of earnings/surplus for each household**.** Therefore, in our table, labor is included in the surplus row as income in addition to the surplus from producing each good**.** This surplus is a difference between the total household output and the sum of the total intermediate inputs, inflows/imports, and wages & salaries, loans and remittances**.** Based on this definition, we calculate the surplus values and present them as a row vector in the value-added area**.** Finally, we create an **adjustment row** in the value-added area to balance the table. This adjustment consists of an artificial row derived from the total output minus the total intermediate input plus the value-added (surplus) section.

Table 8: A general outline of a VIOT 2016 for Phonxay village

		Intermediate Demand							**Final Demand**									**Output**
		HH 1			…	HH 124			HH 1				…	HH 124				
		Rice	…	Other	…	Rice	…	Other	Cons.	Inv.	Exp.	Giv.	…	Cons.	Inv.	Exp.	Giv.	
HH 1	Rice	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	X_1
	……	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	Other	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	X_{10}
…	……	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…..
HH 124	Rice	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	X_1
	……	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	Other	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	X_{10}
VA	Inflow/import	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
	Wage & salary	…	…	…	…	…	…	…										
	Loans	…	…	…	…	…	…	…										
	Remittances	…	…	…	…	…	…	…										
	Surplus*	…	…	…	…	…	…	…										
	Adjustment**	…	…	…	…	…	…	…										
Input		X_1	…	X_{10}	…	X_1	…	X_{10}										

2.4. Sample VIOT analysis and relations among households

Table 9 shows the numerical example of the VIOT for Phonxay village, with 1240 sectors. Each household is assumed to be able to produce at least one of 10 products, as described above. All transactions values at village and market prices are recorded in thousands (1,000) of Kip. To be used as a tool for interdependence analysis, this village IO table (VIOT) needs to be transformed into an analytical model. First, we have to convert the transactions between households into an **A** matrix showing the direct requirements of a household or a sector in order to produce a unit of its product. Matrix **A** is called the technical coefficients matrix or the input coefficients matrix.

Table 9: A numerical example of VIOT for Phonxay village (1,000 Kip)

		Intermediate Demand											Final Demand							Total output
Purchases[2] \ Sales[1]		HH 01					…	HH 124					HH 01			…	HH 124			
		Rice	Crops	…	NTFPs	Others	…	Rice	Crops	…	NTFPs	Others	CONS.	INV.	EXP.	…	CONS.	INV.	EXP.	
HH 01	Rice	1350	0	…	0	0	…	5	0	…	0	0	1150	100	0	…	1095	0	0	6150
	Crops	0	75	…	0	0	…	0	0	…	0	0	215	20	28	…	0	0	0	513
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	NTFPs	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	250	0	0	450
	Others	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	0	0	0	0
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	0	0	0	
HH 124	Rice	279	0	…	0	0	…	266260	0	…	0	0	921	0	0	…	3000	500	280500	651635
	Crops	0	0	…	0	0	…	0	824	…	0	0	0	0	0	…	3716	150	3080	13895
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	NTFPs	0	0	…	0	0	…	0	0	…	57400	0	0	0	0	…	0	0	61100	118675
	Others	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	0	0	0	0
VA	Import	0	250	…	0	0	…	128260	1350	…	11190	0	4400	0	0		52250	198900	0	1673380
	Wages	0	150	…	0	200	…	7100	4660	…	1250	5420	0	0	0	0	0	0	0	98180
	Loans	0	0	…	0	1100	…	0	0	…	0	0	0	0	0	0	0	0	0	173030
	Remittance	0	0	…	0	150	…	0	0	…	0	0	0	0	0	0	0	0	0	33500
	Surplus	4242	29	…	450	-200	…	249429	6239	…	48835	-5420	0	0	0	0	0	0	0	3416648
	Adjustment	0	0	…	0	-1250	…	0	0	…	0	0	0	0	0	0	0	0	0	-304710
Total		6150	513	…	450	0	…	651635	13895	…	118675	0	7701	120	28		292601	453125	622130	11227853

Note: [1] Sales to other households along the top of the table from HH 1 to HH 124 in each row at the left of the table. [2] Purchases from other households at the left of the table by HH 1 to HH 124 in each column.

The inverse Leontief inverse matrix can then be derived and computed from the following simple equation:

$$\mathbf{X = AX + F} \qquad (1)$$

By employing a 1240 x 1240 transaction matrix table of the VIOT (from Table 9), the technical coefficients are calculated from the values taken from the matrix of transactions divided by total input, respectively. Solving the above expression for total output **X** we get:

$$\mathbf{X = (I - A)^{-1} F} \qquad (2)$$

where $\mathbf{(I-A)^{-1}}$ is known as the Leontief inverse matrix or the interdependence coefficients; matrix **A** is known as the input coefficient matrix; and **I** is the 1240 x 1240 identity matrix. **F** is the compositions of goods and services that have gone to final demand sectors of households,

including goods and services domestically produced and of those imported directly from outside the village. These imported products are direct allocation into the value-added row vector in the IO table. We, therefore, can employ equation (2) to calculate the Leontief inverse matrix because our VIOT is an Isard-type table, and we do not need to calculate the import matrix because the inflows and imports are not village production, and recorded outside domestic transactions when constructing the VIOT.

An additional useful interpretation of the transaction table is the measure of economic linkages within the village economy, highly linked household economies tend to be more self-sufficient in production and to rely less on outside sources for its inputs. The degree of interdependency among households on sales and purchases of goods and services in the village can be obtained by analyzing the values of the transaction matrix table. Generally, larger values indicate a tightly linked economy, whereas smaller values indicate a more open economy or depend somewhat on outside sources for their inputs and production.

This study does not directly compute the Leontief inverse matrix from matrix A because, for example, we found that the total output of some products (e.g., chicken) was equal to the total input of the same product (chicken), which results in the same values of coefficients. To solve this problem, we replace this coefficient with 0.90. We assume that if each household receives a ten percent surplus for a product, then the Leontief inverse matrix can be computed. As a result, this Leontief inverse matrix table provides the same or artificial values for backward and forward linkage estimation[5].

Furthermore, the IO analysis offers two distinctive results for each analyzed sector, namely, backward linkages and forward linkages. First, the backward linkages used to present the internal transactions, showing that the increase in the total production of sector j increases the demand of sector j for inputs from the rest of the economic sectors, while forward linkages present the intersectoral transactions, showing that an increase in total production of sector j increases its total supply to the rest of the economic sectors that are using the product of sector j as an input in the production process. In this study, we present the backward and forward

[5] For example, the results of the Leontief inverse matrix in the VIOT with the same matrix coefficients yield the same coefficient values (artificial) for backward linkage and forward linkage in some sectors; e.g. the backward coefficient of cattle, goat and duck in HH 01 is the same (5.654) as the forward linkage coefficient.

linkages for each household by each product. According to this definition, backward and forward linkages can be computed by the following formula:

$$BL(d)_j = \frac{\sum_{i=1}^{n} a_{ij}}{(1/n)\sum_{i=1}^{n} a_{ij} \sum_{j=1}^{n} a_{ij}} \quad (3)$$

$$FL(d)_i = \frac{\sum_{j=1}^{n} a_{ij}}{(1/n)\sum_{i=1}^{n} a_{ij} \sum_{j=1}^{n} a_{ij}} \quad (4)$$

where j = 1, 2, 3., ……. n & i = 1, 2, 3 …...n.

2.5 Results of VIOT Analysis

VIOT analysis will offer the total output multiplier that can indicate the inter-household purchases and sales of products in the village. This total output multiplier, as well as backward and forward linkages indices represent the degree of interdependency among households in the village. The main results of VIOT analysis by multipliers are as follows:

2.5.1 Total output multiplier

For any one household or a sector, a high level of intermediate inputs, e.g. those purchased from other households in the village, suggests strong linkages within economy and creates significant indirect effects in the output of supplying sectors. These effects are quantified by output multiplier. By employing equation (2), and Leontief inverse matrix table derived from VIOT constructed from our household survey data, as shown in Table 9, this VIOT produced a total output multiplier of 1.767. This multiplier can indicate the degree to which an individual household depends on other households for inputs and production in the village. Overall, this output multiplier (1.767) is not so high, and we couldn't conclude that the degree of interdependency among households in the village is weak or strong.[6] The multiplier of 1.767

[6] For example, the multiplier for Japan's IO table (2011), which includes 190 sectors, is 2.00; for the 2005 table for Japan, the multiplier is 1.99; both values are higher than that Phonxay village VIOT value. However, national IO tables tend to have higher multipliers than regional Io tables because each region primarily depends on outside areas for trading (that is, inflows, or imports, and outflows or exports). For example, the multiplier for Hiroshima IO table (2005), which includes 108 sectors, is 1.40, and the multiplier for the Shizuoka IO table (2000), which includes 188 sectors, is 1.30. In contrast, the total output multiplier for the Singapore IO table (2010) is 1.60, which is smaller than that of the Phonxay VIOT.

indicates that the village economy is dependent somewhat on the external economy than the internal economy for their inputs and production**.** The degree of interdependency would not result in large repercussions if agricultural improvement projects were implemented and promoted in the village. However, the interdependency among households in the village varies, as shown by the results of the backward linkage analysis and forward linkage analyses**.**

2.5.2 Backward and Forward Linkages Effects

In this study, the backward and forward indices are estimated by employing equations (3) and (4), respectively. These indices are used to indicate the degree of interdependence among households (sellers and buyers) in the village. The term forward linkage (as a seller) is used to indicate the interconnection of a seller to those buyers in the village (supply-side model). The backward linkage (as a buyer) is used to indicate the interconnection of a buyer to those sellers in the village economy (demand-driven side model). If the forward and backward values are smaller or bigger than one (1) they indicate a weak or strong degree of interdependence among households in the village, respectively. Moreover, if some products have both high forward and backward linkages values, it means that these products play important roles in economic development and growth.

Table 10: Forward linkage values for major product transactions (Indices).

No.	Seller ID	Rice	Seller ID	Crops	Seller ID	Cattles	Seller ID	Goats/pigs
1	124	4,936	121	2,512	116	3,392	97	1,979
2	122	3,851	124	2,445	23	2,570	113	1,840
3	123	3,225	122	1,947	122	1,402	122	1,800
4	121	2,379	116	1,234	124	1,383	124	1,764
5	118	0,887	123	1,215	119	1,009	67	1,696
6	116	0,873	72	1,171	117	0,925	109	1,597
7	47	0,842	118	1,169	118	0,855	101	1,566
8	66	0,839	39	1,137	106	0,746	93	1,562
9	86	0,832	20	1,131	111	0,720	89	1,427
10	93	0,826	112	1,070	123	0,691	114	1,417
11	77	0,814	114	0,984	121	0,676	62	1,330
12	74	0,812	11	0,979	86	0,672	94	1,330
13	103	0,805	43	0,969	60	0,651	72	1,311
14	102	0,803	29	0,957	96	0,633	112	1,304
15	59	0,801	113	0,922	108	0,611	120	1,289
16	70	0,799	52	0,911	112	0,607	119	1,231
17	33	0,796	25	0,897	87	0,582	117	1,280
18	79	0,790	78	0,894	99	0,565	102	1,229
19	78	0,788	35	0,889	104	0,565	110	1,182
20	71	0,786	80	0,887	110	0,565	123	1,049

No.	Seller ID	Duck	Seller ID	Chicken	Seller ID	Bamboo	Seller ID	NTFPs
1	57	5,449	124	2,717	101	2,375	115	3,957
2	97	3,251	113	1,964	115	2,271	117	3,057
3	46	2,827	38	1,696	122	1,861	118	2,921
4	121	2,674	119	1,687	98	1,734	123	2,191
5	113	2,647	47	1,631	97	1,718	121	1,931
6	25	2,169	116	1,600	120	1,553	05	1,593
7	03	2,136	117	1,577	124	1,519	15	1,555
8	116	1,984	56	1,573	121	1,422	90	1,508
9	112	1,729	77	1,535	108	1,329	116	1,470
10	77	1,696	107	1,519	113	1,325	113	1,445
11	92	1,625	120	1,485	39	1,214	92	1,413
12	114	1,561	109	1,479	123	1,143	83	1,385
13	14	1,513	58	1,435	116	1,129	40	1,272
14	53	1,476	76	1,392	90	1,112	34	1,244
15	70	1,461	54	1,364	104	1,056	78	1,244
16	81	1,445	97	1,336	68	0,975	25	1,225
17	33	1,422	121	1,368	26	0,953	37	1,208
18	117	1,409	115	1,308	72	0,918	17	1,194
19	31	1,348	123	1,239	91	0,905	122	1,176
20	120	1,331	112	1,171	118	0,902	124	1,095

Source: Author's calculation from VIOT (March 8, 2017). The third column shows the values of forward linkage effects of each product by VIOT analysis.

Table 10 shows the results of forward linkages estimation from our VIOT. Surprisingly, the findings show that four rich households (HH 124, 122, 123, 121) are likely to have high forward linkages values for all product transactions such as rice, livestock, crops, and bamboo transactions in the village. This means that these four rich households are the main suppliers in the village. For instance, in rice transactions, these four households are key sellers, and especially the transactions among them is stronger than among other poor and non-poor households. In particular, HH 124 with a forward linkage value of 4.936, which is highest among top 20 rice sellers in the village, while HH 121 with a forward linkage value of 2.512 is the highest among top 20 crops sellers in the village, HH 57 with a forward linkage value of 5.449 is the highest among top 20 duck sellers, HH 116 with a forward linkage value of 3.392 is the highest among top 20 cattle sellers, HH 124 with a forward linkage value of 2.717 is the highest among top 20 chicken suppliers, and HH 115 with a forward linkage value of 3.957 is the highest among top 20 NTFPs sellers in the village, respectively. The main findings from table 10 show that the key players in the village are those 4 rich households, who are playing a major role in transactions, they tend to sell more their products to other households in the village.

In contrast, Table 11 shows the results of backward linkages estimation from our VIOT. In overall, our findings show that most of the poor households are likely to have high backward linkages values for major transactions such as duck, chicken, bamboo, crops, and rice transactions in the village. This means that these poor households are the main buyers in the village. For instance, HH 86, HH 47, HH 74, HH 102, and HH 66, are the main rice buyers, while HH 20, 47, 77, 57, and 37 are the main duck buyers in the village. The rice transactions between these households and other households are very common in the village. The backward linkage analysis finds a strong degree of interdependence among the poor and non-poor counterparts in duck and chicken transactions. More specifically, we find that HH 86 with a backward linkage value of 1,070, which is highest among top 20 rice buyers in the village, while HH 57 with a backward linkage value of 3,715 is the highest among top 20 duck buyers, and HH 20 with a backward linkage value of 1,696 is the highest among top 20 chicken buyers in the village, respectively. The findings from table 11 show that the key buyers in the village are those who are poor and some non-poor households in the village. They therefore tend to buy more products from other non-poor households, who are also playing roles in village transactions.

Table 11: Backward linkage values for major product transactions (Indices).

No.	Buyer ID	Rice	Buyer ID	Crops	Buyer ID	Cattles	Buyer ID	Goats/pigs
1	86	1,070	87	1,375	115	5,654	97	1,979
2	47	1,041	27	1,365	116	3,392	62	1,754
3	74	1,034	73	1,364	23	2,926	93	1,695
4	102	1,029	90	1,310	60	1,352	109	1,693
5	123	1,021	34	1,287	86	1,290	72	1,687
6	66	1,019	83	1,246	117	0,925	94	1,678
7	70	0,991	20	1,237	118	0,842	32	1,567
8	93	0,988	72	1,171	119	0,799	101	1,566
9	75	0,986	48	1,159	109	0,746	114	1,453
10	78	0,977	85	1,157	111	0,720	89	1,427
11	59	0,966	101	1,144	122	0,701	28	1,408
12	124	0,957	31	1,119	123	0,690	71	1,362
13	02	0,954	71	1,111	121	0,675	66	1,360
14	122	0,953	86	1,089	87	0,582	29	1,306
15	121	0,947	29	1,058	120	0,581	102	1,294
16	30	0,945	36	1,025	113	0,568	35	1,290
17	73	0,939	97	1,015	62	0,565	39	1,210
18	77	0,934	96	1,008	70	0,565	110	1,182
19	110	0,931	40	1,000	103	0,565	99	1,131
20	71	0,928	84	0,995	109	0,565	82	1,068

No.	Buyer ID	Duck	Buyer ID	Chicken	Buyer ID	Bamboo	Buyer ID	NTFPs
1	57	3,715	20	1,696	101	2,374	115	3,957
2	97	3,251	47	1,593	115	2,268	117	3,057
3	46	2,827	107	1,585	120	1,854	118	2,921
4	50	2,714	108	1,542	98	1,734	123	2,191
5	03	2,136	77	1,535	97	1,696	121	1,931
6	14	1,819	57	1,522	122	1,627	05	1,593
7	77	1,696	56	1,508	108	1,329	15	1,555
8	92	1,625	109	1,479	124	1,277	90	1,508
9	25	1,583	37	1,478	121	1,269	116	1,470
10	33	1,546	92	1,472	39	1,245	113	1,445
11	31	1,481	106	1,471	113	1,216	92	1,413
12	09	1,447	58	1,435	116	1,131	83	1,385
13	81	1,445	97	1,423	104	1,123	40	1,272
14	53	1,441	70	1,411	90	1,121	34	1,244
15	70	1,426	44	1,388	123	1,090	25	1,225
16	40	1,422	26	1,377	118	1,044	37	1,208
17	121	1,421	54	1,364	68	1,033	17	1,194
18	07	1,417	18	1,358	26	0,965	122	1,176
19	90	1,411	33	1,352	119	0,935	20	1,171
20	18	1,409	43	1,176	72	0,912	119	1,158

Source: Author's calculation from VIOT (March 8, 2017). The third column shows the values of backward linkage effects of each product by VIOT analysis.

2.6 Concluding Remarks

The following conclusions can be drawn from the main results of the VIOT analysis:

1) Interdependency between households tends to be stronger in transactions among high-income households (HH 121, HH 122, HH 123, and HH 124) in any transaction.
2) For rice transactions, including rice dusk, rice grain, the degree of interdependency between four high-income households is stronger than that among lower-middle income households in the village.
3) Lower/middle-income households and high-income households depend on transactions involving other foods, such as other crops and bamboo. The main suppliers in other crop transactions are high-income households, while many lower/middle-income households are purchasers. In bamboo transactions, lower/middle-income households are both sellers and buyers, but many lower/middle-income households are also suppliers, which may indicate that lower/middle-income households sell bamboo to buy other crops within the village.
4) Transactions involving relatively expensive products, such as duck and chicken, seem to be active between lower/middle-income households and higher-income households. In these transactions concerning domestic animals, a common feature is that the main suppliers are almost always high-income households, while many lower/middle-income households are on the demand side. In duck transactions, many buyers are lower-income households, although the number of transactions is not very large. Considering this finding and the results described in (3) above, lower/middle-income households may tend to buy expensive goods within the village, and not from outside it. Thus, expensive goods (e.g., cattle) are the main products outside the village.
5) Overall, the degree of interdependency between the four richest families through direct transactions is extremely strong, while there are few transactions among lower-income households in the village.

These results indicate that transactions involving relatively cheap goods (e.g., rice) mainly generate strong interdependency among the four higher-income families, while the degree of interdependency among lower-income households is weak. Transactions involving relatively expensive goods (e.g., duck and chicken) between higher-income households and lower/middle-income households are strong. In addition, we can easily imagine that the four higher-income households that work as traders in the village gain large profits from the price

gap between the village price and the market price. The estimation of exactly how much these four rich households obtain in profits after considering transportation costs and savings costs for goods is difficult, but this difference in interdependency and roles between the four rich families and other households could be a structural cause of the huge income gap in this village.

CHAPTER 3
MEASUREMENT OF RECIPROCITY IN THE VILLAGE THROUGH SOCIAL NETWORKS

3.1 Introduction

This paper examines the interdependency among households through their transactions by using a qualitative village input–output table (QVIOT) in an isolated and disadvantaged village in a developing country. To obtain the QVIOT, we used a village input–output (VIOT) created from household survey data collected beforehand as mentioned in Chapter 2 above. By converting the VIOT into a QVIOT framework, we can examine the economic transactions among key agents in the corresponding village because each household is not only a producer but also a consumer who is trading products and consuming them within the village.

The QVIOT can provide us direct and indirect transaction numbers that might be a better indicator to measure the degree of interdependency among households in the village. Because it provides a basic information describing transactions for sales and purchases of goods and services among households within a village. Therefore, the information contained in such tables is useful not only to reveal the effects of production in the village but also as directional pair data, which can be used to estimate the causal effects of a treatment by following a micro-econometric methodology. Transforming the values in transaction matrix table of the VIOT into a number in the transaction matrix table of QVIOT is a useful technique to fulfill the main research objectives and questions in this chapter.

In both developing and developed economies, finding the causes of poverty and considering how to overcome it are classic problems. The international aid mainly provided by the International Monetary Fund (IMF) and the World Bank after World War II did not necessarily lead to improvements in the poverty rate in many developing countries that had previously been colonized.[7] One reason for this failure is that economists could not formulate a mechanism that describes how poverty or income gaps emerge in a society; in addition, each country's economic development is greatly affected by political conflicts and its particular social context,

[7] For more information regarding the serious problems with international financial support, see Deaton (2013) and Krueger (1998).

including institutional and cultural matters.[8] Thus, the problem of poverty reduction is a social and political issue as well as an economic matter. While classical economists such as Smith and Marx identified principles of economic development through trade and capital circulation, it is widely known that income gaps frequently emerge. Income gaps and their causes are among the most fundamental issues in economics, along with trade or the exchange of goods. The input–output model developed by Leontief has long been a useful tool for such investigations. It was used to develop the concept of the multi-sectoral multiplier in the industrial sector, which is derived from the macroeconomic multiplier developed by Keynes. This multi-sectoral multiplier can be used as an index for the interdependency of industries. By converting this multi-sectoral model into a multi-household model, the IO model is applicable for examining the interdependency among households within an area or region. This means that it can measure the income gap or the expansion of poverty by the frequency of trade among households because interdependency occurs in human relationships through trade. In many rural areas in developing countries, the producers of goods, such as farmers, are also the consumers in the village, which means that each household depends on the other households. In such areas where the same household or person has characteristics of both a producer and a consumer, the input–output model is advantageous for analysis.

This paper offers the QVIOT model as an applicable method for a VIOT to examine household interdependency data in order to capture villagers' interdependency.[9] Theoretically, this method is based on graph theory in the field of mathematics (c.f. Clark and Holton, 1991), and recently, it has been used in social network analysis, c.f. Jackson (2008) and Wasserman and Faust (1994). VIOTs can be used to examine economic transactions among agents in isolated villages because each household is not only a producer but also a consumer who trades products and consuming them within the village. Representing such a village structure is necessary to obtain the basic production ability of the village and its potential for development. VIOTs can be used as a fundamental approach to understand the basic economic situation in the village.

Taylor and Adelman's (1996) study is one among the previous studies that used rural input–output information including social accounting matrix (SAM) and computational general

[8] For more information on the influence of the political system and institutions on economic development, see Acemoglu and Robinson (2011).

[9] Our VIOT is similar to an international or interregional IOT, e.g. an Izard-type, if one considers each household to play the role of a country or region (Hongsakhone et al.,2017).

equilibrium. The authors focused on the main flows of money, including income; therefore, the sector sizes of their IOTs were relatively small, and they included only five sectors. The authors used 1982 household survey data from a major migrant-sending village in central Mexico to analyze the economic structure of a migrant-sending rural economy. The results showed that the production linkages within the village economy were weak, although there were strong consumption and investment linkages, especially for food and livestock. In addition, Lewis and Thorbecke (1992) employed a SAM approach to examine the economic linkages in a small regional economy in Kenya: their results showed that agricultural activities had the largest impact on income generation. Subramanian and Qaim (2009) developed a micro SAM to analyze the economy-wide effects of agricultural biotechnology application on cotton production for rural households in India using village census data from four states to analyze the income effects for large farms. Martin and Holden (2004) also built a small village SAM based on their own household survey con- ducted in rural Mozambique to capture tree resources and to assess the multiplier effects of charcoal production, and Agaje (2008) extended their village SAM to capture household income losses due to soil degradation. Faße et al. (2014) developed environmentally extended village SAMs for Tanzania to model the input–output relationships among households to examine the transactions of an entire village economy. These previous studies relating to SAM applications were constructed from household data, but they mainly used aggregated tables with few sectors. In contrast, studies applying graph theory and network analysis to input–output analysis include Defourny and Thorbecke (1984), Holub and Schnabl (1985), Olsen (1992), and DeBresson et al. (1996).[10] Defourny and Thorbecke (1984) introduced the concept of structural path analysis to decompose a SAM multiplier and found that path analysis is effective for decomposing the multiplier into an open loop and a closed loop. Their idea was to decompose a 'black box' inverse SAM or input–output table into a repercussion or transmission process of exogenous demand, but their paper was introductory rather than comprehensive. Holub and Schnabl (1985) introduced the concept of graph theory into the trading relations among industrial sectors. Thus, they introduced new terms to explain relations among sectors, e.g. velocity and radius. In addition, Olsen (1992) likened graph theory in qualitative IO analysis to analyses of currents and voltages in electrical engineering and to the use of network theory in the transportation field. DeBresson et al. (1996) introduced directed graphs to analogize clusters of innovative links among industries. The graphs revealed some patterns in linkages, e.g. cliques, technological complexes, and simple agglomerations. The authors summarized

[10] Hamasuna (1996) tells us that Czayka's earliest work on qualitative input-output analysis.

their analysis with a focus upon two innovative clusters around final demand goods and producer goods, so the graphical approach was used as a complementary tool.

The main purpose of these previous studies was to introduce qualitative analytical concepts using graph theory or network theory; so, they tended not to offer comprehensive analyses founded upon QIOT. In this paper, we convert a VIOT built with household survey data into a QIOT and then fully analyze interrelations among households. A main reason for using a QIOT is the data accuracy problem. When we conducted a household survey in the studied rural village in Laos to construct the VIOT, we investigated economic activities related to production and consumption over the previous year. But the data were not necessarily accurate because of the residents' difficulty remembering their activities retroactively. In fact, there was a gap in the balances of sales and purchases for each good in our survey data (Hongsakhone et al., 2017). To overcome this problem, we used qualitative data on the existence of trade and expressed the interdependency among households from the QIOT as an index. This type research has been useful to capture the reciprocity in a village because researchers often lack sufficient and accurate information and socio-economic statistics.

3.2 Household Survey in a targeted village

As we presented in the previous chapter, the targeted village was a small rural village called Phonxay in Ngoi district of Luang Prabang province, Lao PDR. As of 2016, there were 124 households in the village, which had 720 inhabitants. The average monthly per capita income was 197,365 Kip, which was above the Lao national poverty line for rural areas. The main household income was rice (45%), followed by non-timber forest products (25%), livestock (19%), and wages, salary and remittances (7%), respectively.

Our household surveys were conducted in March 2015, and March 2016 in this village, which is a typical disadvantaged village and community under the poverty line in an Asian country. The village was selected by local government in Luang Prabang province, Lao PDR, when we asked which village was the most challenged regarding economic development in the targeted district (see details presented in Chapter 2).

3.3 Converting the Household Survey to an IO framework

Each household primarily produces at least one of the following nine goods: rice, other crops, cattle/buffaloes, goats/pigs, ducks, chickens, bamboo shoots, broom grass, and NTFPs. Other

crops include corn, maize, chili pepper, eggplant, and cucumber, and the NTFPs include tree bark, rattan shoots, and herbal roots. In addition to these products, we established 'others' as a sector that includes goods such as durable goods (motor vehicles), fertilizer, food for livestock, and other household equipment. These items are typically imported goods from outside the village. As a result, our VIOT consists of nine plus one item from 124 households, and the matrix size is 1240×1240.

Our household survey data include information on the volume of products sold to or bought from other households, goods donated to or received from others, and basic information, such as family members, production activities, income, and expenditures. The exchange information corresponds to intermediate input and final demand in the VIOT. Note, however, that the total number of transactions between households does not include information on how many products were used as intermediate inputs and how many were consumed as final goods. Therefore, we calculated a consumption ratio using the initial survey data for each household. Based on this ratio, the transactions between households under each category are allocated into intermediate inputs and consumption.

Final demand consists primarily of consumption, investment, and outflows/exports, but we added one more column called 'giving in kind' to relatives, friends and others. Of the categories of the final demand, investment is the inventory/stock of each household. Outflows/exports are the values of sales for each household to people outside the village. 'Giving in kind' is getting of goods directly from one household to another. Inflows/imports are the values of purchases for each household from people outside the village, but this category is shown in the table as a row. This approach means that the VIOT is an Izard-type or non-competitive import type, which is similar to an international IOT because inflows/imports are excluded from domestic transaction when creating the VIOT. In the value-added area, wages and salary are the compensation paid to other households to produce each good, which means that these are payments or costs, not received money. On the other hand, surplus is a household's earnings for each good, including earnings from labor for other households to help produce goods, which is not included in the other categories. This labor for other households sometimes contributes to production, and it can be considered a type of earnings/surplus for each household. Therefore, in our table, labor is included in the surplus row as income additional to the surplus from producing each good.

In addition, loans and remittances/gifts are also included in the value-added area in the table.

Information about monetary transfers from outside the village is usually not included in an input-output table because they are not production activities or value-added activities. Still, we added the information to the table to understand the amount of monetary inflows for each household. Finally, we included an adjustment row in the value-added area to balance the table.

3.4 An Example of Village IOT (VIOT) and Qualitative VIOT (QVIOT)

Table 12 which is recalled from Chapter 2, provides a completed outline of the VIOT for Phonxay village with 1240 sectors. Each household is assumed to be able to produce 10 products, as mentioned above. Transactions among households are allocated to intermediate inputs and consumptions according to the consumption ratio of each household. We showed how a VIOT is constructed from household survey data in details in Chapter 2, but the result of the induced multiplier was 1.767. This level of multiplier is not extraordinarily high, [11] so that village economy depends somewhat on transactions from outside the village, e.g. the degree of interdependency within the village is not very high. Therefore, the repercussion effects (ripple effects) or induced outputs through engaging in projects such as agricultural improvements in the village would be small.

Nevertheless, transaction amounts recorded in this table might not necessarily indicate the strength of the relationships among households because most households in the village are under the national poverty line. The transactions of the four households whose income is far above the national poverty line tend to be larger than the transactions of the other households. Therefore, (direct and indirect) transaction numbers among households rather than transaction amounts might be a better indicator to measure their interdependency, particularly for the lower-income households. We measure the interdependency by transforming the transaction matrix table of the VIOT into a transaction path (number) matrix table (see Table 13).

The simplest way to do this is via a QVIOT,[12] which is an application of graph theory or

[11] For example, the multiplier of Japan's IOT with 190 sectors is 2.00 in 2011 and 1.99 in 2005, which are both higher than that of the Phonxay VIOT. In general, a national IOT tends to have a higher multiplier than its regional counterparts because subregions tend to depend more on outside areas for trade, e.g. their commodity in-and outflows. For example, the multiplier of the Hiroshima IOT (2005) with 108 sectors is 1.40, and that of the Shizuoka IOT (2000) with 188 sectors is 1.30, both of which are lower than that of the Phonxay VIOT.

[12] For more information about the qualitative input-output method, see Holub and Schnabl (1985) and Defourny and Thorbecke (1984). The application to economic analysis and the interpretations of this method are shown in Ichihashi (1995, 2004, 2007).

network theory in mathematics.[13] A brief outline of a QVIOT is shown in Figure 4, and table X shows the original transactions in three sectors. The numerical value of each element represents the intermediate inputs in the input-output table. If this value is greater than zero, it is replaced with 1; otherwise, it is replaced with 0. Such replacing in all cells leads to table **Q**. The value of 1 in the table means that a transaction (length 1) exists between two sectors. Additionally, exponentiating **Q** means that if a transaction is repeated under the same input-output structure, it shows how many transactions (of length 2) occur directly and indirectly among sectors. The total value of the table shows the number of transactions in each sector.

This exponentiating matrix includes some transaction chains as elements. For example, in the 3-by-3 matrix $\mathbf{Q^2}$, an element in the first row and the second column is as follows: the element x^2_{12} represents a trade between sector 1(producer) and sector 2 (purchaser), which means a trade of length 2. The element includes all patterns of trade from sector 1 to sector 2. More specifically, the elements are sales from sector 1 to sector 2 via a trade within sector 1, sales within sector 2 via a trade from sector 1 to sector 2, and sales from sector 3 to sector 2 via a trade from sector 1 to sector 3. In this case, because a trade of length 2 consists of three terms, the value of $\mathbf{Q^2}$ is 3 if there exists a trade in all paths; otherwise, $\mathbf{Q^2}$ is 0. Therefore, the value of the exponentiating matrix represents the total amount of (direct and indirect) trade between two sectors. This is a simple and convenient method to determine the relations between the two sectors, although this matrix does not show the actual volume of trade.

In Figure 4, there are no transactions between sector 1 (row 1) and sector 3 (column 3), sector 2 (row 2) and sector 1 (column 1), and sector 3 (row 3) and sector 2 (column 2) in the initial step (Q). however, we can see that transactions between these sectors do occur in the second step ($\mathbf{Q^2}$), which means that the repercussions of transactions in other sectors indirectly link to transactions in these sectors; the number of transactions is counted in later steps. This method emphasizes a relationship between sectors by replacing the input coefficient with binary data. It clearly shows that interdependency can accumulate through repeated transactions.

[13] Our method is an application of directed graph and network theories from Clark and Holton (1991, Chapters 1 and 7), see also Miller and Blair (2009, Chapter 14).

Table 12. Sample VIOT: Intermediate Transaction Matrix Table (Recalled from Ch. 2)

		Intermediate Demand											Final Demand							Total output
Purchases[2] \ Sales[1]		HH 01					…	HH 124					HH 01			…	HH 124			
		Rice	Crops	…	NTFPs	Others	…	Rice	Crops	…	NTFPs	Others	CONS.	INV.	EXP.	…	CONS.	INV.	EXP.	
HH 01	Rice	1350	0	…	0	0	…	5	0	…	0	0	1150	100	0	…	1095	0	0	6150
	Crops	0	75	…	0	0	…	0	0	…	0	0	215	20	28	…	0	0	0	513
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	NTFPs	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	250	0	0	450
	Others	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	0	0	0	0
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	0	0	0	
HH 124	Rice	279	0	…	0	0	…	266260	0	…	0	0	921	0	0	…	3000	500	280500	651635
	Crops	0	0	…	0	0	…	0	824	…	0	0	0	0	0	…	3716	150	3080	13895
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	NTFPs	0	0	…	0	0	…	0	0	…	57400	0	0	0	0	…	0	0	61100	118675
	Others	0	0	…	0	0	…	0	0	…	0	0	0	0	0	…	0	0	0	0
VA	Import	0	250	…	0	0	…	128260	1350	…	11190	0	4400	0	0		52250	198900	0	1673380
	Wages	0	150	…	0	200	…	7100	4660	…	1250	5420	0	0	0	0	0	0	0	98180
	Loans	0	0	…	0	1100	…	0	0	…	0	0	0	0	0	0	0	0	0	173030
	Remittance	0	0	…	0	150	…	0	0	…	0	0	0	0	0	0	0	0	0	33500
	Surplus	4242	29	…	450	-200	…	249429	6239	…	48835	-5420	0	0	0	0	0	0	0	3416648
	Adjustment	0	0	…	0	-1250	…	0	0	…	0	0	0	0	0	0	0	0	0	-304710
Total		6150	513	…	450	0	…	651635	13895	…	118675	0	7701	120	28		292601	453125	622130	11227853

Note: [1] Sales to other households along the top of the table from HH 1 to HH 124 in each row at the left of the table. [2] Purchases from other households at the left of the table by HH 1 to HH 124 in each column.

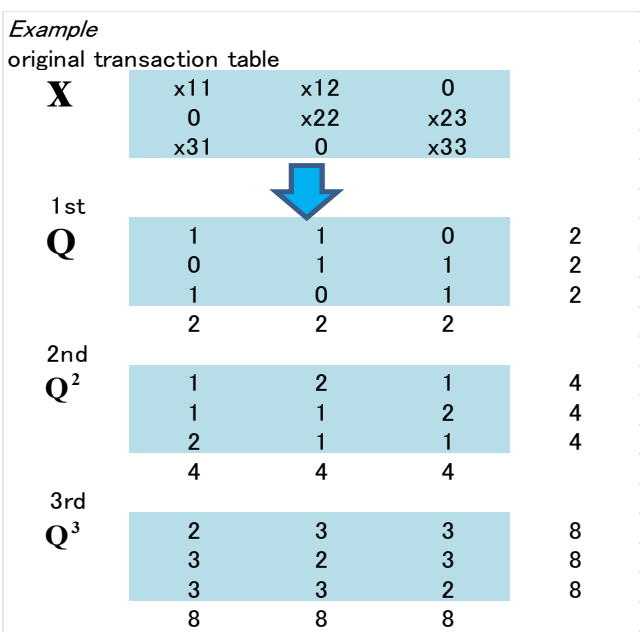
These steps are shown in the network flowchart of Figure 5, which is a visual image of Figure 4. In this figure, each node represents each sector. A downward-pointing arrow from the upper sector to the lower sector indicates inputs from upper sector to the lower sector, and the same arrow indicates outputs from the lower sector to the upper sector. For example, sector 3 inputs to sector 2 initially appear in this figure in the first step, and this results in inputs from sector 2 to sector 1, thereby linking sector 3 to sector 1.

Table 13. Sample QVIOT: Intermediate Transaction Path Matrix Table.

		Intermediate Demand																				
		HH 1										…	HH 124									
		Rice	Crops	Cattle	Goats	Duck	Chicken	Bamboo	Broom	NTFPs	Others	…	Rice	Crops	Cattle	Goats	Duck	Chicken	Bamboo	Broom	NTFPs	Others
HH 1	Rice	1	0	0	0	0	0	0	0	0	0	…	1	0	0	0	0	0	0	0	0	0
	Crops	0	1	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Cattle	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Goats	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Duck	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Chicken	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Bamboo	0	0	0	0	0	0	1	0	0	0	…	0	0	0	0	0	0	1	0	0	0
	Broom	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	NTFPs	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
	Others	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0
…	…	…	…	….	…	…	…	…	…	…	..	…	…	…	…	…	…	…	…	…	..	…
HH 124	Rice	1	0	0	0	0	0	0	0	0	0	…	1	0	0	0	0	0	0	0	0	0
	Crops	0	0	0	0	0	0	0	0	0	0	…	0	1	0	0	0	0	0	0	0	0
	Cattle	0	0	0	0	0	0	0	0	0	0	…	0	0	1	0	0	0	0	0	0	0
	Goats	0	0	0	0	0	0	0	0	0	0	…	0	0	0	1	0	0	0	0	0	0
	Duck	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	1	0	0	0	0	0
	Chicken	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	1	0	0	0	0
	Bamboo	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	1	0	0	0
	Broom	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	1	0	0
	NTFPs	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	1	0
	Others	0	0	0	0	0	0	0	0	0	0	…	0	0	0	0	0	0	0	0	0	0

Note: Obtained from the Intermediate Transaction Matrix Table of VIOT, 2017.

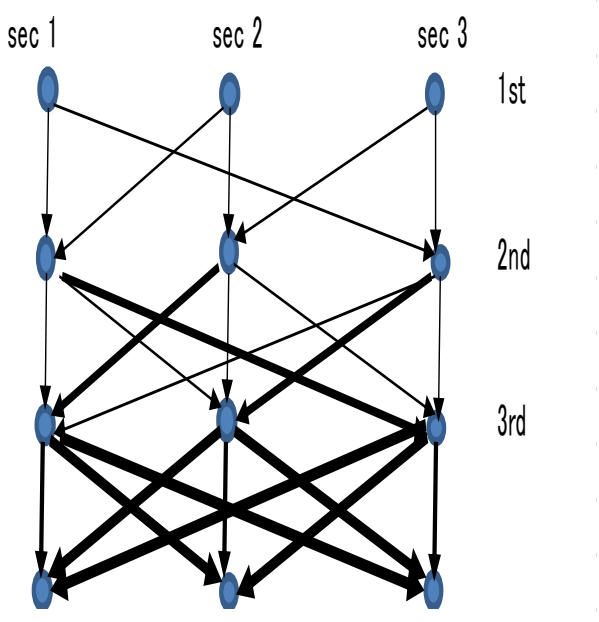
Figure 4. Sample of converting from usual IO table to qualitative IO table.



The inputs in the self-sector indicate direct and indirect transaction numbers of inputs of certain

goods by themselves that are used to produce the same good. In the example above, an input from sector 1 to sector 1 represents not only a direct transaction by itself but also an indirect transaction through another transaction from sector 1 to sector 2 in the second step, which results in 2 for the influence of a transaction from sector 2 to sector 1.

Figure 5. Network flow of qualitative IO.



The above result is derived from the following simple calculation. Our basic model is a typical input-output model: $X = AX + F$, where X is total output vector, A is the input coefficient matrix,[14] and if F is the final demand vector (excluding import information). We assume that the matrix and vectors separately treat the import vector as in an Isard-type input-output model or the non-competitive import model.[15]

From this formula, we can obtain the Leontief inverse: $X = [I-A]^{-1} F$. The Leontief inverse then can be decomposed by power series approximation as follows:

[14] For the simplicity of our explanation, we use a simple matrix **A** here. This matrix can be easily transformed into the matrix reflected self-sufficient rates, but our explanation remains the same. Also, **A** can be replaced with the allocation coefficient matrix of the Ghosh model, but for our purposes, the traditional Leontief model is suitable. See Leontief (1986) for the classical input-output model and see Dietzenbacher (1997) for interpretations of the Ghosh model.

[15] Even if we assume a competitive import model, the result holds.

$$\mathbf{L} = [\mathbf{I}-\mathbf{A}]^{-1} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \ldots\ldots\ldots \quad (5)$$

Here, **L** is the Leontief inverse matrix and **I** is the identity matrix of the same dimensions. The Leontief inverse can be expressed as a cumulative result of the process of exponentiating **A** from the 0^{th} to infinity. This is a summation of the infinitive geometric series of matrix **A**. $\mathbf{A}^0$ or I is the unit matrix and $\mathbf{A}^1$ is the input coefficient matrix.

Replacing the A matrices in Equation (5) with matrix Qs yields the qualitative IO matrix:

$$\mathbf{I} + \mathbf{Q}^1 + \mathbf{Q}^2 + \mathbf{Q}^3 + \ldots\ldots = \mathbf{S} \quad (6)$$

Q is a binary data matrix, which shows that existing trade between two sectors is expressed as 1. Matrix **S** is a summation of the number of trades between each sectoral pair, which include direct and indirect transaction paths. This indicator (S) is used to indicate the degree of interdependency among sectors. Each term from **Q** to $\mathbf{Q}^n$ represents each step from 1 to *n*. In fact, we cannot calculate this value until infinitive step because matrix **S** diverges as the process advances, which occurs because the coefficients in matrix **A** are repeated with 1 or 0 in matrix **Q**. We will show, however, to find their interdependency among sectors, the cumulative results from a smaller set of terms in the power series (3 or 4) is enough.

3.5 Results of QVIOT analysis

The results from Equation (6) through the third step applied to the Phonxay VIOT are shown in Table 14 and 15. The tables show the cumulative number of transaction paths in the village up to third round. We can certainly calculate this number for three more rounds; however, from the perspective of empirical research, cumulative numbers of transactions up to the third round are sufficient to summarize the transactions in the system because a summation of the exponentiating input coefficient matrix is known to rapidly converge to the Leontief inverse in several steps.[16] The power series approximation using Q^n to the Leontief inverse VIOT for

[16] See Miller and Blair (2009, Chapter 2, 7, and 14) for power series approximation. In general, the summation of the power series estimation of the Leontief by exponentiating matrix A up to the third round yields a result that is sufficiently close approximation to the Leontief inverse, that is it provides results that are 90% of all values. For example, the result of this calculation using Japan's (2000) input-output table with 37 sectors converged to within 95% of all values in the Leontief inverse by the third round, and the calculation of the Asian (2000) input-output table with 70 sectors yielded values within 94% of those in the Leontief inverse by the third round (Ichihashi, 2007).

Phonxay village was within 80% by the third round, but terms through the eighth round were needed to get within 90%. Still, to simplify the calculation, we used the results up through just the third round.

Table 14 provides a summary of the cumulative number of transactions by goods, including the total number of transactions for each good. The numbers in the table can be interpreted as the strength of the interdependency between households. There are many transactions involving rice in the village, at more than 538,700, followed by transactions involving other crops and bamboo. In contrast, the fewest transactions are for brooms; they are not shown here, but there were only 51 across the village. Thus, transactions of relatively inexpensive goods other than brooms are frequent in the village.

Table 14. Results of cumulative transaction paths and amounts of products by goods.

	Rice	**Crops**	**Bamboo shoots**	**Chicken**	**Duck**
Cumulative transaction paths	538,711	25,292	20,983	7,042	1,527
Amounts (Unit: 1,000 Kip)	2,572,221	142,442	184,974	185,870	70,974
	Goat/pigs	**Cattles**	**NTFPs**	**Broom grass**	
Cumulative transaction paths	1,488	221	147	51	
Amounts (Unit: 1,000 Kip)	556,295	1,322,960	289,340	812,750	

Note: Here, 1,000 Kip is around 0.125 US dollar (1 US dollar is around 8000 Kip). This calculation is from the qualitative village input-output table.

The resulting number of transactions does not necessary correspond to the amount of production of each good in the bottom row in the table. Rice production and transactions are the most common, the second highest production category is cattle, and the third is brooms. These three goods appear to be the main goods in the village, but they do not necessarily correspond to transactions *within* the village. Those transactions within the village mainly relate to food, and among these transactions, relatively inexpensive foods in addition to the staple food (rice) are frequently traded. Thus, there are few broom transactions within the village because brooms are a nonfood product. In addition, transactions involving expensive food (e.g. cattle) are extremely rare, while transactions involving inexpensive foods (e.g. bamboo and other crops) are more common. Chicken, a relatively expensive domestic animal but less expensive than other domestic animals, is also frequently traded. These results indicate that independent of the production amount in the village, mainly inexpensive food products are traded.

The fact that the transactions within the village are not proportional to production in the village means that expensive food, cattle, and nonfood items, like brooms, are sold to agents outside of the village as the primary products, while staple foods such as rice are traded both inside and outside of the village. Theoretically, these transaction results partially relate to intermediate goods, not consumption goods; and consequently, the results of the transactions of relatively inexpensive foods might include both intermediate goods and consumption. Unfortunately, there is no method that can strictly distinguish intermediate demand from final demand.

Interestingly, other features appear from an examination of the transactions involving each good. Table 15 shows the top 20 transactions, including six goods with more than 1000 cumulative transactions. Column 2 of the table shows the household IDs of sellers, and column3 shows the household IDs of buyers. Column4 shows the total number of transactions from a seller to a buyer. The values in the table are calculated using the third step. The data in the table are origin–destination (OD) data, which are often used in social network analysis and transportation economics. The data in the matrix formed from the input–output table can be developed for social network analysis or OD analysis. For example, see Ichihashi et al. (1995).

Table 15. Results of selected top 20 transaction paths by goods.

	Seller	Purchaser	Rice		Seller	Purchaser	Other crops		Seller		Purchaser	Bamboo
1	124	122	531	1	122	116	52	1	124	124		38
2	122	122	522	2	124	116	49	2	121	122		33
3	123	122	478	3	124	123	42	3	121	124		32
4	124	124	476	4	122	19	39	4	124	122		30
5	122	124	465	5	124	19	39	5	52	124		28
6	124	121	454	6	122	124	39	6	121	26		27
7	122	121	446	7	122	122	38	7	121	121		27
8	118	122	445	8	122	44	37	8	37	122		27
9	124	123	444	9	124	124	37	9	121	113		26
10	122	123	440	10	124	03	36	10	32	122		26
11	116	122	432	11	124	44	36	11	12	124		26
12	123	124	427	12	122	115	36	12	14	124		26
13	124	117	424	13	121	116	36	13	54	124		26
14	112	122	419	14	122	123	36	14	64	124		26
15	122	117	416	15	124	14	35	15	124	26		25
16	124	35	415	16	124	30	35	16	124	113		25
17	124	33	413	17	122	33	35	17	122	121		25
18	123	121	411	18	124	121	35	18	124	121		25
19	113	122	410	19	124	33	34	19	122	122		25
20	122	35	407	20	122	03	33	20	55	123		25
	Seller	Purchaser	Chicken		Seller	Purchaser	Duck	Seller		Purchaser	Goats	
1	112	124	35	1	122	14	17	1	124	124	24	
2	113	124	26	2	124	40	15	2	124	99	20	
3	121	124	24	3	122	91	12	3	124	96	19	
4	124	124	24	4	123	14	11	4	124	113	19	
5	112	42	23	5	124	16	11	5	124	122	19	
6	114	124	23	6	122	113	11	6	121	124	19	
7	119	124	23	7	116	117	11	7	123	124	19	
8	112	97	20	8	112	02	10	8	123	99	18	
9	116	124	19	9	113	14	10	9	124	121	17	
10	118	124	19	10	124	14	10	10	124	87	16	
11	113	108	18	11	114	16	10	11	124	109	16	
12	115	108	18	12	118	31	10	12	122	124	16	
13	116	40	17	13	124	113	10	13	124	72	15	
14	112	55	17	14	122	05	9	14	121	96	15	
15	112	108	17	15	116	16	9	15	123	96	15	
16	117	124	17	16	117	05	8	16	121	113	15	
17	121	37	16	17	112	06	8	17	123	113	15	
18	112	40	16	18	112	19	8	18	121	122	15	
19	112	50	16	19	112	30	8	19	123	122	15	
20	112	119	16	20	117	8	7	20	124	71	14	

Note: The second column is the household ID in seller side and the third is one in purchaser side. The fourth column shows total transaction number of products by multiplying QVIOT by third step.

Table 16 and 17 show the top 10 households with the most frequently sale and purchase transactions in the village. In Table 16, we find that the most frequently sale transactions in the village are the higher-income households and rich households who are trading products very frequently. For example, HH 124, HH 122, HH 123, HH 121, HH 118, HH 116, HH 113, HH 119, and HH 117 are considered as key suppliers in the village. For example, these households mostly are commonly engaged in rice, crops, chicken and bamboo transactions, respectively. More importantly, we see that, as previous findings, HH 124, HH 122, HH 123, HH 121, the

richest households, who are having frequent transactions with others, are playing key roles in transactions for sales and purchases of rice in the village. Whereas, table 18 indicates the top 10 households with the most purchase transactions are not only the four rich households (HH 122, HH 124, HH 121, and HH 123), but also some poorest households (HH 35, HH 33, HH 14, and HH 05) are involving rice transactions in the village.

Table 16. Top 10 households with the most frequently sales transactions in the village, 2016.

Product	**Seller ID in the QVIOT for Phonxay, 2016**									
	HH 124	HH 122	HH 123	HH 121	HH 118	HH 116	HH 112	HH 113	HH 119	HH 117
(1) Rice	40374	39525	36095	30867	8206	7076	5974	5410	4363	4145
(2) Crops	1425	1452	947	1110	881	395	771	407	639	524
(3) Cattles/buffaloes	15	23	17	17	9	3	3	3	15	17
(4) Goat/pigs	271	169	209	191	69	80	24	106	51	66
(5) Duck	130	128	51	103	71	101	120	91	83	80
(6) Chicken	476	297	209	464	300	446	628	514	422	343
(7) Bamboo shoots	445	380	142	456	31	105	103	136	173	173
(8) Broom Grass	3	3	3	3	3	0	3	3	3	3
(9) Other NTFPs	3	3	3	3	3	3	3	3	3	3
Total	**43142**	**41980**	**37676**	**33214**	**9573**	**8209**	**7629**	**6673**	**5752**	**5354**

Note: The last vector row shows total transaction numbers of products by multiplying QVIOT by third round. This calculation is from the qualitative village input-output table, July 30, 2018.

Table 17. Top 10 households with the most frequently purchase transactions in the village.

Product	**Buyer ID in the QVIOT for Phonxay, 2016**									
	HH 122	HH 124	HH 121	HH 123	HH 117	HH 120	HH 35	HH 33	HH 14	HH 05
(1) Rice	41931	37185	36985	35670	7361	6343	5907	5676	4635	4047
(2) Crops	570	630	654	677	92	367	210	555	611	388
(3) Cattles/buffaloes	3	27	3	3	3	9	0	0	0	0
(4) Goat/pigs	96	120	95	43	3	3	9	0	0	3
(5) Duck	25	29	3	34	43	38	3	41	83	59
(6) Chicken	38	354	3	98	12	140	3	132	132	120
(7) Bamboo shoots	1726	1765	1327	1214	113	247	522	13	24	529
(8) Broom Grass	3	3	3	3	3	0	0	0	0	0
(9) Other NTFPs	3	3	3	3	3	3	0	0	0	3
Total	**44395**	**40116**	**39076**	**37745**	**7633**	**7150**	**6654**	**6417**	**5485**	**5149**

Note: The last vector row shows total transaction numbers of products by multiplying QVIOT by third round. This calculation is from the qualitative village input-output table, July 30, 2018.

Table 18 and 19 show the worst 10 households with few or no transactions for sales and purchases of products in the village. In Table 18, we find that the worst 10 households with few or no transactions with others are HH 102, HH 104, HH 87, HH 82, HH 73, HH 79, HH 69, HH 97, and HH 89, respectively. These middle-income households are considered as isolated households in the village transactions. They are also designated as middle-income households, who are having few product transactions, except rice sales in the village. This means that, without having frequently sales transactions with others, they are likely to be self-sufficient in any products and overcome their poverty incidence in the village. Whereas, in Table 20, we find similar behaviors of households in product transactions, except rice transactions with others in the village. These households (e.g. HH 60, HH 84, HH 79, HH 85, HH 91, HH 69, HH 98, HH 77, and HH 51), are in the poor groups, and are considered as isolated buyers, who are making few purchases of goods and services in the village.

Table 18. The worst 10 households with few sale transactions in the village, 2016.

Product	**Seller ID in QVIOT for Phonxay, 2016**									
	HH 102	HH 104	HH 87	HH 82	HH 73	HH 79	HH 69	HH 76	HH 97	HH 89
(1) Rice	1756	1758	1855	1753	1752	1855	1758	1758	1778	2074
(2) Crops	20	86	40	8	3	3	133	146	113	3
(3) Cattles/buffaloes	0	0	3	0	0	3	3	3	3	0
(4) Goat/pigs	3	3	3	3	0	3	3	3	3	3
(5) Duck	3	0	0	0	28	0	3	0	3	0
(6) Chicken	3	3	3	160	9	3	3	9	160	3
(7) Bamboo shoots	5	90	37	86	234	164	129	215	91	175
(8) Broom Grass	0	0	0	0	0	0	0	0	0	0
(9) Other NTFPs	0	0	0	0	0	0	3	0	0	0
Total	**1790**	**1940**	**1941**	**2010**	**2026**	**2031**	**2035**	**2134**	**2151**	**2258**

Note: The last vector row shows total transaction numbers of products by multiplying QVIOT by third round. The calculation is from the qualitative village input-output table, July 30, 2018.

Table 19. The worst 10 households with few purchase transactions in the village, 2016.

Product	**Buyer ID in QVIOT for Phonxay, 2016**									
	HH 60	HH 84	HH 79	HH 92	HH 85	HH 91	HH 69	HH 98	HH 77	HH 51
(1) Rice	3	993	1093	1113	1093	1418	861	1543	1093	1826
(2) Crops	69	22	3	3	369	15	131	76	186	3
(3) Cattles/buffaloes	9	3	3	0	0	0	3	3	0	3
(4) Goat/pigs	3	3	3	3	3	3	3	3	3	0
(5) Duck	9	3	0	3	0	64	3	15	3	0
(6) Chicken	3	83	16	143	3	31	3	51	3	3
(7) Bamboo shoots	18	0	6	3	0	3	672	3	523	0
(8) Broom Grass	0	0	0	0	0	0	0	0	0	0
(9) Other NTFPs	3	0	0	3	0	0	3	0	3	0
Total	**117**	**1107**	**1124**	**1271**	**1468**	**1534**	**1679**	**1694**	**1814**	**1835**

Note: The last vector row shows total transaction numbers of products by multiplying QVIOT by third round. The calculation is from the qualitative village input-output table, July 30, 2018.

3.6 Concluding Remarks

The following conclusions can be drawn from the main results of QVIOT analysis:

(1) Interdependency among households tends to be stronger in transactions among higher-income households, namely, the four families from HH121 to HH124.

(2) Particularly for rice transactions, the degree of interdependency among high-income households is strong. Households that strengthen their interdependency through indirect and transactions involving rice are more likely to be high-income households rather than low-income households.

(3) Lower and middle-income households and high-income households depend on transactions involving other foods, such as other crops and bamboo in the village transactions. The main suppliers of other crop transactions are high-income households, while many lower/middle-income households are purchasers. In bamboo transactions, lower/middle-income households are both sellers and buyers. But many lower/middle-income households are also suppliers, which may indicate that lower/middle-income households sell bamboo to buy other crops within the village.

(4) Transactions involving relatively expensive goods, such as duck and chicken, seem to be more common among lower/middle-income households and higher-income households. In these transactions involving domestic animals, a common feature is that the main suppliers are almost always high-income households, while many lower and middle-income households are on the demand side. Particularly in the case of duck transactions, many buyers are lower-income households, although the number of transactions is not substantial. Based on this result and that in (3) above, lower and middle-income households tend to buy expensive goods within the village, not from outside of it.

(5) Overall, the interdependency among the four richest households in the village through direct and indirect transactions is very strong, while there are few transactions among lower-income households. Transactions involving relatively expensive goods occur frequently between higher-income and lower/middle-income households. This result means that lower-income households in the village do not necessarily rely on the same level of income as other households to cooperate with other when trading their products.

These results indicate that transactions involving relatively inexpensive goods (e.g. rice and bamboo) mainly generate strong interdependency among the four higher-income families, while the degree of interdependency among lower-income households is weak. Transactions involving relatively expensive goods (e.g. duck and chicken) occur frequently between higher-income households and lower/middle-income households. In addition, we can surmise that the four higher-income households who work as traders in the village obtain substantial profits from the price gap between the village price and the market price. It is difficult to estimate exactly how much profit these four households gain after considering transportation costs and saving costs for goods, but the different interdependency among and the role of the four households and other households in the village could be the prime structural cause of the sizeable income gap in this village.

CHAPTER 4
INVESTIGATING INFLUENCE OF REMITTANCES ON TRANSACTIONS

4.1 Introduction

Labor migration and remittances have grown increasingly more important in the global economy and especially, in developing countries, including Lao PDR. Remittances, money sent to family members, relatives or friends within the rural villages, are an important source of incomes. Previous empirical work on remittances reveals that it can solve expenditures of households in various ways, depending on how these money transfers are used and considered by their family members. In the developing world, remittances make a direct contribution to increasing income of the families left behind, and as such they contribute to easing budget constraints of the poorest, reducing poverty and improving average living conditions (Acosta, Calderon, Fajnzylber, & Lopez, 2008). A pessimistic view argues that remittances may leave investment decisions unchanged if they are spent on status-oriented, conspicuous consumption, and as such they may have little impact on local economies (Démurger, S & Wang, X, 2016). A more optimistic view argues that remittances are a transitory source of income for families left behind, and are therefore invested, at the margin, rather than consumed. In that case, remittances may foster investment in human and physical capital at home (Adams, 1998).

The information obtained from our VIOT is useful, it is showing not only the flows of major goods and services among households in the village but also providing us with a rich data on money transfers as remittances from relatives and family members outside the village. Remittances maybe used and spent on consumer goods and services as well as spent on intermediate inputs and intermediate demand because households who received remittances are not only producers but also consumers, who are also trading these products with others in the village. In this study, we assume that households with remittances can facilitate their transactions in the village. Moreover, we also assume that geographical locations and distances of households affect the transactions among rich households and others in the village. However, no empirical studies and evidences that examine the impact of remittances on transactions among households using data from VIOT. Therefore, it is interesting to explore ways to maximize the impact that remittances have on development at the village and community level. This chapter investigates the influence of remittances on transactions through the sales and

purchases of products among households in an isolated village in a developing country. In addition, we also examine how remittances as well as financial support from outside the village are used and spent for investment and consumption in receiving households in this village. To do this, we use trade data of individual household extracting from transaction tables of the village input-output table (VIOT)[17] built from our own household survey data 2015 and 2016, Additionally, we apply a propensity score matching (PSM) method to this uniquely constructed VIOT and estimate the average treatment effects on the treated (ATET). Although the amount of remittances may vary from one household to another, it should be treated as a continuous variable rather than a binary variable. This current treatment variable is whether household *i* (himself/herself) or *j* (partner) receives remittance. The impact of *i*'s own remittance receipt has a different impact of *j*'s receipt. However, this PSM approach can be justified only when there is virtually no variation in the amount of remittance receipt in each household in the village.

In general, several developing countries have seen remittances as an engine for local socio-economic development; because remittances can be allocated to purchase basic goods like food, healthcare expenses, and invest in human, social and physical and financial assets such as education, marriage, livestock, housing, equipment, farming activities. In fact, it is rare to capture monetary transactions of households when they buy input (e.g., seeds, fertilizer, pesticide, etc.) from neighboring farmers rather than from local agricultural supply shops. Therefore, investigating the influence of domestic remittances on mutual monetary transactions is our main research interest discussing in this paper.

Most empirical studies have pointed to the impact of remittances on household expenditure behavior and consumption in migrant-sending regions, these studies provide mixed evidence. Some find positive impact of remittances on investment goods including education, housing and health, income generating and farming activities and some find negative impact of remittances on poverty, inequality, food consumption and education. Acosta, P., et al (2008) reveal that remittances sent by migrants directly support an increasing income of households in rural areas, and these private transfers contribute to easing budget constraints of the poorest, reducing poverty and improving average living conditions in developing countries. S. Piras et

[17] This VIOT was made by HONGSAKHONE Soulixay and Ichihashi Masaru when conducting research on making a village input-output table from household survey data in 2017. This paper was presented in the 25th IIOA Conference at Atlantic city, New Jersey, USA, June 19-23, 2017.

al (2018) use the household budget survey for 2007-2013, and 2015 survey of a sample of 126 households to assess the impact of remittances on agricultural production practices and investment. They find that recipient households reduce their drudgery by substituting family labor and self-produced seeds and feed with mechanization services and purchased inputs, without increasing production efficiency. They also find that the relationship between remittances and agricultural investments is very weak or negative. Because most recipients do not invest in agriculture, minority that does invest has access to remittances.

Bui, T.T.N. et al. (2015) find that oversea remittances are associated with increased investment in education and has a future social return, especially those residing in urban areas, are more likely to channel funding towards productive business investment and capital gains in comparison those without remittances. Adams, R.H., & Cuecuecha, A. (2013) show that households receiving remittances spend more at the margin on three investment goods: education, housing and health. Similar findings have been reached on Guatemala (Adam & Cuecuecha, 2010), Mexico (Taylor & Mora, 2006; Amuedo-Dorantes & Pozo, 2011). Démurger, S., & Wang, X. (2016) use data from the rural-urban migration in China survey, assess the impact of remittances sent to rural households on consumption-type and investment-type expenditures and they find that remittances supplement income in rural China and lead to increased consumption rather than investment. Cristian., Î. & Maha., L.G. (2012) also find that remittances had a more significant contribution to household investment than consumption in Romania. Most remittance-use studies conclude that a large part of remittances is consumed instead of invested and thus is not put to productive use in migrant-sending areas (Taylor, E., & Mora, J. 2006).

Diego E. (2017) indicates that increases in remittances have a negative and statistically significant impact on overall poverty and inequality in Latin America. Remittances seem to have a stronger effect in countries receiving small amounts and in countries with a larger share of its population working abroad. Démurger, S., & Wang, X. (2016), Nguyen, D.L., et al (2017) find the evidence of a strong negative impact of remittances on education expenditure, which could be detrimental to sustaining investment in human capital in poor rural areas in China. Similarly, Acosta, P. *et al*. (2008) show that remittances have increased growth, and reduced inequality and poverty in Latin America. Jimenez-Soto, E. et al. (2012) find that remittances reduce the incidence of poverty by 31 percent and depth of poverty by 49 percent. The results

are robust both to alternative specifications of the PSM model and to use of an alternative counterfactual income estimation method.

Aggarwal, R. et al. (2011) show a positive, significant, and robust link between remittances and financial development in developing countries. Moreover, Coulibaly., D. (2015) finds that remittances positively influence financial development in only 4 countries (Niger, Senegal, Sierra Leone and Sudan). Christian, A & Cuecuecha., A. (2016) find positive and statistically significant effects of remittances on the ownership of saving accounts, the existence of debts, and on recent borrowing. Meyer., D. & Shera., A. (2016) suggest that remittances have a positive impact on growth and that this impact increases at higher levels of remittances relative to GDP. In contrast, Combes, J.L., & Ebeke, C. (2016) find that remittances significantly reduce household consumption instability. Feldman, A.L., & Chavez, E. (2016) find that remittances decrease the likelihood that a household will participate in natural resource extraction, households that receive remittances and extract natural resources have lower environmental income and lower environmental reliance that households not receiving remittances. Furthermore, Clément (2011) uses the 2003 Tajikistan Living Standards Measurement Survey data to assess the impact of remittances on household expenditure patterns in Tajikistan. He finds no evidence of any positive impact of remittances on investment expenditures.

However, there is no such clear evidence on how remittances are used and spent for transactions via the sales and purchases of goods in migrant-sending communities. The impact of remittances on transactions among households at the village level in developing countries is not empirically examined and found yet. Therefore, we need to understand how these remittances are playing a major role in mutual transactions in disadvantaged villages in the least developed countries like Lao PDR. While Lao PDR is one of the fastest economic growth in Asia-Pacific region in last decade. The economy of the Lao PDR continues to grow at average 7 percent annually. Migration and remittances are one of the driven of socio-economic development in Lao PDR over the last decade. People have been moving away from a subsistence lifestyle in rural areas and migrating to towns and urban cities. Although there is no official survey and exactly data on migration and how much internal remittances are flowing and spent on local economic transactions in rural Lao PDR. It is essential to maximize the impact that remittances have on rural household transactions, consumptions and investments.

Our own Household Surveys conducted in 2015 and 2016 in a village called *"Phonxay village"* in northern Luang Prabang province, Lao PDR provided us with rich data on money transfer as

remittances, transactions of major products among households who are not only producers, but also consumers of these locally produced products within the village. Therefore, our research attempts to investigate how much do remittances have impact on economic transactions at household level by estimating the average treatment effects of remittances on consumptions and investments in the corresponding village. Moreover, its impact on mutual transactions of intermediate inputs and intermediate demand as final products among households would be examined by using propensity score matching (PSM) method.

The rest of the paper is structured as follows. In Section 4.2 and 4.3, we describe the data from our own household survey and provide descriptive analysis. The previous empirical studies and strategy adopted in our cross-sectional analysis are presented in Section 4.4. Estimation results is in Section 4.5. Section 4.6 concludes the results and policy implication.

4.2. Data Summary and Descriptive Analysis

To understand circular flows of goods and services between households, we conducted the household survey 2015 and 2016 and gather detailed information on household transactions and its compositions within the village. The household surveys comprise all 124 households who are trading local products in the village. 55 out of total households does receive remittances, and 69 out of total households does not receive remittances. In order to capture the interdependency among households in the village through their transactions, we extract data on inter-household trade transactions from the transaction matrix table of the village input-output table (VIOT) built from our own household survey data, and then we make a transaction matrix table of 124 x 123 size[18], transacting from sellers to buyers, as a result, we obtain 15,252 pairs in total.

Our Household Surveys were carried with the cooperation between our team from Hiroshima University and local government officials from the Trade Office of Ngoi district of Luang Prabang province, Lao PDR. In our dataset, we treated both potential outcome and covariates variables as the origin-to-destination (OD) data, flowing from sellers to buyers in any product transactions such sales and purchases of major goods among households within the village. The data on transactions among households with remittances are treated as 6765 pairs (55 x 123 =

[18] This information on transactions among households used in this paper was extracted from the village input-output tables (VIOT). This VIOT was prepared and made by Hongsakhone & Ichihashi (2017).

6765), whereas the data on transactions among households without remittances are treated as 8487 pairs (69 x 123 = 8487). This data excludes transactions, sales to, and purchases from outside the village, respectively. As we are interested in only transactions among households and other expenditures such as consumptions and investments in households with remittances. We define that households with members working outside the village and reporting migration income are identified as households with remittances. In contrast, households with members not working and working outside the village, but do not report migration income are considered as households without remittances in this study.

In our analysis, remittances are used and spent for transactions of major products, consumptions, and investments, education and healthcare expenditures. Transactions among household *i* and *j* are total amounts of sales and purchases of locally produced products in the village such as rice, NTFPs, livestock, poultry, and crops. Consumptions in each household are total amounts of rice, NTFPs, livestock, poultry, and crops, respectively. Investments include household spending on accumulated stock of rice, NTFPs, livestock, poultry, crops, including farm inputs: fertilizer, equipment, tools, and motor vehicles.

Table 20 shows the example of our data preparation: it is an OD data, flowing from sellers to buyers in the village. This data, again, is in the matrix form 124 x 124 size, which is a pair data between sellers and buyers. As a result, only 15,252 (124 x 123) pairs of household transactions data will be used in this chapter. In this case, XX_{11}, XX_{22}, …. XX_{124124} are excluded from the estimation, because they are self-product transactions.

Table 20. An example of data preparation for transactions among households, 2016.

Seller ID	Buyer ID	Transactions among them	Remark
01	01	$X_{1\,1}$	Excluded
01	02	$X_{1\,2}$	Included
01	03	$X_{1\,3}$	Included
02	01	$X_{2\,1}$	Included
02	02	$X_{2\,2}$	Excluded
02	03	$X_{2\,3}$	Included
….	….	….	….
124	121	$X_{124\,121}$	Included
124	122	$X_{124\,122}$	Included
124	123	$X_{124\,123}$	Included
124	124	$X_{124\,124}$	Excluded

Note: $X_{1\,1}, X_{2\,2}, \ldots X_{124\,124}$ are excluded from the estimation in this chapter because they are transactions themselves in the village.

Table 21 presents the characteristics of households with remittances (WRs) and households without remittances (WORs) in the village. It shows the age of household head, sex, year of education, household size and land size owned by households in the corresponding village. The descriptive statistics show that WRs and WORs strongly differ in terms of many observable and unobservable characteristics. These characteristics might be correlated with the outcome variables. Households that receive remittances tend to be larger in term of education level of household head, and land size, while households that does not receive remittances tend to be larger in terms of age of household head, gender and household size, respectively.

Table 22 provides a comparison of the two groups in terms of per capita income, per capita production, per capita consumption and per capita investment, respectively. By comparing the mean difference of income, production, consumption and investment of households with remittances and households without remittances in the village, we find that they are totally different. For instance, there are significant differences in per capita income, production, consumption and investment among two groups, respectively. Furthermore, households with remittances, have higher income per capita, tend to spend more on productions, and investments in the village. Table 23 provides a comparison of the two groups in terms of consumptions. We find that the mean differences in product consumptions between households with remittances

and household without remittances are significant different. Households with remittances are likely to consume more than households without remittances. This indicates that receiving remittances are used and spent on consumer goods, mainly through rice, followed by health care expenditure, livestock, and other food items in the village, respectively.

Table 21. Summary statistics by remittance status-household characteristics, 2016.

Household characteristics	**WRs (1)**	**WORs (0)**	**Difference in means**	**T-test**
Age (28<age<81)	48.20 (12.35)	49.57 (12.44)	-1.379	0.615
Gender (female = 1, other = 0)	0.10 (0.31)	0.15 (0.36)	-0.050	0.805
Year of education (0< year <12)	6.12 (2.68)	5.49 (2.89)	0.634	1.253
Household size (4<member<12)	5.70 (1.69)	5.88 (1.52)	-0.174	0.602
Land size (0<area (Ha)<5)	1.26 (0.70)	1.25 (0.66)	0.012	-0.101
Observations	**55**	**69**		

Notes: Standard deviations in parentheses. WRs and WORs represent households with remittances, and households without remittances, respectively. The last two columns show the differences in means of all observed characteristics of households, and t-test. Age is age of the head of household; Sex is 1 if household head is a female and 0 if a male, Education is a number of schooling year of the head of household: if no formal education is 0, completed primary school is 5, completed secondary school is 8 and completed higher education is 12; Household size is number of family members in household; Land size is agricultural land areas owned by household (ha).

Source: Household Survey Data conducted by Authors, March 8-29, 2016.

Table 22. Summary statistics by per capita income, production, consumption and investment.

Household characteristics	**WRs (1)**	**WORs (0)**	**Difference in means**	**T-test**
1. Per capita income (Excl. remittances)	1223.980 (2691.570)	565.090 (398.830)	658.070**	2.005
2. Per capita production	2040.030 (4053.750)	794.230 (375.060)	1245.800**	2.541
3. Per capita consumption	1538.010 (833.380)	1208.990 (461.840)	329.020***	2.787
4. Per capita Investment	4236.320 (14290.670)	569.730 (383.480)	3666.590**	2.132
Observations	**55**	**69**		

Note: Standard deviations in parentheses. The last two columns show the significance level by t-test between households with remittances (WRs) and households without remittances (WORs). *** significant at 1%, ** significant at 5%, respectively. The amount of transactions shown here are expressed in Lao Kip (1.000 Kip).

Table 23. Summary statistics by remittance status- Consumptions, 2016.

Household Consumptions	WRs (1)	WORs (0)	Difference in means	T-test
1. Rice	2742.810 (1016.180)	2425.210 (771.830)	317.600**	1.977
2. NTFPs	77.810 (88.080)	57.760 (56.740)	20.057*	1.534
3. Livestock	462.720 (1382.770)	113.330 (249.470)	349.393**	2.053
4. Poultry	287.630 (281.870)	158.40 (200.760)	129.230***	2.978
5. Crops	653.700 (1055.750)	451.080 (450.950)	202.622*	1.439
6. Education expense	577.270 (410.94)	473.180 (343.910)	104.084*	1.535
7. Health expense	1635.450 (5383.860)	725.360 (387.730)	910.092*	1.401
Observations	**55**	**69**		

Note: Standard deviations in parentheses. The last two columns show the significance level by t-test between households with remittances (WRs) and households without remittances (WORs). *** significant at 1%, ** significant at 5%, and * significant at 10 %, respectively. The amount of transactions shown here are expressed in Lao Kip (1.000 Kip).

Table 24. Summary statistics by remittance status- Investments, 2016.

Household investments	WRs (1)	WORs (0)	Difference in means	T-test
1. Rice	11921.640 (46713.11)	144.560 (38.86)	11777.070***	2.096
2. NTFPs	5978.450 (23206.30)	141.950 (194.91)	5836.498***	2.091
3. Livestock	2181.810 (4991.06)	894.340 (1392.47)	1287.470**	2.047
4. Poultry	438.810 (458.38)	327.970 (273.10)	110.847**	1.671
5. Crops	30.450 (20.50)	29.780 (24.03)	0.671	0.164
6. Farm inputs	15004 (63907)	1576.950 (1059.37)	13427.040**	1.746
Observations	**55**	**69**		

Note: Standard deviations in parentheses. The last two columns show the significance level by t-test between households with remittances (WRs) and households without remittances (WORs). *** significant at 1%, and ** significant at 5%, respectively. The amount of transactions shown here are expressed in Lao Kip (1.000 Kip). Farm inputs include fertilizer, equipment, and motor vehicles.
Source: Household Survey Data conducted by Authors, March 8-29, 2016.

Table 25 provides a comparison of transactions for sales and purchases of products among two groups in the village. The table shows interesting features because the transactions among households who are receiving remittances tend to be higher than households without remittances in the village. For example, the average rice transaction, NTFPs, and livestock

transaction of WRs and WORs in the village were significantly different. Households with remittances are more likely to make purchases or sales transactions better than WORs. In addition, the analysis also finds that there are also strong significant differences in consumption and investment expenditures between WRs and WORs. This means that WRs have a higher spending capacity rather than WORs in rural Lao PDR. Moreover, these WORs have a lower income earnings capacity and per capita consumption level than WRs in this village. Accumulated (stock) products or cash savings of WORs are relatively low compared to the accumulated products of WRs. The raw statistics and data from our survey also provide strong evidence on the use of remittances by households in the village, and we find that remittances represent a large share of income for households who are frequently trading of these goods and services in the village. surprisingly, most households with remittances are non-poor group, which seem to spend a significantly higher share of their incomes on both transactions and consumptions, as well as spending more on family investments in tradable and accumulated products rather than households without remittances in the village.

Table 25. Summary statistics by remittance status- Transactions, 2016.

Transactions	**WRs (1)**	**WORs (0)**	**Difference in means**	**T-test**
1. Rice	68.010 (246.430)	19.930 (125.300)	48.079***	15.618
2. NTFPs	22.470 (105.110)	1.570 (13.320)	20.903***	18.137
3. Livestock	20.080 (294.150)	7.860 (104.280)	12.218***	3.556
4. Poultry	5.310 (31.720)	3.380 (23.720)	1.928***	4.293
5. Crops	3.520 (25.870)	2.490 (20.620)	1.027***	2.727
Observations	**6765**	**8487**		

Note: Standard deviations in parentheses. The last two columns show the significance level by t-test between households with remittances (WRs) and households without remittances (WORs). *** significant at 1%. The amount of transactions shown here are expressed in Lao Kip (1.000 Kip).

Source: Household Survey Data conducted by Authors, March 8-29, 2016.

4.3 Geographical Location of Households and Transactions in the village

Regarding village's geographical location, the village is approximately 50 Km, 70 Km, and 200 Km from the Laos-Vietnam border market, the Ngoi district, and the markets in the capital city of Luang Prabang province. The expected savings on transport costs and communication are

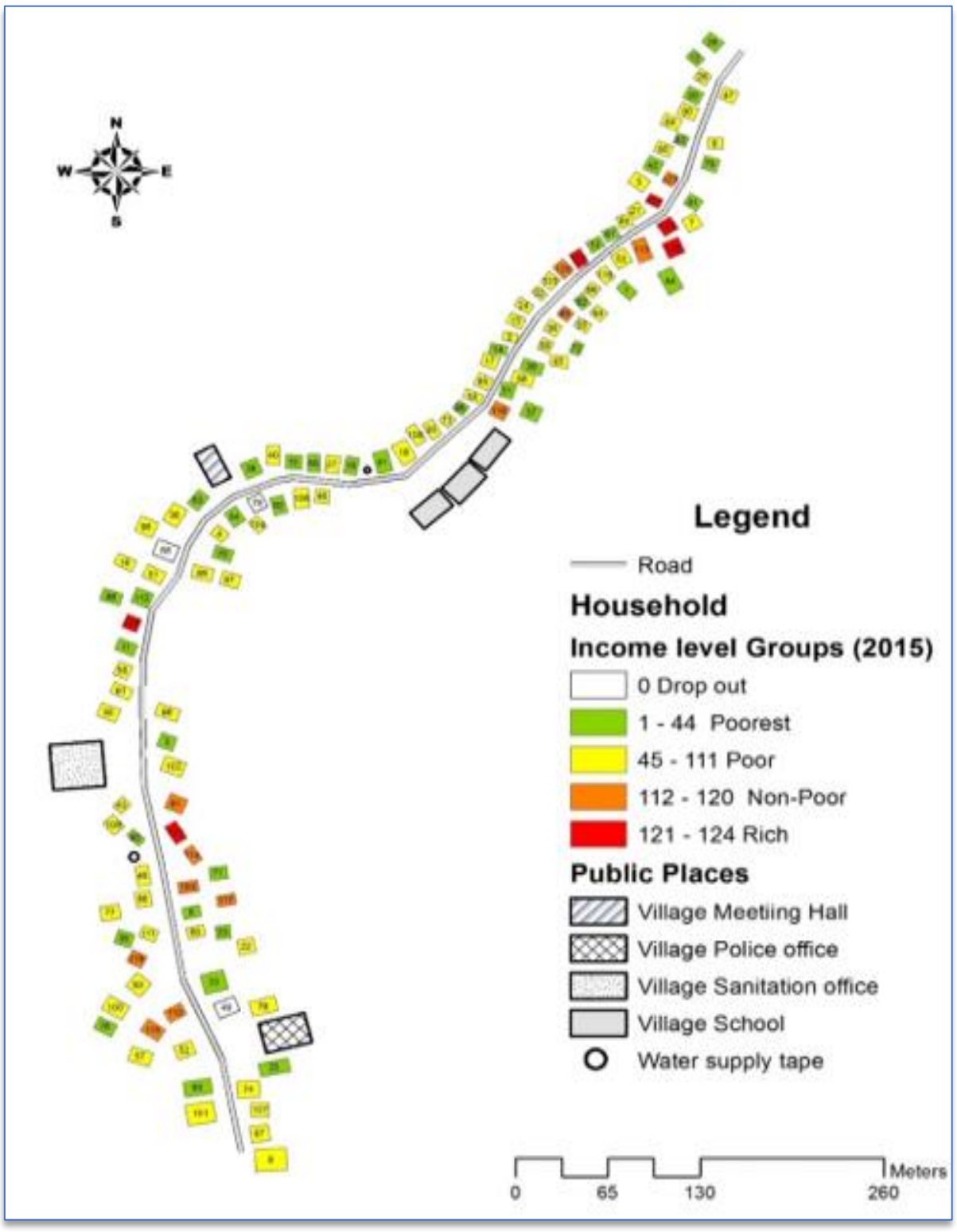
the main reason that most traders and producers tend to trade each other in the village market rather than trading outside the village market although the market prices outside the village are higher than village prices. Decentralized wholesale market might be a good option for villagers. Indeed, the key traders in the village have been in business long and established farming contracts with the buyers in the village market. Several informants mentioned that there are 4 main traders who dominate the village market. Since, in the village, there is an agricultural market, where transactions between key traders and buyers frequently occur.

This section focuses mainly on the economic transaction aspects of poor and rich households' interdependence in the village. Our main observation concerns the key position of the four rich (traders) households in the village distribution of goods and services, especially rice and bamboo products transactions in the village. Therefore, we want to know more whether the transactions between the four rich households, mainly HH 121, HH 122, HH 123, and HH 124 (key traders) and other poor and non-poor households (buyers) are affected by the geographical location of households in the village. By using data on inter-household transactions extracting from our VIOT and QVIOT in this research. Our focus here is on the sales and purchases of rice and bamboo net selling and buying households in the village.

To examine this hypothesis, we identify net sellers and buyers in the village. Figure 6 displays the locations of each household in the village. The households (HH) number 121, 122, 123, and 124 represent the rich households (net sellers) who have sales of products greater than the purchases of similar products, and a monthly income per capita of a million or more Kip per person, while HH number 112-120, 45-111, and HH number 1-44, indicate non-poor, poor, and poorest households, respectively. Most of these households are net buyers, who have purchases of products greater than sales of major products in the village. We then make a comparative distribution of rice and bamboo transactions between four key sellers and other buyers using the values of transactions for sales and purchases of rice and bamboo recorded in the VIOT and transaction numbers of rice and bamboo obtained from QVIOT by multiplying it up to third round. Finally, we compare how transactions between 4 rich households as net sellers and other households as net buyers in the village. Of course, for simplified the comparison of transactions, we selected only rice and bamboo transactions and whole distribution of rice and bamboo buyers and sellers will be shown and identified by the following figures because rice and bamboo production are the primary economic activity in the village.

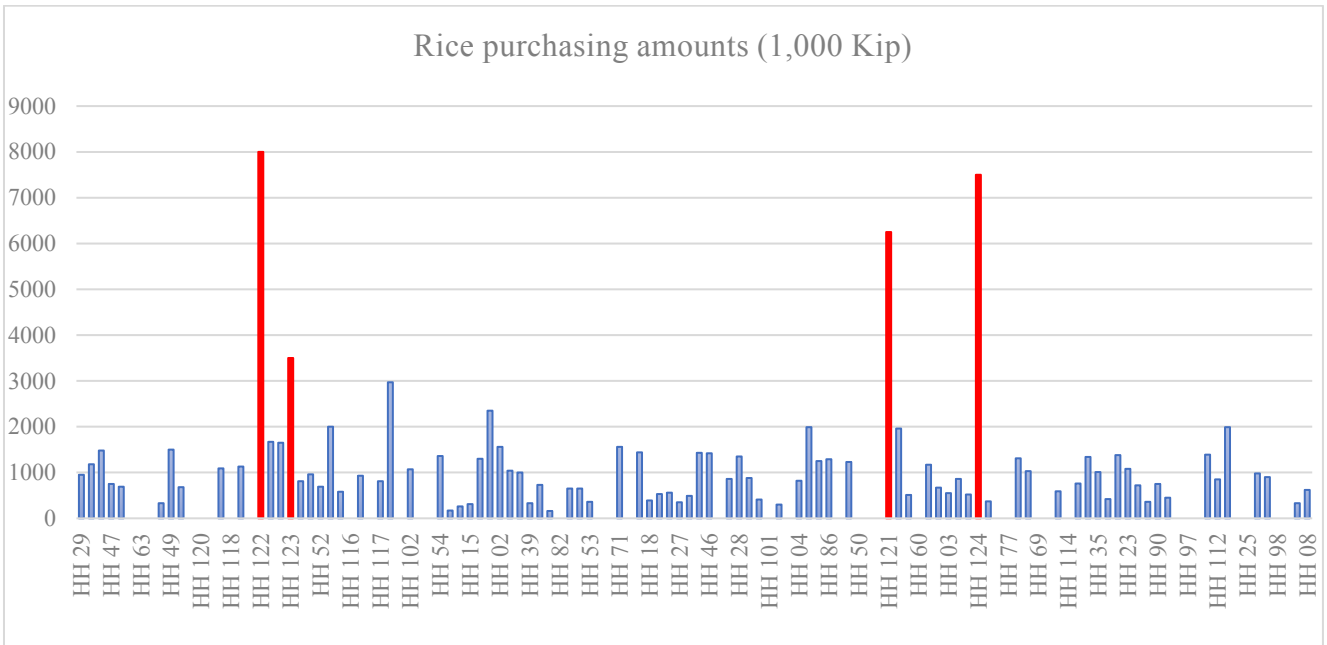
Our surveyed data show that most of the poor in the village are net rice (food) buyers, while the net rice sellers in the village are those who have higher incomes, especially the 4 rich households. Although the largest share of poor households is found to be net rice or food buyers, almost 90 percent of net buyers are marginal net rice buyers who would not be significantly affected by the geographical location of households in the village. Moreover, net sellers are relatively well to do households with larger farms, while net buyers are assumed to be poor laborers or small farmers. Figure 7, 8, 9, and 19 show the data descriptive results for rice and bamboo purchasing households from the four rich households, separately in the village, 2016. Overall, households are clearly located in and around major suppliers. More specifically, households with high values or frequency of transactions are surrounded by households with higher sales values or frequency of transactions in the village. For instance, the figures highlighted the rich four households or net sellers in the village, and their positions in the village. We also find the significant differences in rice purchasing amounts and rice purchasing frequency of households in the village. In terms of rice purchasing amounts, the rice transactions among four rich households are higher than that these four households and others. However, this transaction amount may not capture the strength degree of interdependency among them, because in terms of rice purchasing frequency, most of the net rice buying households are small farmers who frequently buy rice from these four rich households in the village. More specifically, HH 122 is the most frequent seller amongst four net rice sellers. However, both purchasing amounts and frequency is not affected by location; this furthers understanding of the impact the geographical location has on rural consumer behavior. This data descriptive results do not support our hypothesis; rice and bamboo purchasing do occur more frequently in poor households when compared to rich households. That the frequency of rice and bamboo purchasing is greater in the village.

Figure 6. Geographical Location of each Household by income level in the village.

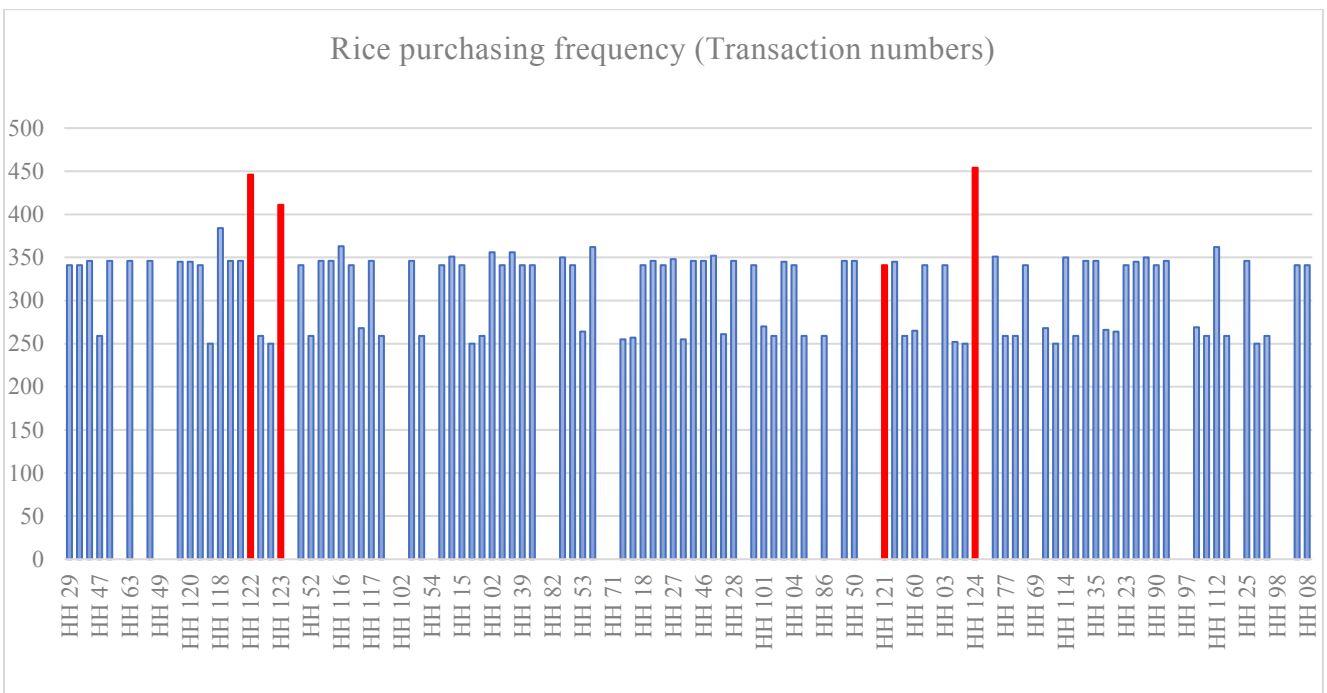


Source: The map is drawn from the Field survey, March 8, 2016.

Figure 7. Rice purchasing of others from HH 121 in the village, 2016

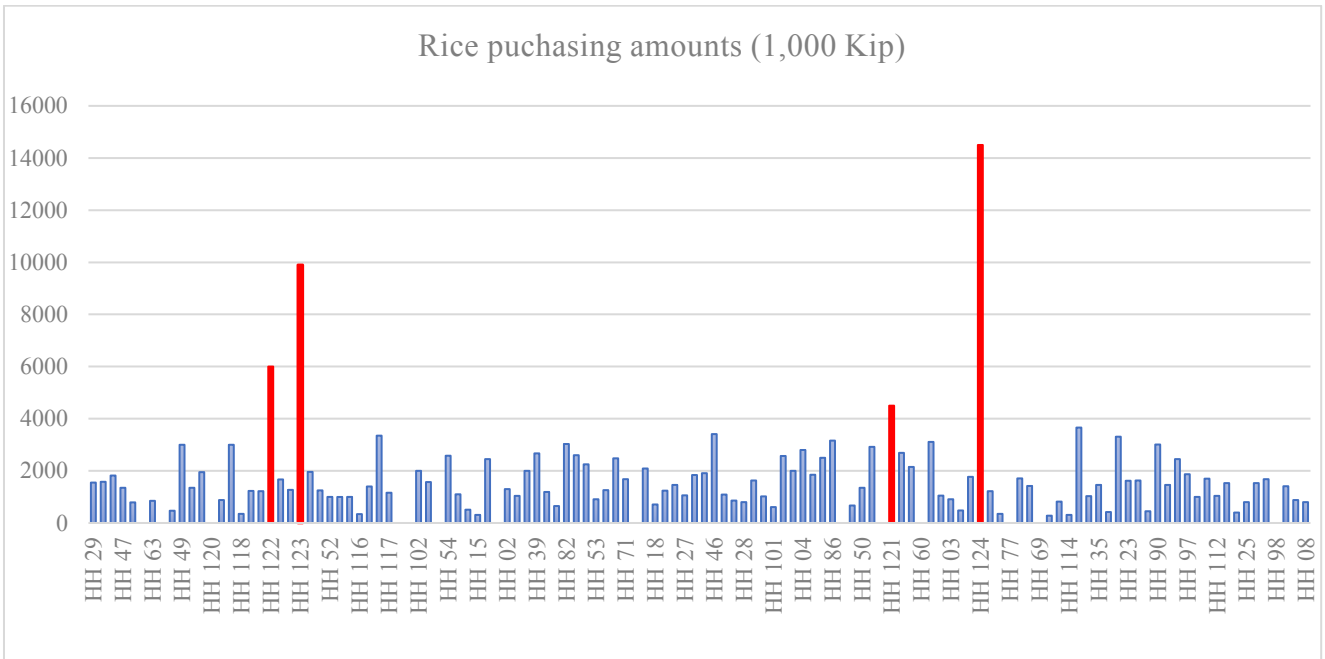


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

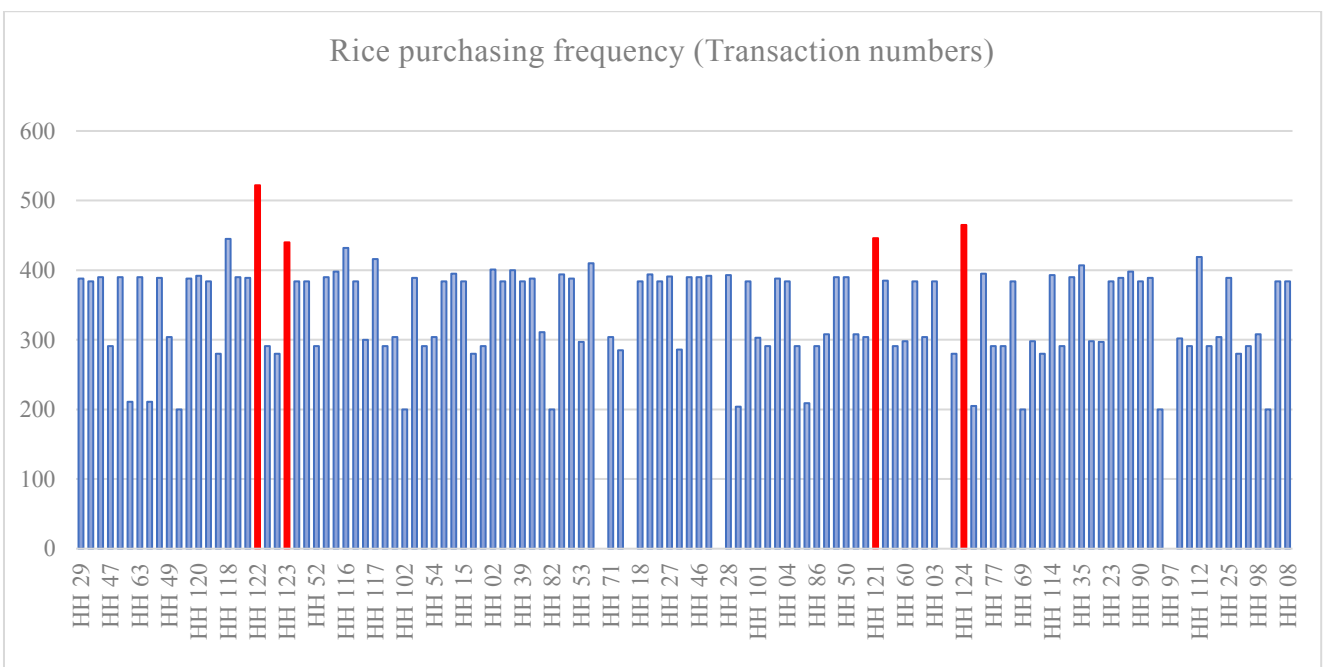


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 8. Rice purchasing of others from HH 122 in the village, 2016

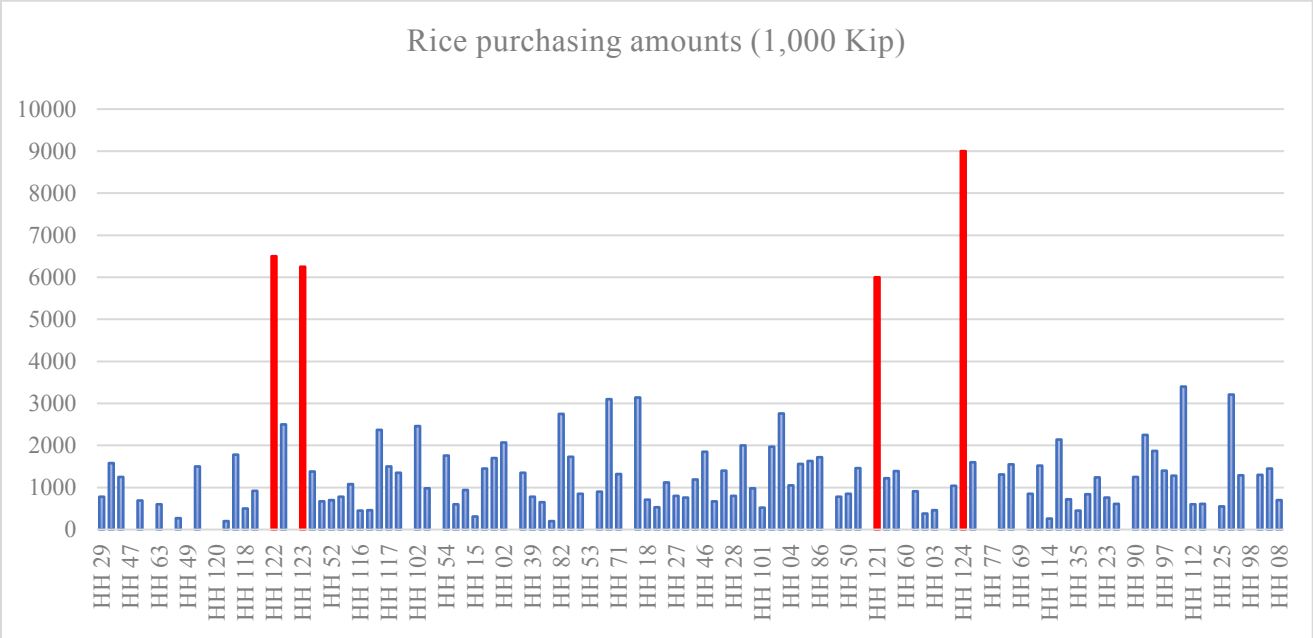


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

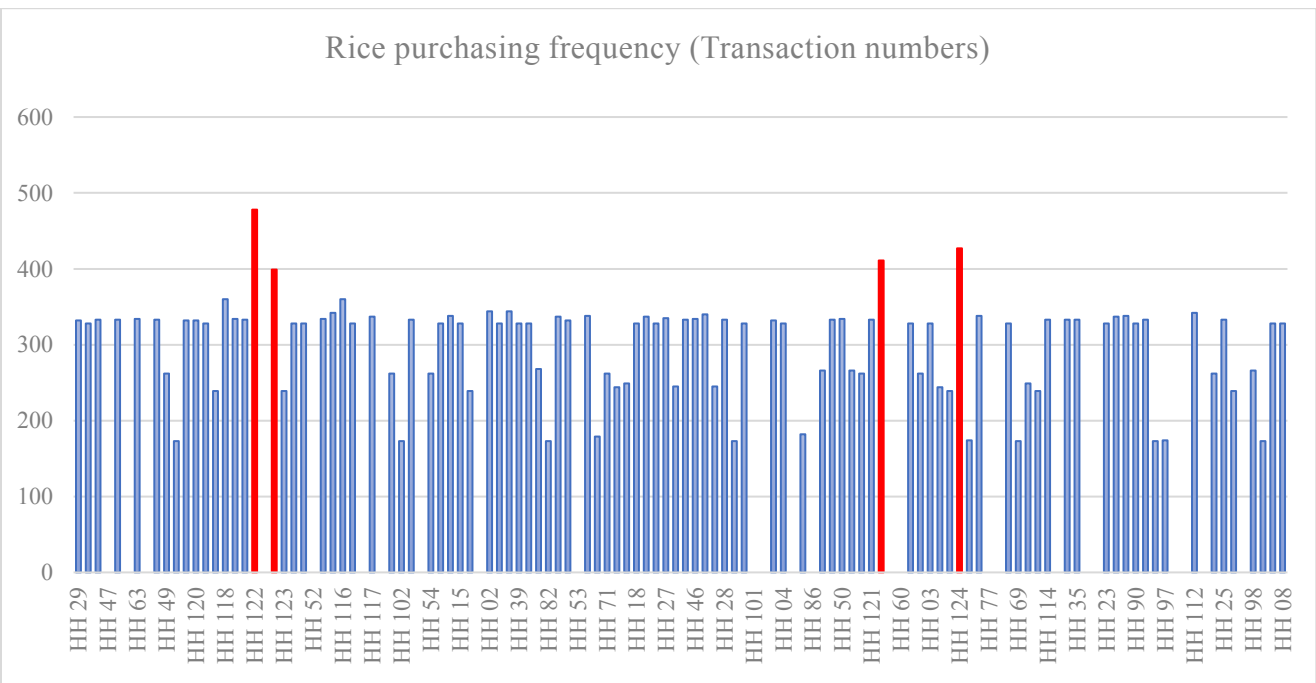


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 9. Rice purchasing of others from HH 123 in the village, 2016

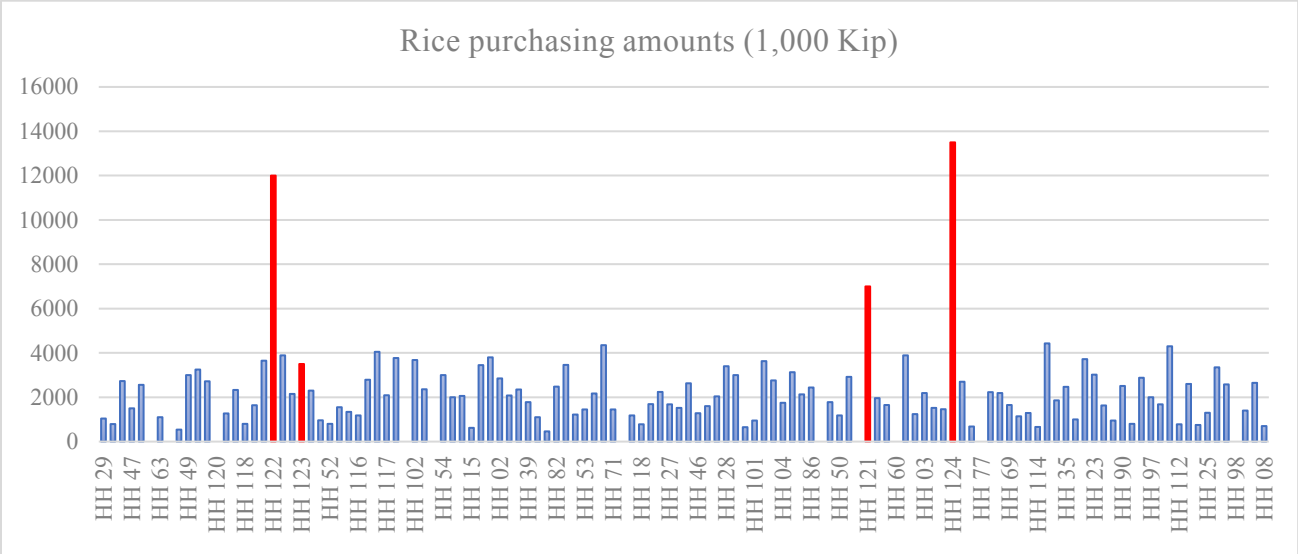


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

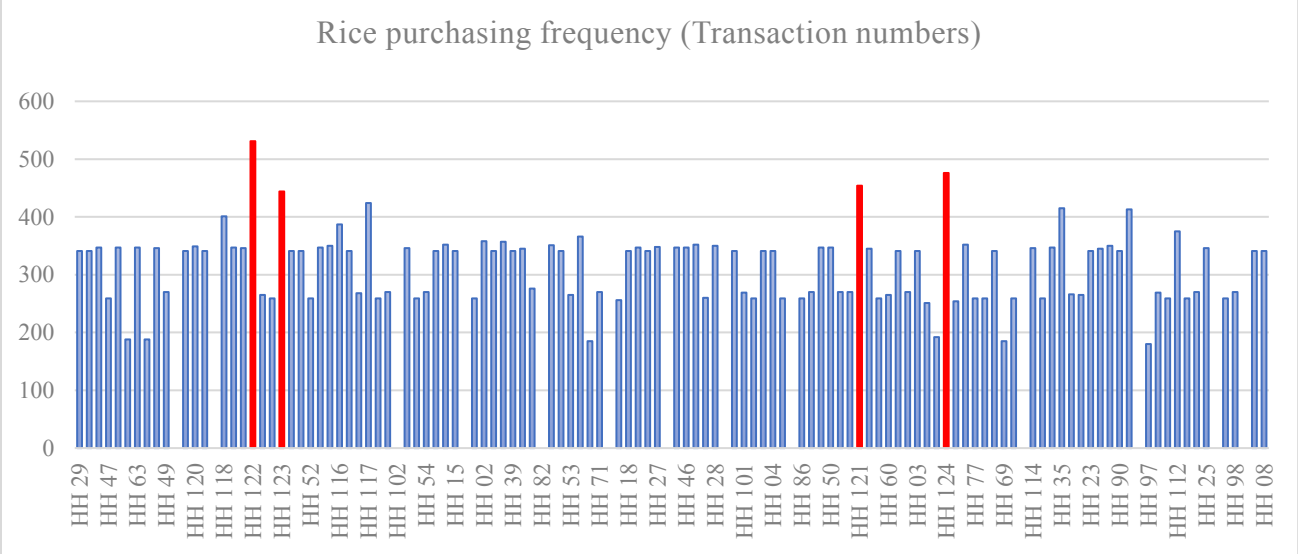


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 10. Rice purchasing of others from HH 124 in the village, 2016



Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

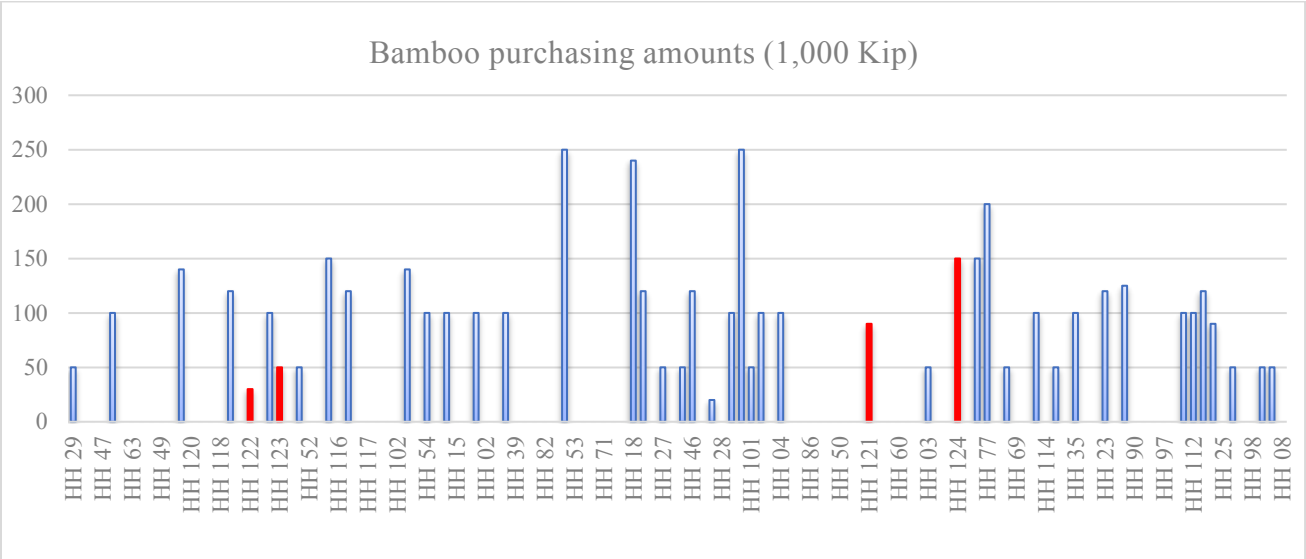


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

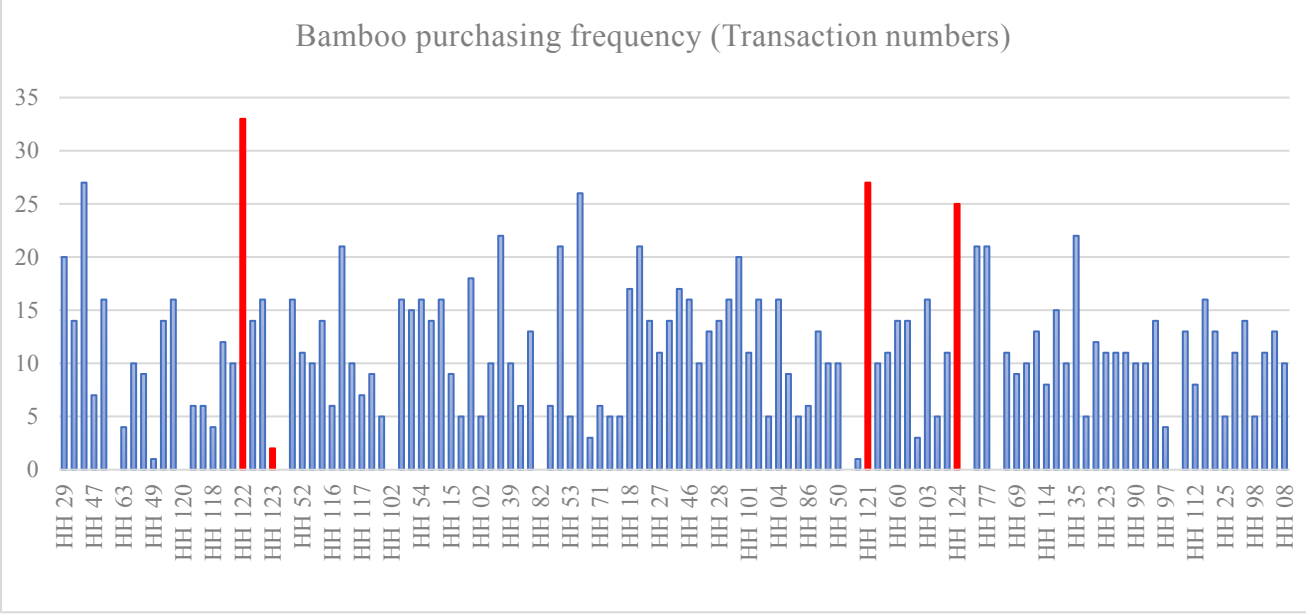
Figure 11, 12, 13, and 14 show the geographical and location characteristics of bamboo sellers and buyers in the village, 2016. The data descriptive analysis shows the similar distributions of bamboo transactions in the village. The highlighted color in the graph represents the rich four households or net sellers in the village, and their positions in the village are from HH 122, HH 123, HH 121, HH 124, respectively. We find that the sales amounts of HH 124 is highest amongst other three net product sellers in the village. For example, the bamboo transactions

between this net selling household and other net buying households in the village is stronger than others in the village.

Figure 11. Bamboo shoots purchasing of others from HH 121 in the village, 2016

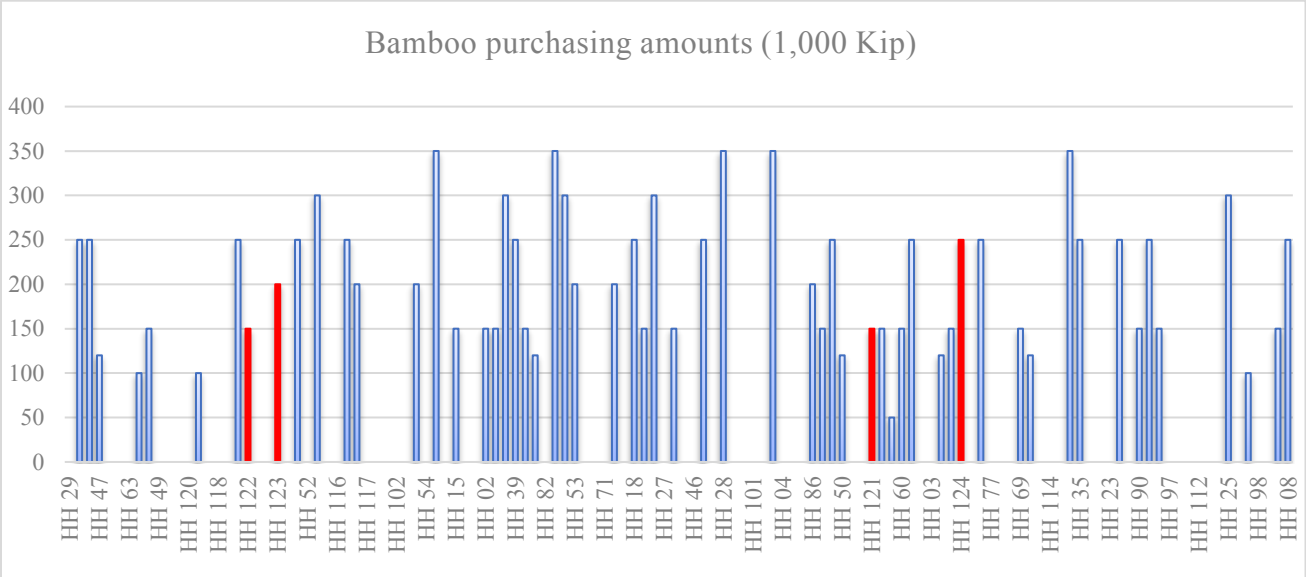


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

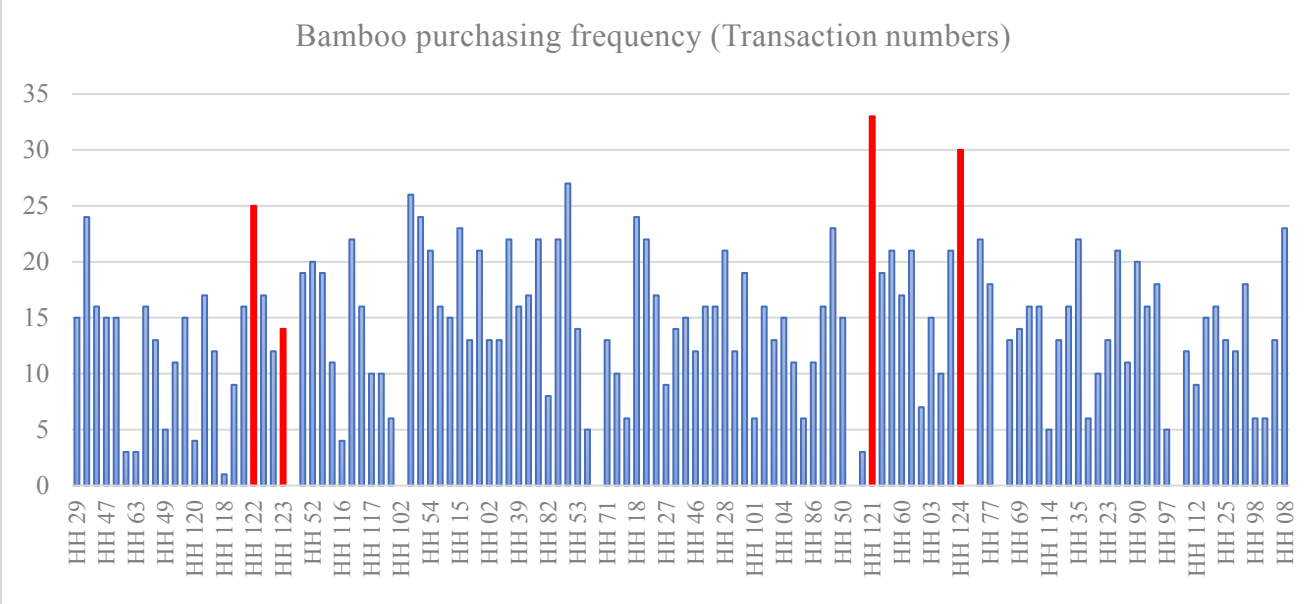


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 12. Bamboo shoots purchasing of others from HH 122 in the village, 2016

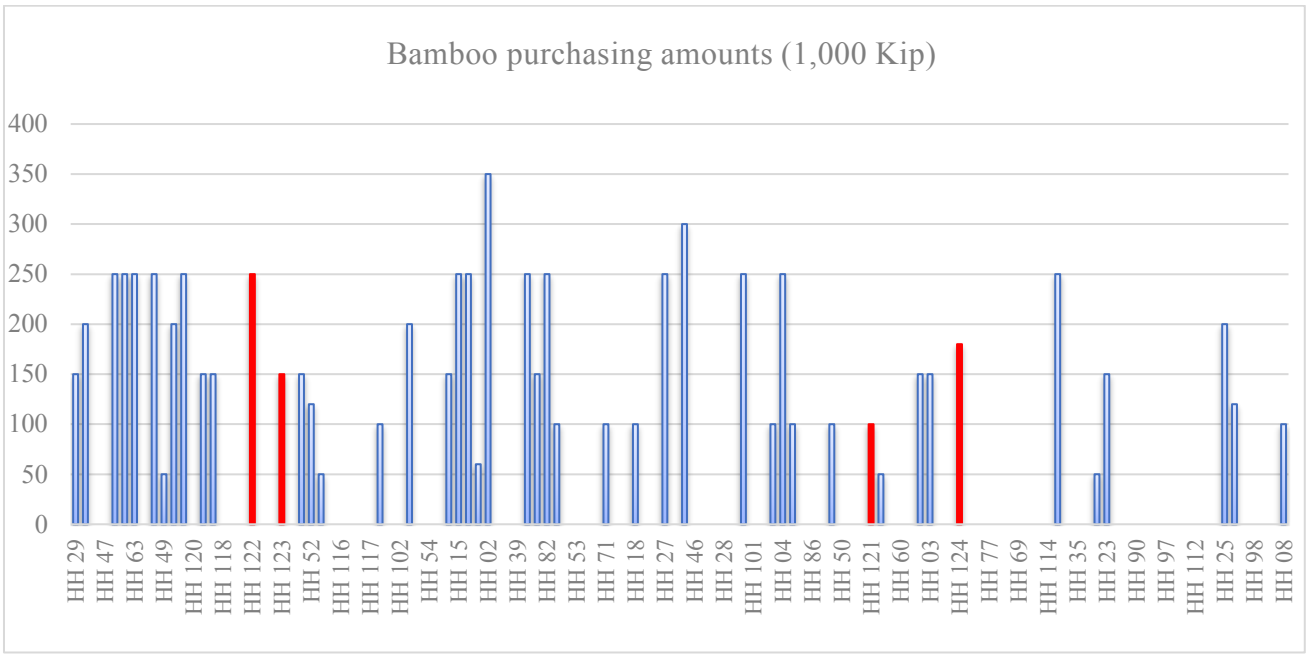


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

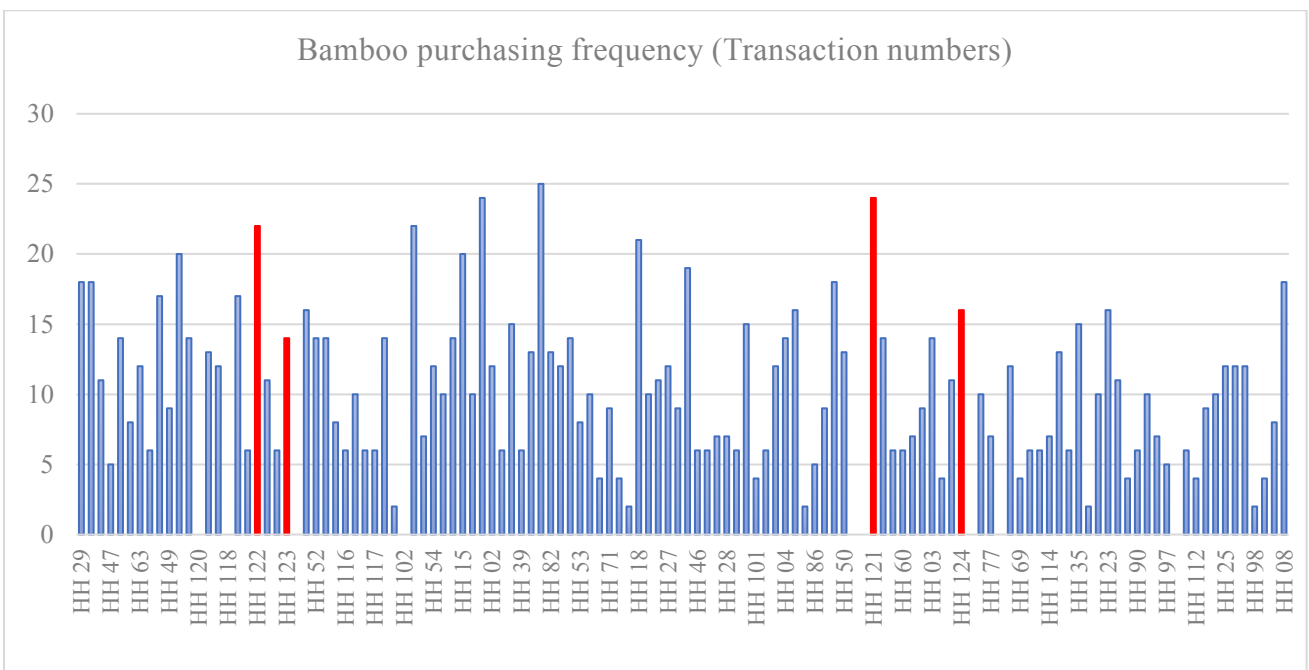


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 13. Bamboo shoots purchasing of others from HH 123 in the village, 2016

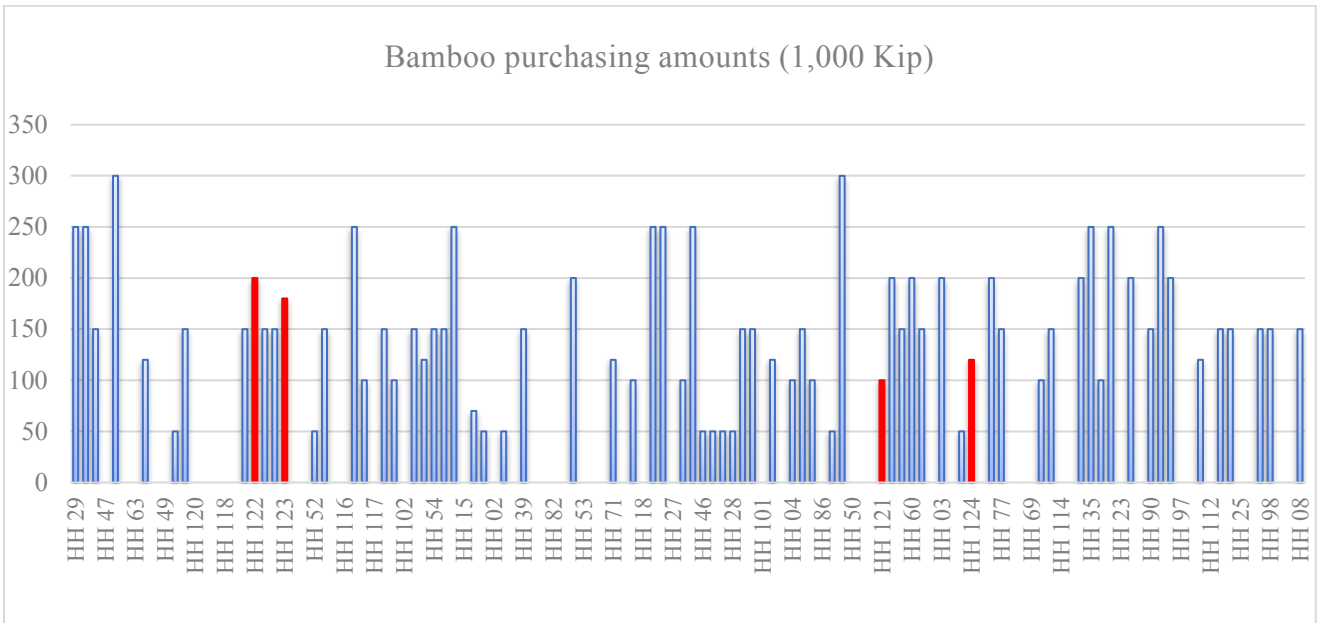


Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.

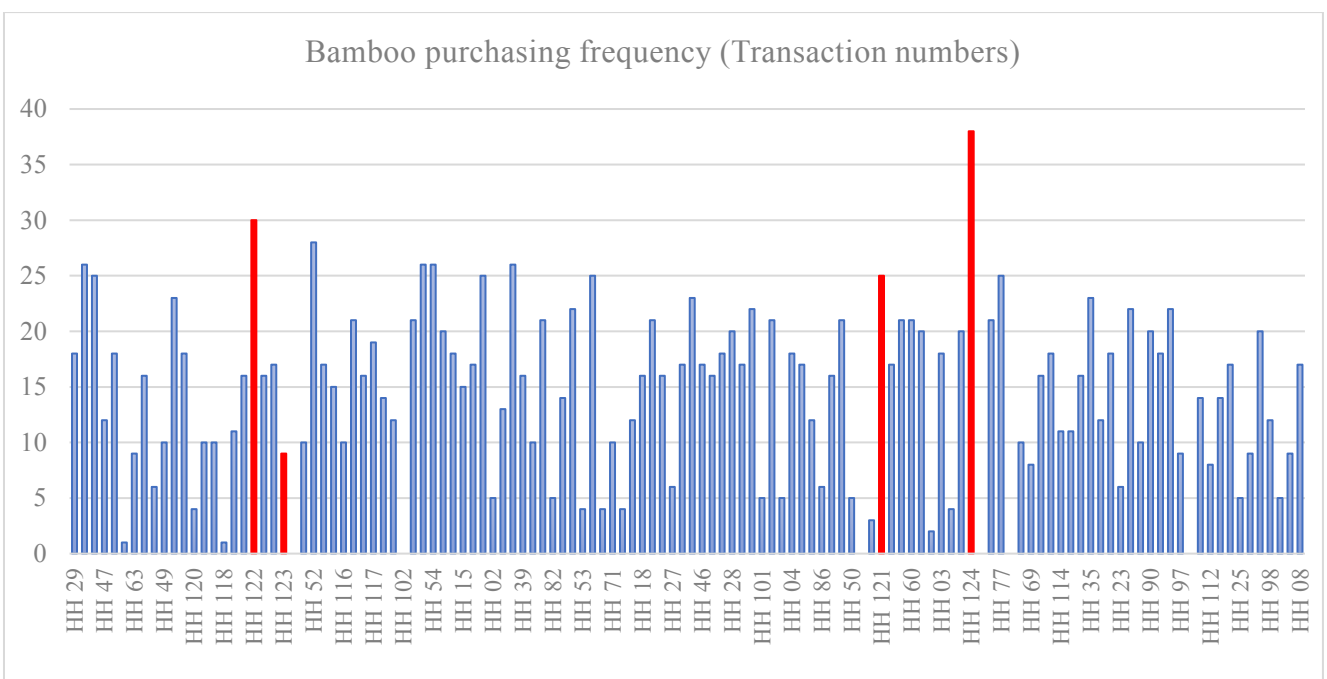


Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

Figure 14. Bamboo shoots purchasing of others from HH 124 in the village, 2016



Source: Data obtained from Leontief Inverse matrix table, VIOT, June 26, 2019.



Source: The graph is drawn from data obtained from QVIOT. The total number of rice transactions by multiplying QVIOT by third round (Q3), June 26, 2019. Note: Households positions are ranked from North to South of the village.

4.4. Research Methodology

Since the focus here is on remittance impact on transactions of intermediate inputs and intermediate demand among households in the village, it is important to clarify how these remittances are measured and defined. Exploring the impact of remittances on transactions of locally produced products between households requires to address some potential endogeneity of the remittance characteristics. Data on remittances used in this paper includes transfers received in forms of money; food; and non-food items such as household appliances (chairs, tables, TV, refrigerators) and equipment. Households which report having migrants and receiving remittances from outside the village is classified as households with remittances (WRs). Households which report having no migrants or having migrants, but do not report receiving remittances are considered as households without remittances (WORs).

In impact assessment studies, biases always come from three sources; (i) selection bias, (ii) self-selection bias, and (iii) difference in observable characteristics. To overcome this selection bias, firstly, we can use t-statistics approach to measure the difference in socio-economic impact of remittances. In this approach, we can measure the remittance impact using all WRs & WORs ignoring selection bias, and counterfactual. Secondly, the conceptual framework from Rosenbaum and Rubin (1983) and Heckman, et al. (1997, 1998); which has been widely used to identify the bias in the estimates.

The previous empirical literatures that estimate the impact of remittances on receiving households using cross-sectional data usually employ two main techniques to overcome this selection problem: an instrumental variable (IV) approach (e.g. Adams & Cuecuecha, 2010, 2013) or a propensity score matching (PSM) approach (e.g. Démurger, S., & Wang, X. 2016; Bertoli & Marchetta, 2014; Jimenez-Soto & Brown, 2012; Clément, 2011). In this paper, we employ the second approach: PSM approach (Rosenbaum & Rubin, 1983). As discussed below, this approach is not without its own faults as it relies on a strong identifying assumption, and various sensitivity tests are needed to assess the quality of the estimates (Caliendo & Kopeinig, 2008).

However, no empirical literatures that apply PSM approach and the trade data of individual household to estimate the impact of remittances on transactions among households in rural developed and developing countries. We treated both potential outcome and covariates variables as the OD data, flowing from sellers to buyers in product transactions. This constitutes

a matrix form of 124 x 123 (15,252) size. We decompose total transactions into five product transactions, each transaction is defined as potential outcome that represents each composition of the total product transactions such as rice, livestock, poultry, crops, and NTFPs transactions among household *i* and household *j*, respectively. In addition, we also decompose investments into five types of product investments as same as product transactions plus one item as investment in farm inputs such as fertilizer, equipment, and tools. Finally, consumptions are decomposed into five product consumptions as mentioned above, education, health expenditures.

In this study, the remittance-response function is estimated first. The major concern in the PSM approach is the determination of which explanatory variables should be included in the remittance-response function to estimate the probability of a household or a group of households receiving remittances or not. This probability depends on characteristics of households with remittances and households without remittances. The dependent variable represents the status of households receiving remittance income or not. E.g. a dependent variable taking a value '1' when a household receives remittances and '0' when it does not.

$$\mathbf{P(X) = Pr\ (}\boldsymbol{T_i = 1|X}\mathbf{)} \qquad (7)$$

P(x) is a propensity of being treated (remittances). Denote T_i the treatment that equals 1 if household *i* or both household *i* and *j* or one of them receives remittances, and 0 otherwise. $\boldsymbol{X}$ is a vector of household level characteristics (e.g. age, gender, year of education, household size, and land size). These characteristics may motivate the migrated worker's decision to remit income and affect remittance income but not the outcome variables.

Formally, the estimated average treatment effect on the treated (ATET) for investments, consumptions in each household and for mutual transactions among household with remittances can be derived as follows. Denote Y_{ij} is the outcome variable representing transactions among households. Y_i is the outcome variable representing consumptions and investments and their components, respectively. The potential outcome of interest for household i is $Y_i(1)$ if household *i* receives remittances and $Y_i(0)$ otherwise. More specifically, the potential outcome of interest for household *ij* is $Y_{ij}(1)$if both household *i* and *j* or one of them receive remittances, and $Y_{ij}(0)$ if both household i and j don't receive remittances. i represents a seller's characteristics, and *j* represents buyer's characteristics, respectively.

Given these definitions, the impact of the treatment T_i on household i; and the impact of the treatment T_i on household i and household j whom trade with each other is given by these equations, respectively.

$$\mathbf{ATET_i} = \mathbf{E}[(\mathbf{Y_i(1)} - \mathbf{Y_i(0)}|\mathbf{T_i} = \mathbf{1}] = \mathbf{E}[\mathbf{Y_i(1)}|\mathbf{T_i} = \mathbf{1}] - \mathbf{E}[\mathbf{Y_i(0)}|\mathbf{T_i} = \mathbf{1}] \quad (8)$$

$$\mathbf{ATET_{ij}} = \mathbf{E}[\mathbf{Y_{ij}(1)} - \mathbf{Y_{ij}(0)}|\mathbf{T_i} = \mathbf{1}] = \mathbf{E}[\mathbf{Y_{ij}(1)}|\mathbf{T_i} = \mathbf{1}] - \mathbf{E}[\mathbf{Y_{ij}(0)}|\mathbf{T_i} = \mathbf{1}] \quad (9)$$

Estimating this ATET imposes an identification problem because $Y_i(0)$ and $Y_{ij}(0)$ the non-treatment outcomes of the treated groups, cannot be observed directly for treated households and must be estimated. Matching methods provide a solution to estimate the counterfactual outcome for the treated households in the hypothetical absence of treatment, by pairing each treated household with a non-treated household that is similar in terms of its observed characteristics (Démurger, S., & Wang, X. 2016). Matching relies on the conditional independence assumption (CIA), which states that, conditional on a set of observable characteristics X, the treatment status is independent of potential outcomes. Furthermore, Rosenbaum & Rubin (1983) have shown that if assignment to treatment is strongly ignorable given X, then assignment to treatment is also strongly given the propensity score *p(X)*, which means that we can reduce X to one dimension and match on *p(X)* instead.

Before we estimate the average treatment effect on the treated (ATET), we first need to construct a statistical comparison group based on a model of the probability of participating in the treatment, using a set of observed characteristics. Then, households that receive remittances are matched based on this probability, or propensity score, to non-receiving households. The ATET can finally be calculated as the mean difference in outcomes across the two groups.

The first step of PSM analysis consists in estimating the propensity score with selected covariates. As recommended in the literature (Caliendo & Kopeinig, 2008, Démurger, S., & Wang, X. 2016), only variables that influence simultaneously the treatment status (e.g. remittance-receiving households) and the outcome variables (e.g. transactions, consumption and investment) should be included in this first step because un-confoundedness requires the outcome to be independent of treatment conditional on the propensity score. Moreover, only covariates that are unaffected by the treatment, thus, preferably observed prior to the treatment should be included in the model to avoid endogeneity due to exposure to the treatment. As our database is the OD data and we have information about each household head's characteristics

such as age of the head of household, years of education schooling, household size that includes total household member, incorporating this information into our covariate variables may reasonably help reduce the potential endogeneity issue.

This study follows previous papers that have recently applied the PSM approach (Démurger, S., & Wang, X. 2016) to analyze of remittances impact on consumption and investment expenditures, and we also try to estimate remittance impact on mutual transactions in the village. Using Origin to Destination (OD) data of the sellers and buyers extracting from our VIOT[19] may produce an interesting result. Then, we incorporate variables related to the household head and household characteristics in the covariates (e.g. the education level of household head, age of household head, household size, land size), as it is usually done in most literature, claiming that household headship could be endogenous to the decision of household members to migrate and remit transfers.

The validity of PSM depends on several conditions. First, matching approach assumes conditional independence, which means that conditional on observable variables X, the assignment to treatment is random, and the outcomes of non-treated units can be used to approximate the counterfactual outcome of treated units in the absence of treatment (Démurger, S., & Wang, X. 2016). Balancing tests allow checking whether observations with the same propensity score have the same distribution of covariates X, independent of the assignment. Table 5 and 6 show the balancing tests for the main treatment, which check the equality of the means of the covariates in the model before and after matching, as well as the standardized bias before and after matching (Lee., S.W. 2013). It shows that after matching, the covariates are almost balanced between the treatment and the control groups.

Table 26 displays both probit and logit estimation used to generate the propensity score for the full samples of consumption and investment expenditures in each individual household, respectively. In this estimation, we use a set of covariates as mentioned above, and only covariates that are unaffected by the treatment (a household who does receive remittances) should be included in the model to avoid endogeneity.

[19] This information about transactions among households is prepared and made by Hongsakhone & Ichihashi (2017) when making a village Input-Output Table (VIOT) to measure the interdependency among households in that village.

Table 26. Probit and Logit estimation for propensity score.

Dependent variable: Whether a household who is trading of products receives remittances		
Covariates (X)	Coefficients (1)	Coefficients (2)
Age (28<age<81)	0.0002 (0.0101)	0.0003 (0.016)
Gender (Female =1, other = 0)	-0.1856 (0.3495)	-0.3032 (0.5678)
Year of education (0< years <12)	0.0532 (0.0462)	0.0867 (0.0749)
Household size (4<member<12)	-0.0722 (0.0809)	-0.1176 (0.0130)
Land size (0< area (Ha)<5)	0.0364 (0.1746)	0.0597 (0.2792)
Constant	-0.0647 (0.6354)	-0.1030 (1.0193)
Pseudo R^2	0.0160	0.0161
Observations	124	124

Note: Standard errors in parentheses. (1), and (2) mean Probit and Logit estimation for propensity score, respectively.
Source: Household Survey Data conducted by Authors, March 8-29, 2016.

Second, a common support must be imposed to mitigate the bias in the estimate and this restriction requires that the overlap in propensity scores across the participant and non-participant samples is sizable. The comparison of the distributions of estimated propensity score among WORs and WRs (Figure 4 & 5) shows that the large overlap, which indicates that observable that predict the probability of receiving remittances are distributed very similarly across the two groups.

The second step in PSM comprises using the estimated propensity scores to match each remittance-receiving household with its "nearest" non-receiving household. Theoretically, various matching methods are available. However, in this paper, we use a Kernel estimator that matches the outcome of each treated household to a weighted average of the outcomes of all the control households, assigning greatest weight to match controls with the closet propensity score. Kernel matching method offers the lower variance because more information is used. Therefore, the average treatment effects on the treated (ATET) shown in Tables 28, 29 and 30 are derived from this procedure. Other methods of estimating treatment effects: Nearest Neighbor Matching (NN-MATCH), Inverse Probability Weighting (IPW), Inverse Probability Weighting (IPWRA), and Regression Adjustment (RA) are not discussed here, but the results of these methods are reported here to check robustness results only.

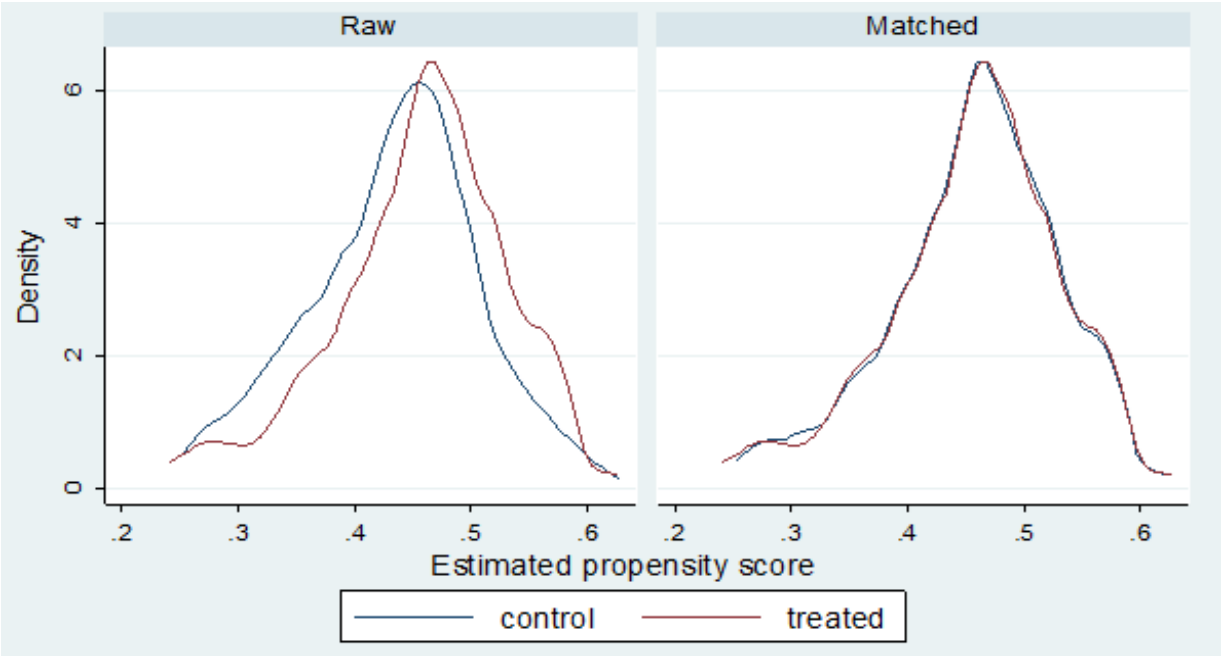
Table 27: Balancing tests for propensity score matching using OD data on transactions.

Covariate balance summary				
	Raw	Matched		
No. of observations	15252	13530		
Treated observations	6765	6765		
Control observations	8487	6765		
	Standardized differences		Variance ratio	
Covariates (X)	Raw	Matched	Raw	Matched
Age (28<age<81)	-0.1121	-0.0932	0.9805	0.1299
Gender (Female = 1, other = 0)	-0.1480	-0.1092	0.7252	1.7846
Year of education (0 <year <12)	0.2293	-0.79e-15	0.8553	1.2811
Household size (4<member<12)	-0.1092	0.0897	1.2251	0.9447
Land size (0< area (Ha)< 5)	0.0184	0.0951	1.1236	1.3525

Note: The balancing test refers to the benchmark specification of the propensity score with all households with remittances included in the treatment group.
Source: Authors' calculation, September 30, 2018.

Figure 15 shows the distribution of estimated propensity scores of treatment and control groups, before and after matching in the consumption and investment expenditures and transactions. It shows that after matching, the covariates such as age, gender, household sizes, year of education, and land sizes are well-balanced between the treatment and control groups in transactions, consumption and investments.

Figure 15. Distribution of estimated propensity scores before and after matching.



4.5. Results of Average Treatment Effects on the Treated (ATET)

4.5.1. Impact of Remittances on Transactions among Households

Table 28 presents the ATET estimates of households with remittances (WRs) for the entire sample on a set of various outcomes related to mutual transactions of intermediate inputs and intermediate demand between households with remittances over the year 2016. These products are the main economic activities in this village such as rice, poultry, livestock, crops and NTFPs transactions. Concerning disaggregate transaction, our estimates indicate that rice and NTFPs transactions are significantly increasing among other transactions in WRs, which are not only producers but traders of these products in the village. In this estimation, the focus is mainly on PSM methods providing a statistically significant result. However, in order to check the robustness for the ATETs on households with remittances, we additionally, employ other three estimators, namely, the Nearest-Neighbor Matching (NN-MATCH), Inverse-Probability Weighting (IPW) and Regression Adjustment (RA). Overall, robust results are found and consistent with PSM results across all estimation techniques. Table 28 shows that remittances are playing significant roles in major product transactions, especially, their impact on rice transactions among households with remittances, followed by NTFPs, livestock, poultry, and

crops transactions, respectively. These findings provide new evidences to the empirical literature on the impact of remittances sent by rural-to-urban migrants on the inter-household transactions. Furthermore, remittances can facilitate the trade of locally-produced products using as intermediate inputs and intermediate demand in an isolated village in Lao PDR, and these remittances spent by WRs also have a favorably impact on the commerce activities in the areas where community markets are a heart of transactions, and this impact encourages some potentially positive effects of remittances on streaming a circular flow of locally-produced products, as well as solving the budget constraint of WRs in the corresponding village.

Table 28: Results of ATET estimation: Impact of remittances on transactions

Remittance (1 vs 0)	PSM		NN-MATCH		IPW		RA	
	ATET	S.E.	ATET	S.E.	ATET	S.E.	ATET	S.E.
Rice	47.838***	4.059	47.292***	3.774	47.876***	3.322	47.834***	3.324
NTFPs	20.860***	1.338	21.009***	1.297	20.875***	1.286	20.885***	1.286
Livestock	13.720***	3.724	13.110***	3.905	11.818***	3.834	11.839***	3.814
Poultry	01.752***	0.646	02.150***	0.538	01.928***	0.470	01.914***	0.471
Crops	01.047**	0.567	00.538	0.547	00.986**	0.389	00.995***	0.388
Observations	15,252		15,252		15,252		15,252	

Notes: *** significant at 1%, and ** significant at 5%. Transactions are expressed in Lao Kip (unit: 1,000 Kip).
Source: Author's calculation using data obtained from VIOT, Household Survey 2016.

4.5.2. Impact of Remittances on Household Consumptions

Table 29 presents the ATET estimates of households with remittances (WRs) for the entire sample on a set of various outcomes related to consumptions and its compositions. Concerning disaggregate consumption expenditures by major goods, three major components reveal the impact and contribution of remittances increasing when a household receives remittances: expenses for consumer goods such as rice, poultry, and livestock, respectively. We also find that remittances have a positive impact on education and healthcare service, but its impact on healthcare service is insignificant. This is due to lack of nursery services in the village, even though, there is a healthcare center in the village, but there are no nurses available for a year-round. NTFPs is insignificant, because the fact that most NTFPs are sold outside the village. In addition, Crops are also insignificant, since all households in this village have their own vegetables plots and they produce for own consumption. These findings indicate that households with remittances spend much on consumer goods and services (e.g. rice and poultry), whereas expenses for education is also significantly increased, showing that remittances have

a positive significant impact on rural household education, because secondary and high school are built and provided in the village by Lao government, and most households are aware of significance of education for their children.

Table 29: Results of ATET estimation: Impact of remittances on consumptions

Remittance (1 vs 0)	PSM		NN-MATCH		IPW		RA	
	ATET	S.E.	ATET	S.E.	ATET	S.E.	ATET	S.E.
1. Rice	312.545***	107.22	219.636	198.83	289.436**	157.99	285.919*	158.59
2. NTFPs	5.436	14.660	28.981*	16.704	17.749	13.801	18.152	13.487
3. Livestock	398.545**	189.91	310.727	192.88	346.154**	188.07	344.032*	189.02
4. Poultry	132.363***	35.801	103.363**	60.071	126.846***	47.105	126.408***	47.271
5. Crops	157.618	106.11	65.072	181.18	189.416	159.91	190.897	157.89
6. Education	150.909**	57.192	183.636**	85.946	100.22	66.569	103.183	65.230
7. Healthcare	889.090	716.68	887.272	725.43	923.632	725.10	929.455	726.18
Observations	124		124		124		124	

Notes: ***, **, and * significant at 1%, 5%, and 10%, respectively. Transactions shown here are expressed in Lao Kip (unit: 1,000 Kip)
Source: Author's calculation using data obtained from VIOT, Household Survey 2016.

4.5.3. Impact of Remittances on Household Investments

Table 30 presents the ATET estimates of the households with remittances (WRs) for the entire sample on a set of various outcomes related to the investment spending and its composition. Indeed, ATET estimates suggest that remittances have a significant impact on investments in major tradable products such as rice, livestock, food products and farm inputs (e.g. fertilizer, tools, equipment, and motor vehicles). This suggests that remittances had a more significant contribution to increased stock of products or savings rather than consumptions in the corresponding village. Moreover, during times of market access constraint, and food insecurity in this village, remittances tend to be used for non-consumption purposes (savings and investment). These domestic remittances can offer an important economic buffer, provide more direct or indirect benefit by acting as a safety net, giving more cashes into local commerce, whereas the extra demand for products and services helps develop local markets and supports business.

Table 30: Results of ATET estimation: Impact of remittances on investments (stock).

Remittance (1vs 0)	PSM		NN-MATCH		IPW		RA	
	ATET	S.E.	ATET	S.E.	ATET	S.E.	ATET	S.E.
1.Rice	11776.45**	6241.49	11771.82**	6241.96	11777.76**	6241.97	11777.320**	6242.27
2.NTFPs	5836.68*	3099.59	5839.773*	3102.86	5834.486*	3100.00	5835.125*	3099.63
3.Livestock	1667.81***	690.752	1438.182**	730.357	1234.310*	707.168	1239.166*	706.951
4.Poultry	68.000	52.0723	139.727**	74.0996	117.240*	68.4965	117.944*	68.849
5.Crops	6.454*	03.4776	-1.181	06.3170	-0.735	4.7348	-0.649	4.6597
6.Farm inputs	13481.09	8557.17	13160.00	8545.00	13415.68	8541.58	13406.81	8542.69
Observations	124		124		124		124	

Notes: ***, **, and * significant level at 1%, 5%, and 10%, respectively. Transactions shown here are expressed in Lao Kip (unit: 1,000 Kip). Farm inputs include fertilizer, tools, equipment, and motor vehicles. The calculation is from data obtained from VIOT, Household Survey 2016.

4.6. Concluding Remarks

This paper investigates how domestic remittances affect the mutual transactions among households with remittances through their trade of locally produced products as the intermediate inputs and intermediate demand in an isolated village. Using origin-to-destination (OD) data, flowing from sellers to buyers in the transaction tables of VIOT built from our own Household Survey 2015 and 2016 for a rural village in northern Lao PDR, we can capture the main flows of goods and services, and monetary transactions among households in the village, and we can investigate the influence of remittances on mutual transactions among households with remittances. Furthermore, we also can quantify remittance impact on consumptions, and investments within remittance-receiving households in this corresponding village.

Our main findings reveal that remittances have a significant positive impact on transactions among households with remittances through their trade of locally produced products. Among transactions, rice is the main product transactions in the village, contributing a major role in total transactions among households with remittances, this is followed by NTFPs, livestock, poultry, and crops transactions, respectively. Therefore, remittances can act as a facilitator in the transactions. In addition, remittances have positive impact on increased investments, accumulation of products rather than consumptions. Because several households are subject to income volatility and seasonality in the village, they prefer to stockpile or save their products for emergency or future use instead of selling to other households.

Remittances are used to purchase goods and services in the village. Regarding the transactions of rural households, the key results are threefold. First, Households with remittances are found to be non-poor households, and frequently trade rice, livestock, and poultry with each other in the village. They spend more on intermediate inputs and intermediate demand, accumulated products for investments, and less on consumption, except expenses for healthcare services. Second, within consumptions and its composition, households with remittances are found to favor consumption on food products such as rice, poultry, and healthcare services. This suggests that rural households in Lao PDR tend to pay attention to quality of life improvement and livelihood. Third, households with remittances are found to increasingly invest in major tradable products that they can produce locally. This study finds the similar positive impact of remittances on consumptions and investments. Remittances sent by their family members who are migrants offer an important economic buffer, provide more direct or indirect benefit by acting as a safety net, giving more cashes into local commerce, whereas the extra demand for products and services helps develop and support local markets, as well as local business. Therefore, with the recognition of the impact that remittances have on transactions among households and the role of domestic money transfers through remittances, it is necessary for local governments and the private sector to explore ways to maximize this impact by scaling up successful policies and models.

This paper contributes an interesting finding to the empirical literature on the effects of remittances on transactions through the inter-household sales and purchases within the study village. First, we complement previous studies by using a propensity score matching approach that allow us to estimate remittances impact on the household investment-type and consumption-type expenditures. Second, unlike large-scale databases used in previous studies, our household survey database is unique because the data and information are extremely detailed, capturing all household transactions, expenditures and their compositions. Our main dataset and analysis cover 15,252 household pairs in total. This dataset is originally obtained from our VIOT, which is in a matrix form of 124 x 123 size. We focus on the differentiated impact of remittances on various transactions of local products, especially inter-household trading of intermediate inputs and intermediate demand, which allows us to explore the potential impact of remittances on transactions and extend the debate concerning whether remittances do serve any investment purpose in rural Lao PDR.

Second, we identify whether remittances raise an endogeneity issue: there might be confounding factors that influence both the likelihood of receiving remittances and the household's consumption-type and investment-type expenditure behavior. Thus, in our regression estimates we allow the impact of remittances on transactions to be different for each household in the village, we apply PSM approach to investigate the impact of remittances on transactions through the trading of locally produced products among households with remittances in the village. This PSM method offers the advantage of controlling for self-selection based on observable characteristics without imposing too strong distributional assumptions (Jimenez-Seto & Brown, 2012, S. Démurger, S. & Wang, X. 2016).

Third, our main findings advocate a new evidence to the empirical literature on the impact of remittances on the inter-household transactions. We find that remittances had a more significant contribution to increased investment, stock of goods rather than consumption in households with remittances. Especially, remittances are found to operate mainly through rice and non-timber forest products transactions among remittances-receiving households. This suggests that households with remittances, whom are not only main producers and traders, but also rich in the village, tend to accumulate their resources for future transactions. This finding is different from other previous studies (Démurger, S. & Wang, X. 2016), which reveals that remittances lead to increased consumption rather than increased investment in rural China.

CHAPTER 5

CONCLUSION AND POLICY IMPLICATION

5.1 Main findings

This study examines the reciprocity of households through their transactions in a disadvantaged area in a developing country by using a village input-output table (VIOT) and a transformed qualitative village input-output table (QVIOT) created from our own household survey data conducted in 2015 and 2016 in Lao PDR.

Our main findings are that both VIOT and QVIOT model could be a useful method and a better indicator to capture the interdependency among key agents in isolated village. This VIOT yielded a total output multiplier of 1.767, which is less than 2, it means that this level of multiplier is not so high, suggesting that village economy depends somewhat on transactions from outside the village. Overall, the degree of interdependence regarding the sales and purchases of goods and services among households in the village is not strong, but QVIOT gives a strength degree of interdependency among four higher-income households or as net product sellers (HH 121, HH 122, HH 123, and HH 124) is stronger than that among lower/middle-income households, or those who are net product buyers in the village. Moreover, backward linkage indices indicate that the main buyers are poor households, while forward linkage indices show that most of non-poor households are main suppliers, especially the four higher-income families in the village. Rice production and transactions are the main economic activity in the village. QVIOT analysis also shows the top 10 households, who have the most frequently sales and purchases of local products. For example, HH number 124, 122, 123, 121, 118, 116, 112, 113, 119,and 117, high-income households and rich households are the main product sellers, while HH number 122, 124, 121, 123, 117, 120, 35, 33, 14, and 05 are the key buyers in the village. In contrast, households are found to be smaller farmers, who make few sales and purchases of goods and services with others in the village. For example, HH number 102, 104, 87, 82, 73, 79, 69, 76, 97, and 89 are worst product sellers, except rice transactions, while HH number 60, 84, 79, 92, 85, 91, 69, 98, 77, and 51 are worst product buyers in the village.

In addition, descriptive analysis also finds that households who are receiving remittances can facilitate and enhance their product transactions, especially through the sales and purchases of

rice, non-timber forest products, and crops in the village. Rice and bamboo purchasing frequency is higher in non-poor households than in poor ones, but these transactions among net product sellers, especially the four rich households and net product buyers are not significantly affected by geographical locations in the village. This is due to the distance to regional markets or city markets outside the village is far away.

5.2 Conclusions

VIOT construction for interdependence analysis is simple, but it is a useful method to know economic transactions among key players in disadvantaged area. This study supports our main hypotheses. Most of the poor households depend on goods and services supplied by non-poor counterparts, especially the four rich households in the village, who are not only main producers, but also traders in the village. The reciprocity of rural households in the village was examined by some key product transactions. For example, rice is the main economic transaction, and the degree of interdependency among households, as well as the purchasing frequency among them is very strong and active in the village.

Input-output analysis is an economic tool used to measure the inter-industry relations of an economy. The multipliers, estimated on the basis of the VIOT analysis, are defined as the system of economic transactions that disturbance in an economy. The backward and forward multipliers can be used to identify the degree of structural interdependence between each household and the rest of the village economy.

This VIOT offers comprehensive and detailed information regarding the sales and purchases of goods and services among households, final users (household consumption, investment, exports), imports, and money transfers as remittances from outside the village and factors of production within an economy. Both VIOT and QVIOT model represent an analytical tool for the economists, planners, and policy makers in economic impact analysis and development. QVIOT model offers a simple way to identify the strength of the interdependency among households in a rural village. We examine the number of direct and indirect transactions among households.

In the case of Phonxay village, Ngoi district of Luang Prabang province, Lao PDR, we found rice transactions to be very common, and especially important among the four higher-income families. Indeed, it turned out that these four families facilitated economic transactions for other

villagers. On the other hand, transactions involving relatively expensive goods (e.g. duck and chicken) were far more likely to be observed among higher-income households and lower/middle-income households, which indicates that lower/middle-income households tend to buy these goods from the higher-income households rather than from outside the village. This suggests that net prices of those goods were lower when provided by the wealthier villagers than from sources outside the village. In the village, higher-income households were not only farmers but also merchant traders. Thus, the different roles played by the higher-income households and lower-income households appeared to be structural cause of the large income gap within the village.

5.3 Discussion

Making a VIOT from household survey approach is simple but is expensive and time-consuming. While converting a VIOT model into a QVIOT model can yield insight into trade between sectors. We find reciprocity not only among higher-income households (who trade in higher amounts) but also among lower-income households, while the usual IOT only shows that trading is concentrated among major traders. So VIOT and QVIOT appears to be effective for analyzing interdependency among households in disadvantaged areas, in particular those in isolated areas of developing and developed countries, where it is often difficult to obtain sufficient data. We believe this approach is useful even if the survey data do not necessarily represent the precise transaction involved, which is suggested by our results that rely on binary counts of relationships.

Our hypothesis was that economically disadvantaged areas or regions are characteristically isolated from market transactions, so that such isolated societies are immobilized, resulting in an increased potential for poverty. This research tests the hypotheses by examining the circular structure of goods and money in a community.

We find in the targeted disadvantaged village of Phonxay, Lao PDR, that there is a strong interdependency among the four families with high incomes. This is largely an outcome of being rice merchants acting on the behalf of other households. Conversely, lower-income families are less involved in trade, which suggests that households or sectors that frequently trade with others tend to have more opportunities to earn income and overcome poverty. This result also supports the notion of economic policies that enhance marketing strategies in the

region[20] and develop the region's infrastructure, such as electricity, water, roads, and education, as necessary conditions for the marketing strategy. We hope to test this idea in another application of our analysis.

5.4 Limitations of the current study

The current study faces some limitations discussed in this chapter. First of all, one limitation of this study lies in the fact that it took place in a specific village selected by the local government of Luang Prabang province, Lao PDR. We could not select the target village by our team research due to political and security reason of local authority. This target village is not different from other rural villages of Ngoi district because of its geographical location and characteristics of households, who are under the Lao national poverty line. It is situated along the main road connecting village to other villages nearby and it is accessible in both rainy and dry season. The village is not isolated areas and it is not difficult to access by road and public transportation. Villagers are easily trade with people outside the village. Therefore, this target village selected by local government could not represent a better sample for making a village input-output table (VIOT) model. Second limitation is related to questionnaire design and data collection because we faced data accuracy problem when we conducted our own household survey. Especially, there was a big gap in the balance of information on sales and purchases of goods and services in each household and among households' transactions. By theory, the sales amounts must be equal to purchases amounts, but we found that purchasing amounts of each product was bigger than sale amounts in each household. The informants tend to hide their important information, particularly, the sales information, while they are open to provide us the purchase information. This created imbalance of input and output information. The main reason is that villagers did not recall exactly how often they had sold and purchased products from other villagers, as well as they did not remember well about what they sold to and bought from each villager or others within the village and outside the village in the last 12 months. Therefore, it is suggested that the design of household survey should focus mainly on the data that can capture all their

[20] For example, our results show which households' connectivity in the village or which networks are relatively small and weak, which could be used to inform policy makers regarding which households should be financially supported and which households should be targeted by the marketing strategy. In addition, the results show which households are playing key roles in a village or a community, which would be also informative for policy makers to think their development projects.

transactions during their harvesting season or planting season (for example, during a 3-months in a year-round).

Another limitation is related to the our VIOT construction with data limitation. For example, we also faced a difficulty dealing with consumption data distribution, because households did not know correctly how much they consumed each commodity they bought from others, so we had to solve problems by estimating a consumption ratio and then this ratio was redistributed in each household, this was an artificial value in consumption vector. As a result, the backward and forward linkages values in some products (e.g. duck, cattle/buffaloes) are the same.

5.5 Policy Implications

We examine the extent of interdependency among them and find it a convenient way to observe the potential of their reciprocity or altruism. This can foresee how the approach can be used to examine the impacts of some economic policies like poverty reduction, regional development, new development project, and so on, since the approach informs which households play various roles within the village. One can also discover which households are most spatially isolated, how any two households depends on transactions outside the village.

We suggest that economic policies that enhance marketing strategies in the region might effectively overcome the local poverty situation. For instance, it could be that organizing an autonomous cooperative, for example, rice farmers and livestock cooperative groups would be a good way to increase the village's sales (and, hence, production and income) as a whole since production levels are very similar across the villagers and households. A cooperative might allow villagers to develop specialties and a 'brand'. To gain more income, it seems important that villagers have more extensive opportunities to participate in the market trades. To do so, infrastructure development, such as electricity, water, roads, and education, including skill and job training, is necessary as well.[21]

[21] For the importance of skilled labor for economic development in a developing country, see Rahmaddi and Ichihashi (2013).

REFERENCES

Acemoglu, D. and A. Robinson (2012) *Why Nations Fail.* London, Profile Books Ltd.

Agaje, T.F. (2008) Growth linkages and policy effects in a village economy in Ethiopia: *Analysis of interactions using a social accounting matrix (SAM) framework*. Department of Economics, Faculty of Applied Economics, University of Antwerp, Belgium.

Clark, J. and D.A. Holton (1991) *A First Look at Graph Theory.* Singapore, World Scientific Publishing Co. Pte. Ltd.

Chenery, H.B., Watanabe, T. (1958) International comparisons of the structure of production, *Econometrica*, 26, 487-521.

Cristobal, S. J.R. & Biezma, M.V. (2006) The mining industry in the European Union: Analysis of inter-industry linkages using input-output analysis, *Resources Policy* 31 (2006) 1-6.

Deaton, A. (2013) *The Great Escape*. Princeton, NJ, Princeton University Press.

DeBresson, C., G. Sirili, J. Lemay, X. Hu and F.K. Luk (1996) Innovative Clusters in Italy (1981-85). In: C. DeBresson (ed.) *Economic Interdependence and Innovative* Activity. Cheltenham, Edward Elgar Publishing, 165-177.

Defourny, J., Thorbecke, E. (1984) Structural path analysis and multiplier decomposition within a social accounting framework, *Economic Journal*, 94, 111-36.

Dietzenbacher, E. (1997) In Vindication of the Ghosh Model: A Reinterpretation as a Price Model. *Journal of Regional Science*, 37, 629-651.

Dietzenbacher, E., Los, B. Stehrer, R., Timmer, M.P. & Gaaitzen J. de Vries (2013) The construction of world input-output tables in the WIOD project; *Economic Systems Research,* 2013, Vol**.** 25, No**.** 1, 71-98.

Faße, A., Grote, U. (2014) Bioenergy and rural development: the role of agroforestry in a Tanzanian village economy. *Ecological Economics 106*, 155-166.

Gurgul, H., Majdosz, P. (2005) Key sector analysis: a case of the transited Polish economy, *Managing Global Transitions*, 3(1), 95-111.

Gurgul, H. & Lach, L. (2015) Key sectors in the post-communist CEE economies: What does transition data say? *Communist and Post-Communist Studies,* 48 (2015) 15-32.

Gurgul, H. & Lach, L. (2016) Simulating evolution of interindustry linkages in endogenous dynamic IO model with layers of techniques. *Metroeconomica* 67(2016) 632-666.

Gurgul, H. & Lach, L. (2017) Some Remarks on a Social Network Approach to Identifying Key Sectors, *Economic Systems Research.*

Hamasuna, T. (1996) Kouzou Bunsekitekina Sangyo Renkan no Ichi Keitai. *Keizaigaku Kenkyu* (*Kyushu University*), 62, 185-212 (in Japanese).

Holub, H.W. and H. Schnabl (1985) Qualitative Input-Output Analysis with Variable Filter. *Journal of Institutional and Theoretical Economics*, 141, 282-300.

Hongsakhone, S., M. Ichihashi, and Y. Yoshida (2017) Making a Village Input-Output Table (VIOT) from Household Survey: A Case Study of a VIOT for a Rural Village in Northern Lao PDR. *Proceedings of the 25th International Input-Output Conference.* Atlantic City, NJ, USA. Accessed April 2018https://www.iioa.org/conferences/25th/papers/files/2770_20 170511121Makinga VIOT (20170511).pdf

Hewings, G.J.D. (1982) The empirical identification of key-sectors in an economy: a regional perspective *The Developing Economies*, 20, 173-95.

Hewings, G.J.D., Romanos, M.C. (1981) Simulating less developed regional economies under conditions of limited information, *Geographical Analysis*, 13 (4), 373-90.

Hirschman, A.O. (1958) *Interdependence and Industrialization, in Hirschman*, A.O. (ed,): The Strategy of Economic Development, Yale University Press, New Haven.

Ichihashi, M. (1995) Industrial Structure Analysis by Repercussion Path Matrix. *Social Cultural Research (Proceeding II of Faculty of Integrated Arts and Sciences, Higashihiroshima, Higashihiroshima, Hiroshima University)*, 21,47-66 (in Japanese).

Ichihashi, M. (2004) A Model of Expanding and Shrinking of Social Relation - Approach from Economics. Report Book of Research by a Grant-in-aid for Scientific Research, Type-C (2) 2001-2003, 1-20 (in Japanese)

Ichihashi, M. (2007) *Economic Analysis for the Structure and Change in Japan*. Higashihiroshima, Hiroshima University Press (in Japanese).

Ichihashi, M., H. Ikeda and Iiguni (1995) A Means of Graphical Analysis for Input-Output Tables. *Kochi University Review*, 54, 193-226

Jackson, M.O. (2008) *Social and Economic Networks*. Princeton, NJ, Princeton University Press.

Krueger, A. (1998) Whither the World Bank and the IMF? *Journal of Economic Literature*, XXXVI, 1983-2020.

Leontief, W. (1936) Quantitative Input-Output relations in the economic system of the United States, *The Review Economics and Statistics.* 18(3), 105-125.

Leontief, W. (1986) *Input-Output Economics 2nd Edition*, Oxford University Press, 1986.

Lewis, B. and E. Thorbecke (1992) "District-level Economic Linkages in Kenya: Evidence based on a small Regional Social Accounting Matrix," *World Development* 20: 881-897.

Miller, R.E., Blair, P.D. (1985) *Input-Output Analysis*: Foundations and Extensions 2nd Edition, Cambridge University Press.

Martin, O.S. and S. Holden (2004) Food and Tree in the Village-Economic Development Strategies Based on Food Production and Forest Resources: *A Social Accounting Matrix Analysis* (Unpublished paper presented at the Input-Output and General Equilibrium Modelling: Data, Modelling and Policy Analysis. Brussels, Belgium, September 2-4). Accessed April 2018.

Olsen, J.A. (1992) Input-Output Models, Directed Graphs and Flows in Networks. *Economic Modelling*, 9,365-384.

Rasmussen, P.N. (1956) Studies in Intersectoral Relations. North-Holland, Amsterdam, Netherlands.

Subramanian, A., Qaim, M. (2009) Village-wide effects of agricultural biotechnology: the case of BT cotton in India. *World Development*, 37(1), 256-267.

Temurshoev, U. & Oosterhaven, J. (2014) Analytical and Empirical Comparison of Policy-Relevant Key Sector Measures. *Spatial Economic Analysis.*

The Prime Minister of Lao PDR: *Decree on Poverty and Development Standard 2010 to 2015,* No. 285/PO, dated 13/10/2009.

Z. Zhang et al. (2015) The Compilation of China's Interregional Input-Output Model 2002. *Economic Systems Research*, 27(2), 238-256.

Acosta, P., Calderon, C., Fajnzylber, P., & Lopez, H. (2008). What is the impact of international remittances on poverty and inequality in Latin America? *World Development*, 36(1), 89-114.

Adams, R.H., & Cuecuecha, A. (2010). Remittances, household expenditure and investment in Guatemala. *World Development*, 50,24-50.

Adams, R.H., & Cuecuecha, A. (2013). The impact of remittances on investment and poverty in Ghana. *World Development*, 50, 24-50.

Ambrosius, C., & Cuecuecha, A. (2016). Remittances and the use of formal and informal financial services, *World Development*, 77, 80-98.

Amuedo-Dorantes, C., & Pozo, S. (2011). New evidence on the role of remittances on healthcare expenditures by Mexican households. *Review of Economics of the Household*, 9(1), 69-98.

Aggarwal, R., Kunt, A.D, & Peria, M.S.M. (2011). Do remittances promote financial development? *Journal of Development Economics*, 96, 255-264.

Bertoli, S., & Marchetta, F. (2014). Migration, remittances and poverty in Ecuador. *Journal of Development Studies,* 50 (8), 1067-1089.

Bui, T.T.N., Le, T.T.N, & Daly, K.J. (2015). Microlevel impacts of remittances on household behavior: Vietnam case study, *Emerging Markets Review*, 25, 176-190.

Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys,* 22(1),31-72.

Clément, M. (2011). Remittances and household expenditure patterns in Tajikistan: A propensity score matching analysis. *Asian Development Review*, 28(2), 58-87.

Combes, J.L., & Ebeke, C. (2016). Remittances and Household Consumption Instability in Developing Countries, *World Development*, 39 (7), 1089-2011.

Démurger, S., & Wang, X. (2016). Remittances and expenditure patterns of the left behinds in rural China. *China Economic Review*, 37, 177-190.

Diego, E. V. (2017). Are remittances helping lower poverty and inequality levels in Latin America? *The Quarterly Review of Economics and Finance* (2017).

Feldman, A.L., & Chavez, E. (2016). Remittances and Natural Resource Extraction: Evidence from Mexico, *Ecological Economics*, 132, 69-79.

Hongsakhone, S., & M. Ichihashi. (2018). Measurement of reciprocity in a village through social networks, *Economic Systems Research*, DOI: 10.1080/09535314.2018.1467882.

Jimenez-Soto, E., & Brown, R.P.C (2012). Assessing the poverty impacts of migrants' remittances using propensity score matching: The case of Tonga. *The Economic Record*, 88(282), 425-439.

Katsushi, S. I., Gaiha, R., Ali, A., & Kaicker, N. (2014). Remittances, growth and poverty: new evidence from Asian countries, *Journal of Policy Modeling*, 36, 524-538.

Lee, W.S. (2013). Propensity score matching and variations on the balancing test, *Empirical Economics*, 44, 47-80.

Meyer, D., & Shera, A. (2016). The impact of remittances on economic growth: an econometric model, *EconomiA* (2016). http://dx.doi.org/10.1016/j.econ.2016.06.001.

Nguyen, D. L., Grote, U., & Nguyen, T.T. (2017). Migration and rural household expenditures: A case study from Vietnam. *Economic Analysis and Policy*, 56, 163-175.

Piras, S., Vittuari, M., Mollers, J., & Herzfeld. T. (2018). Remittance inflow and smallholder farming practices. The case of Moldova. *Land Use Policy*, 70, 654-665.

Rosenbaum, P.R., & Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1),41-55.

Taylor, E., & Mora, J. (2006). Does migration reshape expenditures in rural households? *Evidence from Mexico*. The Work Bank.

Yang, D. (2008). International migration, remittances and household investment: Evidence from Philippine migrant's exchange rate shocks. *The Economic journal*. 118, 591-630.

APPENDICES

Appendix 1. Individual Report on TAOYAKA Onsite Team Project: Revitalizing Nijo Village Hub through Local Transport Services.

INTRODUCTION

My TAOYAKA Program Onsite Team Project entitled: Revitalizing Nijo Village Hub through Local Transport Services was carried out during April 2017 -March 2018 in Nijo, Masuda city of Shimane prefecture. This project is a significant component of TAOYAKA Program for creating a flexible, enduring, peaceful society, Hiroshima University. Nijo is a rural district located roughly 20 kilometers from Masuda city, Shimane prefecture. There are six communities spread across a hilly area within Nijo. In 2015, there were 270 households with a total population of 567 persons in Nijo, but in 2017 this figure went down to roughly 210 households.

Nijo experienced several issues: economic stagnation, aging and depopulation, declining agricultural activity; young people leaving Nijo to work and study elsewhere (Masuda, Hiroshima, Osaka, Tokyo); and few people come back to Nijo after retirement. Farming activity in Nijo is becoming less profitable and is not a viable occupation especially for younger people, while the existing farmers are ageing, therefore, more farmland is being abandoned.

However, Nijo has some basic facilities such as public services and few private shops, but few people do shopping in Nijo. A census-style household survey conducted in 2014 found that about 130 households reported shopping locally, about 202 households reported shopping outside, mainly in Masuda city, meanwhile 18 households used delivery services, and 10 households used mobile shopping services.

The main economic activity within Nijo appears to be agriculture, but most middle-aged and younger people have jobs in Masuda city. According to a 2014 Household Survey by the Nijo Community Association (*Nijo Satozukuri no Kai),* roughly 30 percent of total households are engaged in agriculture; 20 percent were employers working in companies; and about 10 percent were self-employed. However, the primary source of income in Nijo was pension, and income from agriculture activity accounted for only 17 percent.

TAOYAKA Onsite Team Project (Team 6)

The goal of our project was to revitalize the Nijo Village hub through local transport services. This project aimed to achieve the following outcomes:

Outcome 1: Develop a Joint Plan to Revitalize the Nijo Village Hub

Outcome 2: Creation of Bus Waiting Area and/or Local Freight Distribution Center

Outcome 3: Piloting local transport service to increase intra-Nijo mobility.

My main contribution was to construct a Nijo Input-Output Table (NIOT) using information and data from Household Survey under Outcome 1. As we have known, Input-Output (IO) model has been a useful quantitative technique to capture economic activity and transactions especially the inter-dependency between industrial sectors in an economy (Hongsakhone and Ichihashi, 2018). By making use of this IO approach, we attempted to apply it to Nijo economic study. We proposed to construct a NIOT from household survey data to investigate the commodity flows between households within Nijo, as well as between Nijo and Masuda city. Information allocated into NIOT could statistically help us understand the physical movement of goods, money as well as social network and relations that span Nijo and Masuda city (see an example of Nijo Input-Output Table in Table 1).

In April 2017, we presented our project proposal and plan to TAOYAKA Program Committees and our supervisors. We developed our own household survey in consultation with the Nijo Community Association and heads of neighborhood associations during May to July 2017. During end of September to the beginning of October 2017, we started conducting household surveys.

Data obtained from this survey could tell us:

1. Who are producers and traders, how are they trading their products (from both production and consumption aspects)?
2. Socio-economic relations (interdependency) between the sub-districts and between Nijo and other areas.
3. Which are the key products for trade and consumption?
4. To what extent local (Nijo) people depend on local shops, and what they sell and buy there.

The basic transaction flows within Nijo and between Nijo-outside (Masuda city) is illustrated and shown here:

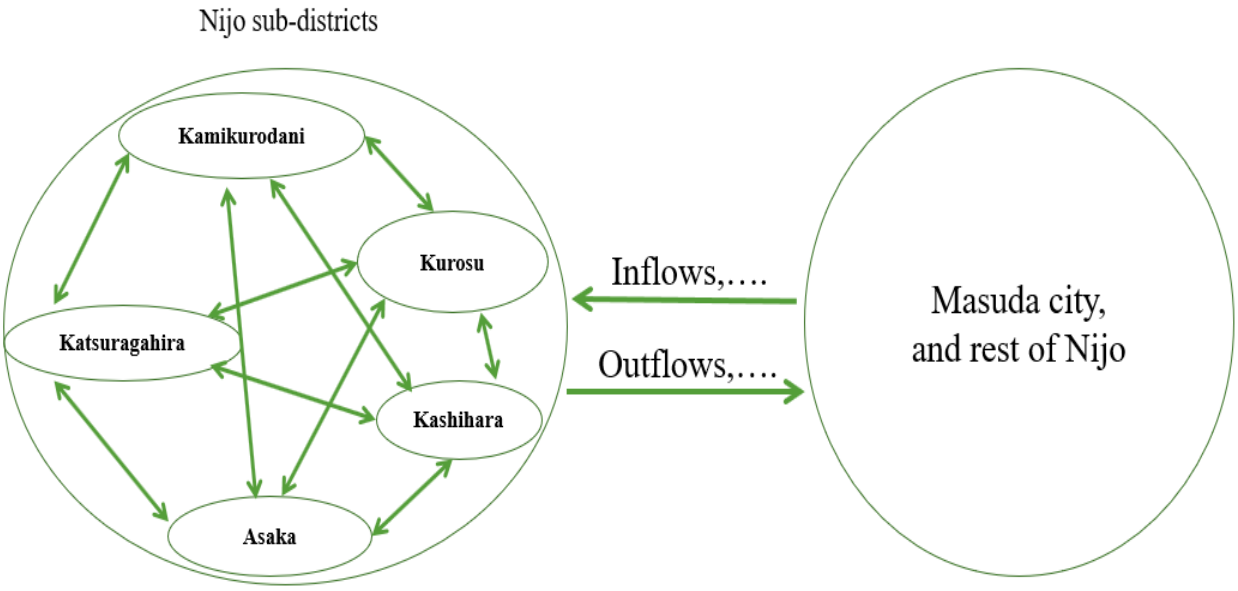


Figure 1: Transaction flows within Nijo & between Nijo-Outside (Masuda city and other towns)

Table 1. Example of Nijo Input-Output Table

		Intermediate Demand							Final Demand							Total output
		Area 1			....	Area 5			Area 1			.....	Area 5			
		Agri..	Manu...	Services	....	Agri..	Manu...	Services	Consu...	Invest...	Export	.....	Consu...	Invest...	Export	
Area 1	Agri..				....							.....				
	Manu...				....							.....				
	Service				....							.....				
.....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Area 5	Agri..				....							.....				
	Manu...				....							.....				
	Service				....							.....				
VA	Inflow				....							.....				
	Wages				....							.....				
	Adjustment				....							.....				
Total Input					....							.....				

Note: The outline of this IO table is similar with the inter-regional IO table, because imports are excluded from domestic transactions when creating this IO table.

Project Implementation

*** Data collection**

Data collection and Household Survey (combined with transportation survey) was carried out during September to October 2017. The household survey questionnaires mainly focused on the following basic questions:

1. What kind of product did you grow/produce?
2. What did you buy/sell?
3. Where did you buy/sell? - to whom/from whom?
4. How frequently did you shop in Nijo?
5. What percentage did you spend/consume in Nijo for a month?

*** Result of Household Survey Data Collection**

Our survey collected a total sample of 42 households in Nijo, representing about 20% of all samples (210 households) in Nijo district.

1. Rice Production

Figure 2 shows that about 59 percent of households produce rice, and about 26 percent of their rice is sold outside Nijo market. Rice product transaction in Nijo is small, about 38 percent and 9 percent is bought and sold in Nijo, respectively, while buying from outside Nijo accounted for only 14 percent. This indicating that Nijo is a self-sufficient in rice production, however, rice production is only for their own consumption.

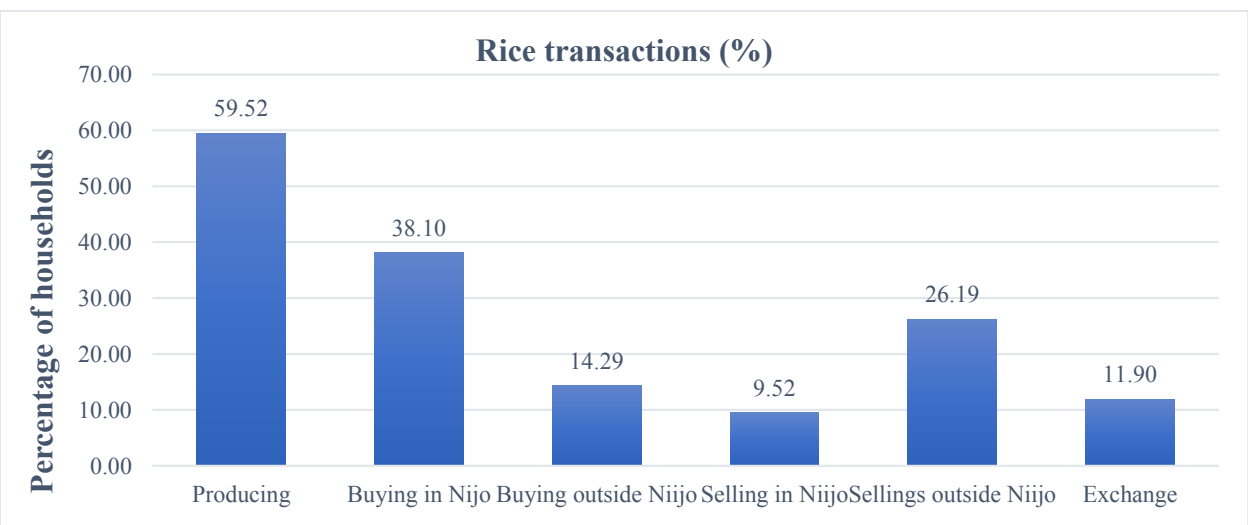


Figure 2: Rice Transaction in Nijo & between Nijo -outside

Source: Household Survey Data, October 15, 2017.

The survey found that in terms of rice production, due to labor shortage and aging people, some households asked Yokoemon (a local agricultural cooperative company) to produce. However, some people do not want to pay- this leads to agricultural land being abandoned. Some households sell their products to Japanese Agricultural Association. Yokoemon plays an important role in rice transaction and in producing dried products, e.g., vegetables, Yakiniku sauces in Nijo. However, they are aging groups, and lack skills of marketing management; therefore, linking farmers to markets is necessary.

2. Vegetable production

Figure 3 shows that most households grow vegetables (81%) except people who live near Nijo center. Most people who drive to work in Masuda city or other cities will buy vegetables from supermarkets. There are shops in Nijo, but they don't buy too much due to (1) **too expensive;** and (2) **No variety.** We found that it is very strange that people in Nijo don't sell products of Nijo in the local markets of Nijo area.

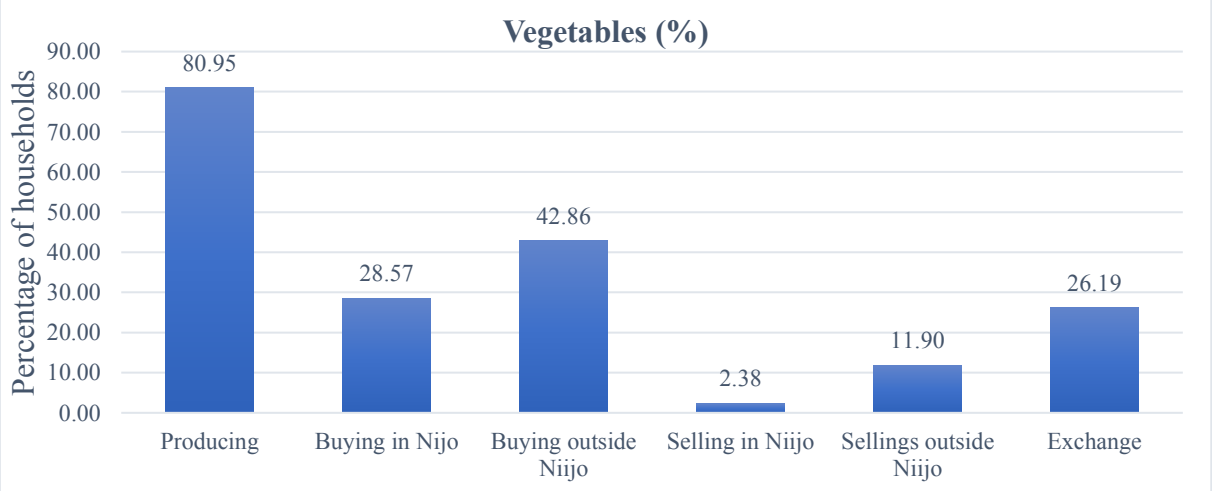


Figure 3: Vegetables Transaction in Nijo & between Nijo -outside

Source: Household Survey Data, October 15, 2017.

Figure 3 also shows that most households, about 97 percent sold their vegetables outside the Nijo and selling in Nijo accounted for only 2 percent, while buying from outside was about 71 percent and buying in Nijo was 28 percent. This suggesting that Nijo people are more depending on outside economy than inside Nijo economy.

3. Other products

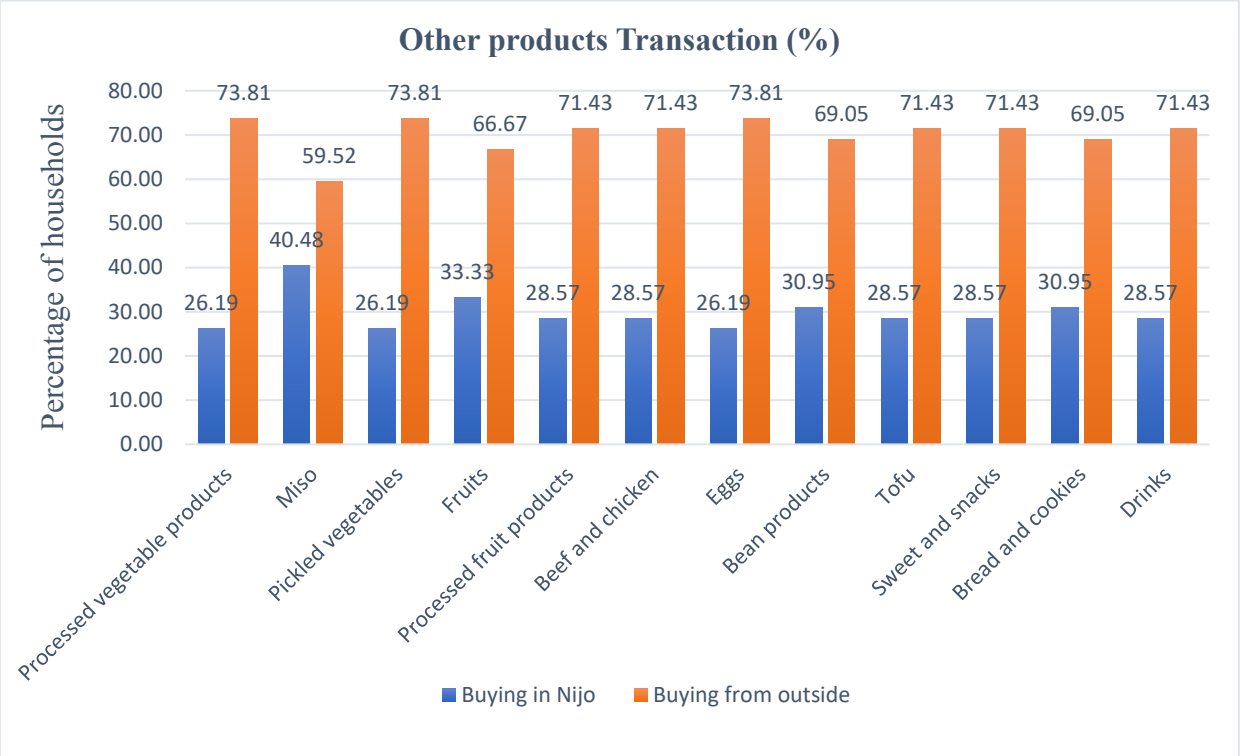


Figure 4: Another products transaction in Nijo & between Nijo -outside

Source: Household Survey Data, October 15, 2017.

Figure 4 shows that important products for consumption such as processed vegetables, miso, picked vegetables, been products and other food products and drinks are mainly imported from outside Nijo; for example, more than 70 percent of processed vegetables and pickled vegetables were bought from outside, while buying in Nijo accounted only 26 percent. This indicates that most households tend to buy goods and services from outside; only old people who do not drive to work in other cities will shop/buy in Nijo stores. Some prefer buying from mobile shops and delivery services (for example, Seikyo).

Nijo' shops owners are already over 80 years old; they want to close their shops soon- it is a big problem for old people who still do shopping in Nijo.

4. Proportion of consumption and frequency of shopping in Nijo

Figure 5 revealed that about 21 households spend 0-20% of their total consumption in Nijo. About 6 households spend almost 80-100% of their total consumption in Nijo. General speaking, over half of households spend their monthly consumption less than 50% in Nijo.

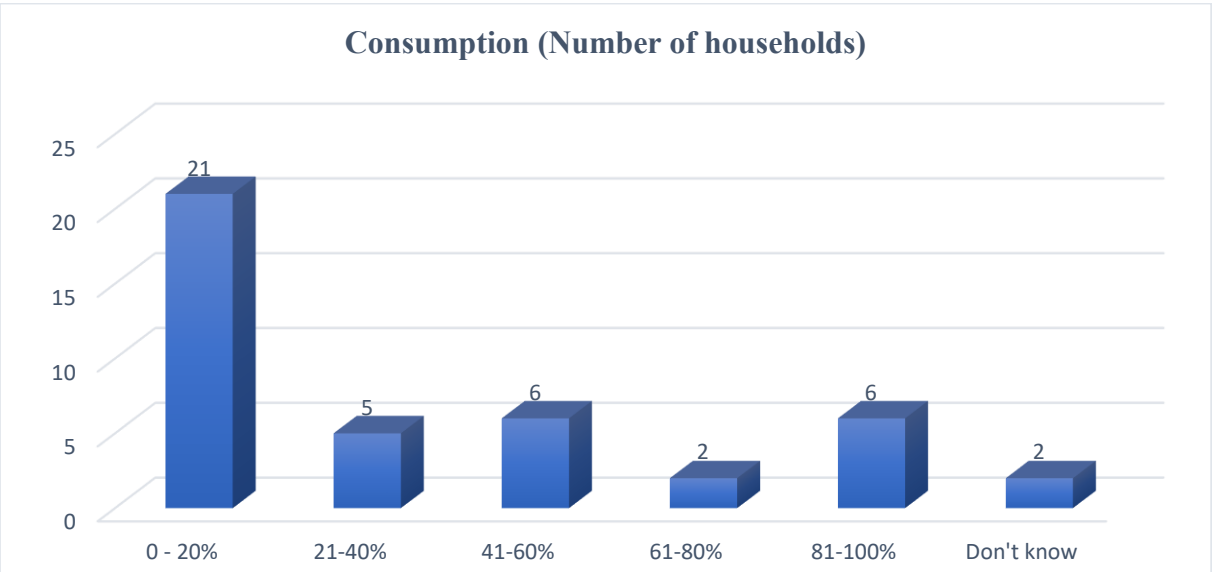


Figure 5: percentage of household consumption expenditure in Nijo
Source: Household Survey Data, October 15, 2017.

Figure 6 indicates that only 7 households do shopping almost every day in Nijo, while about 14 households never do shopping in Nijo, they tend to buy goods and services from outside, 7 households like doing shopping 1-3 times per week in Nijo, 9 households do shopping 3-5 times per week, and only 5 households do shopping 1-2 times a week in Nijo. This indicates that most people in Nijo do shopping outside the Nijo where there are more convenient shops and there are more varieties of products, as well as cheaper products. Most people who leave Nijo to work every day in Masuda city also like doing shopping there.

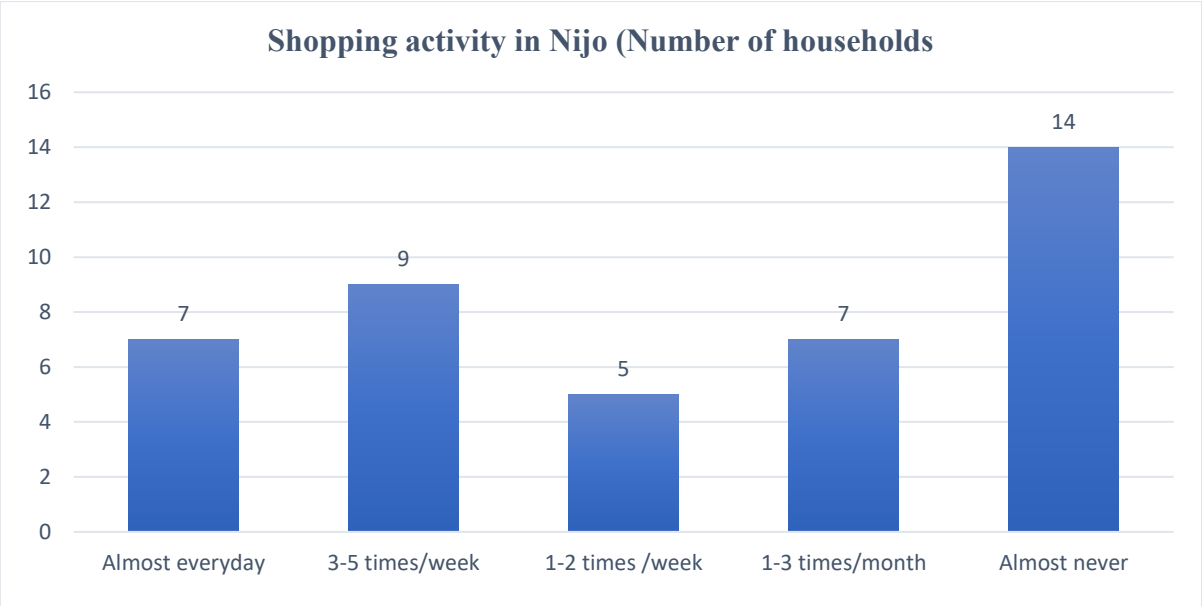


Figure 6: Frequent of household shopping activity in Nijo

Source: Household Survey Data, October 15, 2017.

CONCLUDING REMARKS

Our idea to make a Nijo village Input-Output (NIO) table was not achievable due to lack of sufficient basic data from household survey to support the NIO table construction:

- ❖ We could not collect the key information on commodity flows in each household and between households.
- ❖ Sale and purchase information provided by households did not always identify who are buyers and sellers.
- ❖ Information on household income and expenditure could not be captured, as it was very sensitive to ask for this information directly.

Thus, this household survey only can capture some parts of household economic activities and transactions. Moreover, the household survey data could only represent 20 percent of the total household samples to investigate the production flows within Nijo only and between Nijo-outside. Further study and a lot of investigations are required to obtain such data. Its requirement on manpower, financial cost and time, and language communication barrier constrained our construction of Nijo Input-Output table. Nonetheless, we could say that for the development of a Village Hub in the future, our Team suggests the following recommendations based on the survey results:

1. Establish place for sale of Nijo products (for example, in local stores)
2. Increase the range and quality of products sold in local stores to encourage more people to shop there. A Nijo loyalty card system can also encourage them.
3. Explore online shopping options so that Nijo producers can sell to outside markets.
4. Increase the network of producers in Nijo so that they can share information and help each other.
5. Since many people produce vegetables, think of a system to collect them and bring them to a market. This can be in Nijo (for example, Kobira-ichi) or in Masuda and other towns. Each producer makes only a little, but if they put this together, they can make big enough amount to sell commercially. This will link farmers directly to the market.

REFERENCES

Hongsakhone, S. & Ichihashi, M. (in press). "Measurement of reciprocity in a village through social network", *Economic Systems Research,* research article accepted for publication.

Nijo Satozukuri no Kai (2014). Nijo Community Association Face-to-Face Household Survey ("*Nijochiku Machizukuri Tobetsu Kikitori Chousa Kekka Shuukeihyou"*).

Appendix 2. An Example of Household Survey used for this study

Hiroshima University
Graduate School for International Development and Cooperation (IDEC)
1-4-2 Kagamiyama, Higashi-Hiroshima, 739-8527, Hiroshima, Japan, Phone: +81-824-24-7879

Main Purpose

The main objective of this household survey is to collect all household income, expenditure and relevant data to make a village input-output table (VIOT) for a rural village in Lao PDR. By constructing a perfect VIOT, we could get interdependency between households in the village.

Note:

This household survey will cover all household units in the village. Data collection will be focusing primarily on transactions, in particular, the sales and purchases relationships between households in the village, inter-Household intermediate inputs transactions, as well as final demand such as investments and consumptions, and outflows.

Please do not hesitate to answer our questions provided in this questionnaire, and if you feel uneasy to reply, please leave it. Your information will be used only for the purpose of research, and it will be kept secretly.

We would like to take this opportunity to thank you for providing us your useful information.

Household Survey 2016

Name of village	
Household No.	
Name of respondent	
Date	

Section 1: Household Roster

No	Name	Age	Sex	Education	Occupations	Seasonal work*		
						Yes	No	Place
1								
2								
3								
4								

Codes:

Sex: 0 = male, 1= female

Education level: 0 = None; 1 = primary school; 2= secondary school; 3= high school; 4= higher

Occupations: 1= farmer; 2 = government employee; 3= self-employee; 4 = regular salary worker;

5 = Not working;

*Seasonal worker: If Yes =1, where did you work? (Inside the village = 0; Outside = 1) No = 0

SECTION 2: SALES TRANSACTION OVER THE LAST 12 MONTHS IN 2016

list of products	**Land size**	**Output**	**Consumption**	**Seeds/stock**	**Sold**			
	Area	*Unit*	*Unit*	*Unit*	*Unit*	*Price*	*Place**	*To whom*[1]
I. Crops	***(Ha)***	***(Kg)***	***(Kg)***	***(Kg)***	***(Kg)***	***(Kip)***	***(where?)***	***(name?)***
1. Sticky Rice								
2. Ordinary rice								
3. Maize/corn								
4. Others (specify)								
II. Livestock		**(Head)**	**(Head)**	**(Head)**	**(Head)**	***(Kip)***	***(where?)***	***(name?)***
1. Goat or sheep								
2. Buffalo/cattle								
3. Cattle								
4. Duck								
5. Chicken								
6. Pigs								
7. Others (specify)								
Livestock products		***(Kg)***	***(Kg)***	***(Kg)***	***(Kg)***	***(Kip)***	***(where?)***	***(name?)***
1. Meat								
2. Eggs								
3. Skins								
4. Others (specify)								
III. NTFPs		***(Kg)***	***(Kg)***	***(Kg)***	***(Kg)***	***(Kip)***	***(where?)***	***(name?)***
1. Broom grass								
2. Bamboo shoots								
3. Herbal roots								
4. others (specify)								
IV. Others		***(Kg)***	***(Kg)***	***(Kg)***	***(Kg)***	***(Kip)***	***(where?)***	***(name?)***
1. Wild animals								
2. Honey								
3. Fish/dry fish								
4. Others (specify)								

[1] To whom?

Village shops = 1 (specify);

villagers in the village = 2 (specify the name);

Outside the village (specify) = 3

Place*: 1 = market or shops in the village, 2 = outside

SECTION 3: PURCHASES TRANSACTION OVER THE LAST 12 MONTHS IN 2016

list of products	Consumption	Seeds/stock	Purchased				Receiving**	Giving***
	Unit	*Unit*	*Unit*	*Place**	*Price*	*From whom[2]*	*Unit*	*Unit*
I. Crops	***(Kg)***	***(Kg)***	***(Kg)***	***(where?)***	***(Kip)***	***(name?)***	**(Kg)**	**(Kg)**
1. Sticky Rice								
2. Ordinary rice								
3. Maize/corn								
4. Others (specify)								
II. Livestock	**(Head)**	**(Head)**	**(Head)**	***(where?)***	***(Kip)***	***(name?)***	**(Head)**	**(Head)**
1. Goat or sheep								
2. Buffalo/cattle								
3. Cattle								
4. Duck								
5. Chicken								
6. Pigs								
7. Others (specify)								
Livestock products	***(Kg)***	***(Kg)***	***(Kg)***	***(where?)***	***(Kip)***	***(name?)***	**(Kg)**	**(Kg)**
1. Meat								
2. Eggs								
3. Skins								
4. Others (specify)								
III. NTFPs	***(Kg)***	***(Kg)***	***(Kg)***	***(where?)***	***(Kip)***	***(name?)***	**(Kg)**	**(Kg)**
1. Broom grass								
2. Bamboo shoots								
3. Herbal roots								
4. others (specify)								
IV. Others	***(Kg)***	***(Kg)***	***(Kg)***	***(where?)***	***(Kip)***	***(name?)***	**(Kg)**	**(Kg)**
1. Wild animals								
2. Honey								
3. Fish/dry fish								
4. Others (specify)								

[2] From whom?

Village shops = 1 (specify); villagers in the village = 2; (specify); 3 = Outside the village (specify)

Place*:

Market or shops in the village =1

Outside the village = 2

** 1= receiving from friends/relatives in the village (specify) ; 2 = outside

*** Giving items to relatives/friends in the village (specify name) ; 2 = outside the village.

SECTION 4: EXPENSES ON AGRICULTURAL INPUTS IN THE LAST 12 MONTHS IN 2016

Did you or anyone in your household spend any money on the (item) in last 12 months?

If Yes, please complete the table below, If None, (please skip)

Expenses	How much did you or anyone in your household spend on the (item) in the last 12 months?	
	(Quantity)	**(Kip)**
1. Agricultural tools (unit)		
2. Rice seed (Kg)		
3. Fertilizer (Kg)		
4. Insecticides (Bottle, can)		
5. Wage payments for any activities		
6. Cooperation work (times or hours)		
7. Buying or rent vehicles (tractor, ….)		
8. Others (specify)		

SECTION 5: HOUSEHOLD INCOME IN THE LAST 12 MONTHS IN 2016

Items	**Income Last 12 months**	
	Total amount (Kip)	**Remark**
I. Main income		
1. Selling products		
2. Salary or regular wages		
3. Pension		
II. Other income and assets		
1. Selling assets		
2. Agricultural land rent		
3. Remittances from relatives		
4. Lottery/prizes		
5. Subsidies from government/NGOs		
6. Others (specify)		

SECTION 6. HOUSEHOLD EXPENDITURE IN LAST 12 MONTHS IN 2016

Items	Last 12 months	
	(Quantity)	Total amount
I. Food	(Kg)	(Kip)
1. Sticky rice		
2. Ordinary rice		
3. All vegetables (chili, onion, garlic, etc.)		
4. Fruits (pumpkin, cucumber, etc.)		
5. Milk/butter		
6. Meat/fish/chicken/eggs		
7. Others (specify)		
II. Non-Food Items	(Kg)	(Kip)
1.Alcohol, beer, cigarettes, etc.		
2. Energy (Kerosene or gas, electricity.)		
3. Clothing and shoes		
4. Home appliances (tables, chair, TV, etc.)		
5. Medical expenses (fees)		
6. Education (stationery, book, fees)		
7. Taxes (house, land, vehicles, etc.)		
8. Travel/Petrol, vehicle maintenance, etc.		
9. Ceremonies (marriage, donation...)		
10. Others (specify)		

Thank you very much for your times and cooperation!