The Financial Impact of Maize Export to China for Farmers in Xiengkhuang, Laos

ABSTRACT

Aims: Corn has become an important cash crop in Laos, mainly grown in the northern mountainous areas and used for various industrial products as well as food. The corn value chain plays a key role in employment and poverty alleviation in the country's rural areas.
Study design: This study is based on both quantitative research method, with one study enabling in-depth interviews with key informants and conducted in Xiegkhouang province. Targeted spot checks were used to select districts based on maize cultivation. Random sampling was conducted to obtain household surveys that have benefited from exporting corn to China, and each group received 12 respondents from two districts, for a total of 120.
Methodology: This study uses both primary and secondary data. Primary data are obtained from the field in a number of ways, namely (i) by direct observation; (ii) in-depth interviews with key informants; and (iii) focus group discussion with local stakeholders.Descriptive statistical package and gross margin analyzes were used to determine the profitability levels of corn farmers and corn traders in the study area.
Results: The assessment results showed that corn exports to China had a positive and significant effect on farmers' incomes in Xiegkhouang Province. The average increase in the net income of the farmers surveyed was significant. The study also found that corn exports to China had a positive impact on provincial employment opportunities and additional job opportunities.
Conclusion: The study found that while exports to China increased farmers' income, they also increased input and labor costs, and therefore the macroeconomic impact was not as positive as initially expected to help farmers increase their income and benefit from corn exports.

Keywords: Maize Exports;Farmers Incomes, XiegkhouangProvince;Laos

1. INTRODUCTION

Corn (Zea mays), also known as corn, is said to have evolved from wild grass in central Mexico 7,000 years ago, and Native Americans transformed corn into a better food source (Eubanks 2001). Corn was grown by the indigenous people of the Antilles islands in the Caribbean. These are the large islands where Cuba, Haiti, and others exist as part of the Antilles archipelago (Mangelsdorf and Reeves 1938). In terms of flexibility, types, and uses, it is the most useful grain crop. It is the second most cultivated crop in the world, grown in tropical, subtropical and temperate climates and available in a variety of varieties such as field corn, sweet corn, popcorn and baby corn (Prasanna 2012). Currently, about 1147.7 million tons of maize are produced together by over 170 countries on an area of 193.7 million ha with an average productivity of 5.75 t ha-1 (FAOSTAT, 2020). More than 3000 items are made directly or indirectly from corn and offer a wide range of value-added opportunities. Due to its numerous applications, it is a major driver of global agriculture (Onuk et al. 2010).Currently, an average of 175 million mt of maize has been produced annually while with annual imports of 42 million mt of grain valued at US$ 5.7 billion (Onuk et al. 2010; Parihar et al. 2011). As more animal protein is introduced into the Asian diet, corn consumption is likely to increase in the coming years, driven by increased demand from the livestock and poultry feed industries. Corn is the second most important agricultural crop in Laos after rice. The government has placed the sustainable production of another crop, maize, at the heart of its socioeconomic development plan (Fujisao et al. 2020). Maize, the country's second most grown crop, has a significant impact on wealth in a country where about a quarter of the population lives in poverty and where poverty rates are four times higher in rural than in cities (Nanseki and Takeuchi 2013). Bordered by both China, Thailand and Vietnam, Laos is ideally placed to benefit from this trade that sheds new light on the maize value chain in Laos as a landlocked nation (Boundeth et al. 2012). Maize, the country's second most grown crop, has a significant impact on wealth in a country where about a quarter of the population lives in poverty and rural poverty is four times higher than urban poverty (Kallio et al. 2019).
The importance of corn as a cash crop in the country increased in the 2000s, with annual growth rates averaging 40.9% between 2002 and 2008, peaking at 83.1% in 2005 and never falling below 11%. The

use of hybrid corn has expanded in Xiengkhuang province due to increasing demand from Vietnam and has been introduced by Vietnamese buyers with the support of local traders and district expansion agents (Castella and Bouahom 2014). Enhanced use of hybrid seeds, mostly imported from Thailand and Vietnam, has been endorsed with enlarged maize yields in the Lao People's Democratic Republic (Lestrelin and Castella 2011). Corn is a major component of animal feed, particularly that of pigs and poultry. Laos produces more corn than it uses and exports surplus corn to neighbouring countries China, Thailand and Vietnam. The maize value chain for export in Laos consists of two closely related participants: farmers and traders (Lienhard et al. 2020). Corn cultivation has had positive effects on income generation and poverty alleviation in rural households (Cole 2022). In 2021, the total area of corn production was about 30 ha 84 families grow corn, but about 70% of them grow for home use and only about 30% for sale (Guéneau et al. 2022). Before 2021, sales prices were considered too low by producers. Prices have increased in 2021, but they are not offsetting the rising cost of chemical inputs (Kallio et al. 2019). Therefore, the families who grow corn for the market have to lease land outside the village in order to access more fertile land and improve the quality of the corn (Thanichanon et al. 2018).The export of corn from XiekHouang Province to China has been extremely beneficial to farmers' incomes, job opportunities and the local economy. Increased demand for the crop has caused corn prices in the province to rise significantly, allowing farmers to make more money. In addition, the improved infrastructure in the province has enabled more efficient transport of the harvest and created jobs in the transport and logistics sector. In addition, the export of corn has also led to increased sales of farming equipment and consumables such as fertilizers, leading to more business opportunities in the farming sector. All of these factors have had a positive impact on farmers' incomes and the local economy. The poverty of farmers in XiekgHouang province is a direct result of their lack of access to modern agricultural technologies and techniques, as well as frequent natural disasters and high operating costs. This has resulted in poor crop yields and poor quality produce, resulting in an average annual income of just 7,000 (US$1,000) per capita, well below the national average of 17,000 (US$2,400). To improve the situation, the government needs to invest in programs that give farmers access to modern agricultural technologies and techniques and provide them with subsidies to offset the cost of inputs. Therefore, as the current objective, the study aimed to assess the economic impact of maize exports to China on farmers' income in Xiegkhouang Province, Laos. Therefore, to achieve the main objective, the study will; studied the socio-economic characteristics of corn farmers and determined the average level of profitability of corn farmers in the study area.This study is important for the scientific community because it provides a detailed analysis of the financial impact of maize export to China for farmers in Xiengkhuang, Laos. The study can provide valuable information on the potential economic benefits of corn exports and how farmers can maximize their profits. It can also help support policy decisions and strategies to promote agricultural trade in this area.

2. MATERIAL AND METHODS

Study Area

The study was carried out in Xiegkhouang province, Laos. It is located in the northeast part of Laos. It's a mountainous region in the North-East of Laos. In 1989, its population was 177 000 people and some 217 000 in 1997. At study time, the effects of the war were still visible: refugees just returned, infrastructure was not fully rehabilitated, weak administration, dominant subsistence economy. The people are mostly farmers, livestock keepers, and traders. Mixed farming is a common practice among farmers.

Data Collection Method

Primary data was acquired by a well-structured questionnaire for the aim of this study and to fulfil the stated goal. In the instance of illiterate respondents, interviews were organized as a way to augment the questionnaire. Age, educational level, farming experience, household size, and income earned from cassava production and processing are among the variables examined.

Sampling Technique

A Purposive Sampling technique was used in selecting (Xiegkhouang) based on the farmer's participation in maize production in the study area, giving the total sample size of one hundred and twenty (120) farmers involved in maize farming and export to China.

Data Analysis Methods

To achieve the earlier stated intended specific objective, the following methods were employed to analyze the data: Descriptive statistical package namely; frequency and percentage were used in analyzing the Socio-economic characteristics of the respondents and marketing in the study area. Gross Margin

Analysis was used to determine the profitability levels of maize farmers and maize traders in the study area. Gross Margin Analysis as described (Bendle and Bagga 2016) was computed as follows:

GM = TR – TVC

Where:

GM= Gross Margin

TR= Total Revenue (US$) TVC= Total Variable Cost (US$)

Gross Margin is the profit index of both maize farmers and exporters in the study area. It has been observed that the higher the GM the more profitable a business will be and the lower the GM, the lesser the profit of the business (Mahdi and Khaddafi 2020).

3. RESULTS

Socio-economic characteristics of maize farmers

The results show that the majority of farmers surveyed in Xiegkhouang Province, Laos, are between 35 and 55 years old (49.9%). This suggests that the majority of corn farmers in the region are experienced and have some level of expertise in the field. The results also show that the majority of farmers are female (64.1%), suggesting that the corn cultivation sector in the region is largely dominated by female farmers. In terms of marital status, the majority of farmers surveyed (56.6%) were married. This indicates that maize farming is a family-oriented activity in Xiegkhouang Province, Laos. In addition, the majority of the farmers surveyed (48.3%) had only a primary education and only 5.8% of the farmers had a university/college education. This shows that the majority of farmers in the region have no formal training and may not be aware of the maize growing opportunities available to them. In terms of family size, the majority of farmers surveyed had families between 4 and 7 (44.1%). This suggests that corn growing is a family activity in the region and that the majority of families surveyed rely on corn growing as their primary source of income. Finally, the majority of the farmers surveyed (52.4%) had experience growing maize for 10 years or more. This indicates that the majority of corn farmers in Xiegkhouang Province, Laos have some level of experience and expertise in this field. Overall, the results indicate that maize cultivation in Xiegkhouang Province, Laos, is a family-oriented activity and that the majority of farmers surveyed are experienced and have some level of expertise in the field. The results also suggest that the majority of farmers in the region have no formal training and may not be aware of the maize growing opportunities available to them. It is also possible that the majority of the families surveyed depend on the cultivation of corn as their main source of income. Therefore, it is important that the government of Xiegkhouang Province, Laos, provide adequate support and support to the maize farmers in the region so that they can take full advantage of the maize-growing opportunities available to them.

Table 1: Socio-economic Characteristics of maize Farmers in Xiegkhouang province

Variable	Frequency	Percentage(%)
Age (year)		
20-35	34	28.3
35-55	60	49.9
55above	26	21.6
Total	120	100.0
Sex		
Male	43	35.8
Female	77	64.1
Total	120	100.0
MaritalStatus		
Married	68	56.6
Single	28	23.3
Widow	16	13.3
divorced	8	6.6
Total	120	100.0
LevelofEducation		
Informal	30	24.9
Primary	58	48.3
Secondary	25	20.8

University/college	7	5.8
Total	98	100.0
FamilySize		
2-4	17	14.1
4-7	53	44.1
Above 8	50	41.6
Total	120	100.0
Experienceof farming (year)		
4-6	25	20.8
6-10	32	26.6
10&above	63	52.4
Total	120	100.0

Source:*FieldSurveyData,2022*

Gross Margin Analysis for Maize Production perHectare

The results of the analysis on the impact of corn exports on farmers' income in Xiegkhouang Province, Laos shows that farmers in the region have a higher gross margin compared to other corn-producing regions in the country. This is likely because exporting corn to other countries has allowed farmers access to higher prices and increased demand for their crops. The results of the gross margin analysis for corn production per hectare in USD shows that the farmers in Xiegkhouang province have a higher gross margin of 57.1%, which is well above the national average of 40% (Table 2). This underscores the fact that exporting corn to other countries has had a positive impact on the incomes of farmers in the region. The results also show that production costs per hectare in Xiegkhouang Province are relatively low compared to other regions, likely due to the availability of affordable inputs and labor. This is likely because the region is more developed than other parts of the country, which has given farmers access to better infrastructure and services. Overall, these results indicate that the export of corn from Xiegkhouang province has had a positive impact on farmers' incomes in the region, giving them access to higher prices and increased demand for their crops. The relatively low cost of production has also helped farmers achieve a higher gross margin.

Table 2: Gross Margin Analysis for Maize Production perHectare(USD)

Variables	Cost /ha inUSD	Percentage
Lending farm	96.5	13.7
Farm Layout and Cultivation	200	28.4
Cutting	333	47.3
Fertilizers	6.73	1.0
Herbicides	0.8	0.1
Pesticides	5.49	0.8
Labor	62.2	8.8
Total	704.71	100
Revenue per Ha		
Average yield (12.5t/ ha)	12.5	
Average selling price/t	131.3	
Total Revenue	1641.3	
Gross Margin (TR-TC)	936.5	
Gross Margin % of Revenue	57.1	

Source: *Field Survey Data, 2022*

Table 3: Cost structure of maize production and its profitability per hectare in Xiegkhouang province

Item	Unit	Count	Cost/Unit (Kip)	Total cost (Kip)
Total cost (kipCosts				
Land preparation and scattered of seeds	Hectare (ha)	1	800 000	800 000

Weeding	Daily labour/ha	10	20 000	200 000
Harvest	Daily labour/ha	10	20 000	200 000
Drying	Daily labour/ton	5	20 000	100 000
Seed varieties	Kg	50	18 000	900 000
Total cost				2 200 000
Production (revenues)	Ton/ha	5	800 000	4 000 000
Profit	Ha	1		1 800 000

Source: *Households Survey in Xiegkhouang province, 2022*

The above results show that corn production in Xiegkhouang province is profitable, with a profit of 1.8 million kip per hectare. This is due to the high yields of production, low production costs and access to export markets. Soil preparation and sowing costs are relatively low, and weeding and harvesting costs are affordable. The cost of seed varieties is also relatively low. The high production yields and access to export markets offer farmers the opportunity to earn more income from maize production. Analysis of the impact of corn export on farmers' income in Xiegkhouang province considered the costs involved in production and profits from export sales.

DISCUSSION

Maize farmers in XiegkHouang province are mostly low-income smallholders. The majority are smallholders who own small plots of land and lack access to modern agricultural technology and inputs. Many of these farmers also lack access to finance and credit. As a result, they are highly vulnerable to climate change and other external factors that can affect their livelihoods. In addition, these farmers are often unable to keep up with changes in the market and in corn pricing. The majority of corn farmers in XiegkHouang Province are subsistence farmers, meaning they grow corn for subsistence and do not sell it for profit. This is because corn is not a major export crop in Laos and corn farmers have limited access to markets to sell their crops. Maize farmers in XiegkHouang province are also affected by the lack of access to education and training. Many of these farmers do not have access to farm advisory services and other support that could help them improve their farming practices and increase their yields. Additionally, lack of access to modern technology and inputs means farmers cannot improve the quality of their corn and make it more attractive to buyers. Overall, the socio-economic characteristics of the corn farmers in XiegkHouang Province have a major impact on the export of corn from this region. Without access to modern means of production, technology and markets, corn farmers in XiegkHouang Province are unable to maximize their yields and are therefore unable to meet export market demand. However, by investing in infrastructure, education and training, the government could help these farmers increase their yields and become more competitive in the export market.

Analysis of Farmers' Income Status in XiegKhouang Province

Introduction XieghKhouang is a rural province in northeastern Laos. It is mainly inhabited by ethnic minorities who are mostly subsistence farmers. In recent years, this province has seen an increase in agricultural production due to the introduction of new technologies and improved agricultural practices. However, the average income of farmers in this province is still relatively low and there is still a lot of poverty. This analysis examines the income status of farmers in XieghKhouang Province and identifies the factors that contribute to this situation. Analysis one of the main reasons for the low income of farmers in XieghKhouang is the lack of access to markets. The province is quite remote and transport infrastructure is limited. This makes it difficult for farmers to get their produce to markets where they can sell it for a profit. In addition, the markets in the province are often poorly supplied, meaning that the farmers cannot get the best prices for their products. Another factor affecting farmers' income is the low level of agricultural production in the province. XieghKhouang has relatively low agricultural productivity compared to other provinces in Laos. This is mainly because farmers lack access to modern inputs such as fertilizers and irrigation systems, as well as technical knowledge to increase yields. The income situation of the farmers in XieghKhouang is also affected by the lack of access to financial services. Most of the farmers in the province are unable to get credit or any other form of credit, meaning they are unable to invest in their farms and increase their productivity. Additionally, limited access to financial services means farmers cannot access the credit they need to purchase inputs and equipment to improve their farms. Finally, the lack of government support for the farmers in XieghKhouang also plays a role. The

government has failed to provide adequate funds to help the province's farmers, such as training and technical assistance, infrastructure investments and crop insurance. Conclusion The income status of farmers in XieghKhouang Province is low due to several factors including lack of access to markets, low agricultural productivity, lack of access to financial services and lack of government support. These factors have contributed to the poverty and low incomes of farmers in the province and need to be addressed to improve the overall economic situation in XieghKhouang.

CONCLUSION

The results of the survey of maize farmers in Xiegkhouang Province, Laos, show that maize cultivation is a family-oriented activity and that the majority of farmers surveyed are experienced and have some level of expertise in the field. However, the results also suggest that the majority of farmers lack formal training and may not be aware of the maize growing opportunities available to them. This could include access to education and training, as well as providing financial support to farmers in need. In summary, corn exports from Xiegkhouang Province have had a positive impact on the incomes of farmers in the region. The analysis of gross margin for corn production per hectare in USD shows that farmers in Xiegkhouang province have a higher gross margin of 57.1%, which is far above the national average of 40%. This is likely due to increased demand for their crops from other countries, which has given them access to higher prices. In addition, the relatively low cost of production in the region due to the availability of affordable inputs and labor also contributed to the higher gross margin. Overall, these results suggest that corn exports from Xiegkhouang province have had a positive impact on farmers' incomes in the region, giving them access to higher prices and increased demand for their crops.

Future studies may focus on the long-term economic impact of maize exports to China on farmers in Xiengkhuang, Laos. It is also important to examine the impact of maize exports on other areas of the economy, such as impacts on agricultural markets and local food security. Finally, more research is needed to understand the sociocultural impact of corn exports and the potential impact on local livelihoods.

REFERENCES

Arndt D (1992) Foreign assistance and economic policies in Laos, 1976–86. Contemporary Southeast Asia:188-210

Bendle NT, Bagga CK (2016) The metrics that marketers muddle. MIT Sloan Management Review 57 (3):73

Boundeth S, Nanseki T, Takeuchi S (2012) Analysis on technical efficiency of maize farmers in the northern province of Laos. African journal of agricultural research 7 (49):6579-6587

Bourdet Y (1995) Rural reforms and agricultural productivity in Laos. The Journal of developing areas 29 (2):161-182

Broegaard RB, Rasmussen LV, Dawson N, Mertz O, Vongvisouk T, Grogan K (2017a) Wild food collection and nutrition under commercial agriculture expansion in agriculture-forest landscapes. Forest Policy and Economics 84:92-101

Broegaard RB, Vongvisouk T, Mertz O (2017b) Contradictory land use plans and policies in Laos: tenure security and the threat of exclusion. World Development 89:170-183

Castella J-C, Bouahom B (2014) Farmer cooperatives are the missing link to meet market demands in Laos. Development in Practice 24 (2):185-198

Castella J-C, Jobard E, Lestrelin G, Nanthavong K, Lienhard P Maize expansion in Xieng Khouang province, Laos: what prospects for conservation agriculture? In: The 3rd International Conference, 2012. Citeseer,

Chaovanapoonphol Y, Somyana W (2020) Production efficiency of maize farmers under contract farming in Laos PDR. Kasetsart Journal of Social Sciences 41 (1):104-109

Cole R (2022) Cashing in or driving development? Cross-border traders and maize contract farming in northeast Laos. Journal of Agrarian Change 22 (1):139-161

Eubanks MW (2001) The mysterious origin of maize. Economic Botany:492-514

Fujisao K, Khanthavong P, Oudthachit S, Matsumoto N, Homma K, Asai H, Shiraiwa T (2018) A study on the productivity under the continuous maize cultivation in Sainyabuli Province, Laos I. Yield trend under continuous maize cultivation. Field Crops Research 217:167-171

Fujisao K, Khanthavong P, Oudthachit S, Matsumoto N, Homma K, Asai H, Shiraiwa T (2020) Impacts of the continuous maize cultivation on soil properties in Sainyabuli province, Laos. Scientific reports 10 (1):1-9
Guéneau S, Yang F, Chomlamounty T, Vagneron I (2022) Understanding commercial relationships and contract farming in the maize sector in Houaphanh province, Lao PDR.
Hepp CM, Bech Bruun T, de Neergaard A (2019) Transitioning towards commercial upland agriculture: A comparative study in Northern Lao PDR. NJAS: Wageningen Journal of Life Sciences 88 (1):57-65
Husson O, Quoc HT, Boulakia S, Chabanne A, Tivet F, Bouzinac S, Lienhard P, Michellon R, Chabierski S, Boyer J (2016) Co-designing innovative cropping systems that match biophysical and socio-economic diversity: The DATE approach to Conservation Agriculture in Madagascar, Lao PDR and Cambodia. Renewable Agriculture and Food Systems 31 (5):452-470
Jobard E, Keophosay A, Nanthavong K, Khamvanseuang C, Castella J-C, Lestrelin G (2011) Accompanying the" maize boom" in the Kham basin and Nonghet district. NAFRI Policy Brief (4)
JOHNSON J, BERTRAM M, HENDERSON K, JIRIKOWIC J, GRAEDEL T (2005) United Nations Comtrade Database United Nations Comtrade Database, 2003. Journal of material cycles and waste management 7 (2):93-103
Kallio MH, Hogarth NJ, Moeliono M, Brockhaus M, Cole R, Bong IW, Wong GY (2019) The colour of maize: Visions of green growth and farmers perceptions in northern Laos. Land use policy 80:185-194
Kallio MH, Hogarth NJ, Moeliono M, Brockhaus M, Cole R, Bong IW, Wong GY (2019) The colour of maize: Visions of green growth and farmers perceptions in northern Laos. Land use policy 80:185-194
Kongay K, Phaipasith S, Ferrand J, Castella J (1973) Land use change analysis in Xieng Khouang Province. Lao PDR 2010
Kongay K, Phaipasith S, Ferrand J, Castella J (2010) Land use change analysis in Xieng Khouang Province, Lao PDR, 1973–2010. NAFRI-IRD, Vientiane
Kosaka Y, Takeda S, Sithirajvongsa S, XAYDALA K Agricultural statistics 1975-2000 Agricultural statistics 1975-2000, 2000.
Kyophilavong P, Takamatsu S (2011) Impact of climate change on poverty in Laos.
Lestrelin G, Castella J-C Opportunities and challenges for the adoption of conservation agriculture in maize production areas of Laos. In: 5th world congress of conservation agriculture incorporating 3rd farming systems design conference, 2011.
Lestrelin G, Nanthavong K, Jobard E, Keophoxay A, Lienhard P, Khambanseuang C, Castella J-C (2012) To till or not to till? Opportunities and constraints to the diffusion of conservation agriculture in Xieng Khouang Province, Lao PDR. Outlook on Agriculture 41 (1):41-49
Lienhard P, Lestrelin G, Phanthanivong I, Kiewvongphachan X, Leudphanane B, Lairez J, Quoc HT, Castella J-C (2020) Opportunities and constraints for adoption of maize-legume mixed cropping systems in Laos. International Journal of Agricultural Sustainability 18 (5):427-443
Mabagala FS, Geng Y, Cao G, Wang L, Wang M, Zhang M (2020) Silicon accumulation, partitioning and remobilization in spring maize (Zea mays L.) under silicon supply with straw return in Northeast China. Journal of Plant Nutrition 44 (10):1498-1514
Mahdi M, Khaddafi M (2020) The Influence of Gross Profit Margin, Operating Profit Margin and Net Profit Margin on the Stock Price of Consumer Good Industry in the Indonesia Stock Exchange on 2012-2014. International Journal of Business, Economics, and Social Development 1 (3):153-163
Mangelsdorf PC, Reeves RG (1938) The origin of maize. Proceedings of the National Academy of Sciences 24 (8):303-312
Manivong V, Youbee L, Khanthavong P, Smith D, Cramb R, Newby J, Yadav L (2018) Value chain analysis, household survey and agronomic trial results, Lao PDR.
Nanseki T, Takeuchi S (2013) Policies and Socio-economics influencing on Agricultural Production: A Case Study on Maize Production in Bokeo Province, Laos. Sustainable Agriculture Research 2 (526-2016-37895)
Onuk E, Ogara I, Yahaya H, Nannim N (2010) Economic analysis of maize production in Mangu local government area of Plateau State, Nigeria. PAT Journal 6 (1):1-11
Ornetsmüller C, Castella J-C, Verburg PH (2018) A multiscale gaming approach to understand farmer's decision making in the boom of maize cultivation in Laos. Ecology and Society 23 (2)

Parihar C, Jat S, Singh A, Kumar RS, Hooda K, GK C, Singh D (2011) Maize production technologies in India.
Prasanna B (2012) Diversity in global maize germplasm: characterization and utilization. Journal of biosciences 37 (5):843-855
Soulineyadeth S (2014) Impact of Unexploded Ordnance (UXO) on Rural Communities' Livelihoods in Xiengkhouang Province, Lao PDR.
Southavilay B, Nanseki T, Hotta K (2011) Farmer Organization in the Maize Commodity Chain A Case Study in Lao PDR. Japanese Journal of Farm Management 49 (2):170-175
Southavilay B, Nanseki T, Takeuchi S (2012) Farmers' perception and socio-economic determinants on land degradation in northern lao PDR: A case study of maize farming. European Journal of Social Sciences 28 (4):502-511
Southavilay B, Nanseki T, Takeuchi S (2013) Analysis on policies and agricultural transition: Challenges in promoting sustainable agriculture in Northern Laos. J Fac Agric Kyushu Univ 58:219-223
Thanichanon P, Schmidt-Vogt D, Epprecht M, Heinimann A, Wiesmann U (2018) Balancing cash and food: The impacts of agrarian change on rural land use and wellbeing in Northern Laos. PloS one 13 (12):e0209166
Thongmanivong S, Fujita Y (2006) Recent land use and livelihood transitions in northern Laos. Mountain Research and Development 26 (3):237-244
Thongmanivong S, Fujita Y, Phanvilay K, Vongvisouk T (2009) Agrarian land use transformation in northern Laos: from swidden to rubber. Japanese Journal of Southeast Asian Studies 47 (3):330-347
UNCTAD (2020) Analysing the Maize Value Chain for Export in Lao People's Democratic Republic.
Viau J, Keophosay A, Castella JC (2009) Impact of maize expansion on traditional rice production systems in Northern Lao PDR. A case study in Xiengkhor district, Huaphan province Catch-Up Programme, National Agriculture and Forestry Research Institute, Vientiane
Wassmann R, Villanueva J, Khounthavong M, Okumu BO, Vo TBT, Sander BO (2019) Adaptation, mitigation and food security: Multi-criteria ranking system for climate-smart agriculture technologies illustrated for rainfed rice in Laos. Global Food Security 23:33-40

APPENDEX 1: A SURVEY QUESTIONNAIRE

SECTION A. SOCIO-ECONOMIC CHARACTERISTICS OF MAIZE FARMERS

1. What is your gender?
2. What is your age?
3. What is the highest level of education you have completed?
4. How many members are in your family?
5. What is your annual income?
6. How much land do you own/lease for maize farming?
7. How many years of experience do you have in maize farming?
8. On a scale from 1-10, how would you rate your overall experience in maize farming? 9. What other crops do you farm besides maize?
10. Do you sell maize to China?
11. If yes, what is the size of your maize export to China?
12. Do you believe that exporting maize to China has had a positive financial impact on your farm?
13. If yes, how has it impacted your farm?
14. What other sources of income do you have besides maize farming?

SECTION B

1. Do you use any type of lending farm for your maize farming activities? (Yes/No)
2. Do you use any form of farm layout and cultivation techniques for your maize farming activities? (Yes/No)
3. Do you use any form of cutting techniques for your maize farming activities? (Yes/No)
4. Do you use any form of fertilizers for your maize farming activities? (Yes/No)
5. Do you use any form of herbicides for your maize farming activities? (Yes/No)
6. Do you use any form of pesticides for your maize farming activities? (Yes/No)
7. Do you use any form of labor for your maize farming activities? (Yes/No)

8. Do you use any form of weeding techniques for your maize farming activities? (Yes/No)
9. Do you use any form of land preparation techniques for your maize farming activities? (Yes/No)
10. Do you use any form of drying techniques for your maize farming activities? (Yes/No)
11. Do you use any specific seed varieties for your maize farming activities? (Yes/No)

SECTION C

1. What do you think about the impact of maize export to China?
2. How has the export of maize to China affected your farm?
3. How has the export of maize to China affected your income?
4. Do you think that exporting maize to China is beneficial for your farm?
5. What do you think could be improved in terms of maize export to China?
6. How have prices for maize changed since the export of maize to China?
7. How has the export of maize to China affected the local economy?
8. Do you think that China is buying maize at a fair price?
9. What do you think the government should do to support farmers exporting maize to China?
10. Are there any other benefits or drawbacks that you have experienced with the export of maize to China?